Irrigation Water Compliance Monitoring Annual Report 2008-2009

Technical Report 2009–100

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Executive summary

This is the seventh Annual Report issued by the Taranaki Regional 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 2008 – 30 June 2009. The report covers 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. Every year the Council prepares a monitoring programme for all pasture irrigation water permits.

At 30 June 2009, a total of 80 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, 17 for horticultural activities and 9 for recreational purposes (golf clubs). Seventy consents licensed surface water abstractions (87.5 %) while 10 (12.5 %) licensed groundwater abstractions.

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 fulfill crop water requirements

Maintaining environmentally appropriate flow-rates in streams and rivers to protect aquatic habitat is of primary concern to the Council, particularly with respect to the abstraction of water.

The 2008-2009 monitoring programme for irrigation water permits comprised three primary components: liaison with consent holders, site inspections, and data gathering and review and assessment for compliance. 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 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 monitored.

There have been concerns that some flowmeter installations have been inadequate which compromises accuracy. 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 of flowmeters and dataloggers. All installations are inspected by the Council.

The 2008-2009 summer period was wetter than the previous year, with rainfall percentages for the region ranging between 87 and 118% of normal. This was predominantly due to higher precipitation in February (recording up to two times its normal rainfall, in particular around Patea and Hawera, where 222 and 223% respectively of normal precipitation was recorded).

During the 2008-2009 irrigation season, the Council carried out compliance monitoring inspections at 61 sites, compared to 54 inspections carried out for the 2007-2008 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.

It was still a busy season for the Council's hydrological unit, despite the wet February, with close and frequent monitoring required to ensure the waterway's ecological flows. During

the period under review compliance with residual flow conditions for surface water abstraction sites was assessed 34 times in 16 waterways.

The examination of the data supplied to the Council, revealed that five consent holders breached limits for rate/volume abstracted. As happens each year, consent holder performance was assessed based mainly on compliance with allocated abstractions, maintenance of minimum residual flows, and the provision of abstraction records.

No complaints were received during the year, and there were no incidents recorded by the Council relating to the consent holders' water abstraction.

During the year under review a good level of environmental performance was demonstrated by pasture irrigators.

This report includes recommendations for the 2009-2010 monitoring year.

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1. Introduction

This is the seventh Annual Report issued by the Taranaki Regional Council to report on the compliance monitoring programmes associated with resource consents for the abstraction of freshwater for irrigation purposes in Taranaki. The report covers the period 1 July 2008 – 30 June 2009. The report covers data collected for compliance monitoring programmes for resource consents for pasture irrigation, horticultural and golf courses irrigation.

The irrigation requirements during the 2008-2009 season were higher than in previous years with soil moisture levels dropping to as low as 15% in coastal areas. The rainfall for 2008-09 was higher than the previous year, with rainfall stations in Taranaki recording above normal rainfall in February 2009. However, much of this rainfall fell on 2 or 3 days of the month, so it was not sufficient to replenish the soil moisture. April's rainfall saw the end of irrigation for many farmers in the Taranaki region.

1.1 Structure of this report

Section 1 of this report presents the background section. It presents general information about compliance monitoring under the Resource Management Act, the Regional Freshwater Plan for Taranaki and the Council's obligations and approach to monitoring through annual programmes, the resource consents held by pasture irrigators to take and use fresh water, the nature of the monitoring programme in place for the period under review, and a description of the activities and operations conducted.

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

Section 3 talks about the results, provides an explanation, and their implication for the environment.

Section 4 presents recommendations to be put into operation in the 2009-2010 monitoring year.

1.2 Compliance monitoring and the Resource Management Act (1991)

The Resource Management Act primarily addresses environmental effects that 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 water take, and may include cultural and socio-economic effects;
(b) physical effects on the locality, including landscape, amenity and visual effects;
(c) ecosystems, including effects on plants, animals, or habitats, whether aquatic or terrestrial;
(d) natural and physical resources having special significance (e.g., recreational, cultural, or aesthetic);

(e) risks to the neighbourhood or environment.

In its management of fresh water, the Taranaki Regional Council must:

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

1.2.1 Regional Freshwater Plan

Section 14(1)(a) of the Resource Management 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 Resource Management Act 1991 (Act).

The Regional Fresh Water 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 fresh water under the Act.

Rule 15 of the RFWP provides for the abstraction of up to 50 cubic metres per day of surface water at a maximum rate of 1.5 litres per second as a permitted activity for each certificate of title. The same provision applies for groundwater under Rule 48 of 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 also satisfied.

However, most irrigation abstractions demand significantly more water than the daily permitted allocation and consequently require resource consent. 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 an 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.

1.2.2 Evaluation of environmental performance

Besides discussing the various details of the performance and extent of compliance by the consent holders during the period under review, this report also assigns an overall rating. The categories used by the Council for evaluation are described 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 trivial (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 year were negligible or minor at most, items of concern were resolved positively, co-operatively, and quickly, the

Council did not record any verified unauthorised incidents involving significant environmental impacts and was not obliged to issue any abatement notices, 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.

- **improvement desirable** indicates that the Council may have been obliged to record a verified unauthorised incident involving significant environmental impacts against the company, and/or abatement notices may have been issued; there were adverse environmental effects arising from activities and intervention by Council staff was required, and there were matters that required urgent intervention, took some time to resolve, or remained unresolved at end of the period under review.
- **poor** performance is used where there were grounds for prosecution or infringement notice

1.2.3 Regional fresh water allocation

At 30 June 2009, a total of 80 resource consents to take and use fresh water for irrigation purposes were registered in the Council's databases. Of that, 54 were for pasture irrigation, 17 for horticultural activities and 9 for recreational purposes (golf clubs). Seventy consents licensed surface water abstractions (87.5 %) while 10 (12.5 %) licensed groundwater abstractions. Figure 1 shows a pie-chart of the distribution of the water allocated for irrigation purposes in Taranaki as of June 2009.

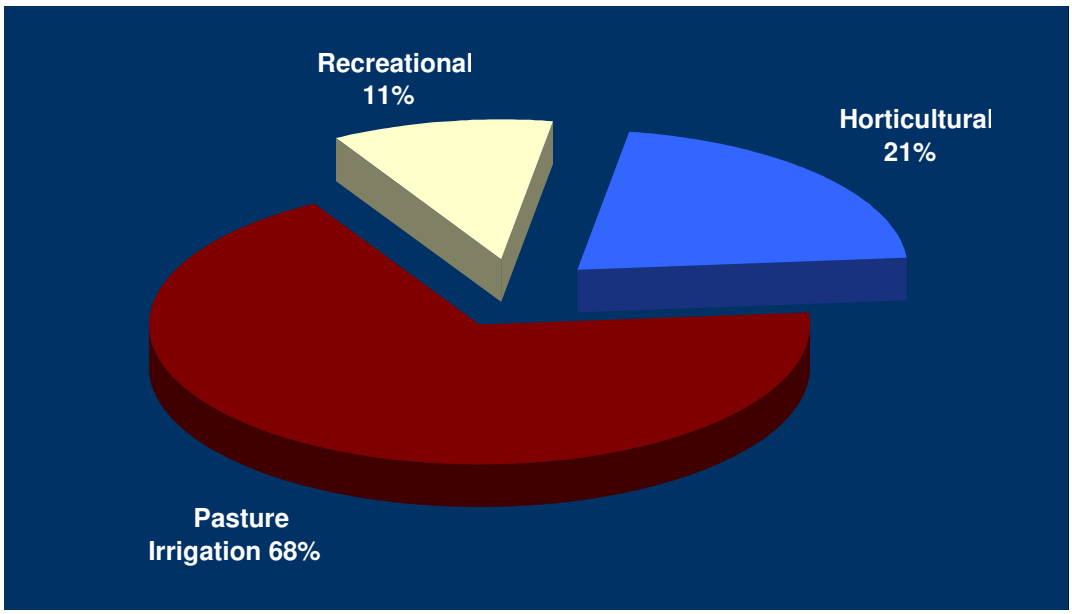

Figure 1 Percentages of water allocation per activity in the Taranaki Region

The breakdown of fresh water allocation in the region indicates that other uses[1] represent 66% of all water takes; pasture irrigation only represents 23% of the total

[1] Includes: Aquaculture, Building Construction/Drainage/Flood Control, Chemical Processing/Manufacturing, Dairy Farm, Dairy, Processing/Manufacturing, Distribution, Storage, Drystock Farm, Hydrocarbon Exploration, Landfills, Local Authorities, Meat and Byproduct Processing, Petrochemical Processing, Piggery Farms, Poultry Farms, Power Generation - HydroPower Generation & Thermal, Quarries, Recreation/Tourism/Cultural, Road/Bridge Construction or Maintenance, Swimming Pools, Tanneries, Timber Treatment or Sawmills, Water Supply or Treatment.

consented water abstractions. Other types of irrigation (golf courses and for horticultural proposes) add up to only 11% (Figure 2).

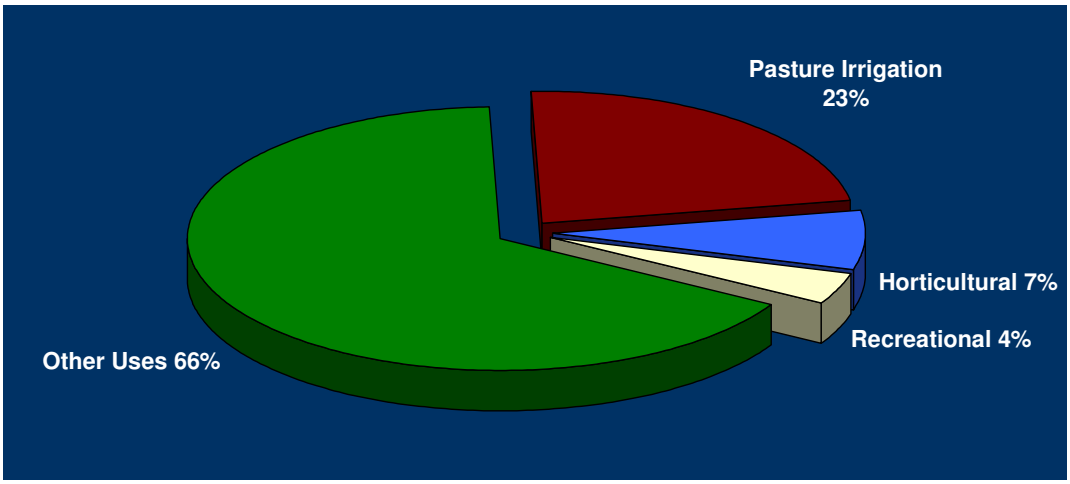

Figure 2 Total water abstractions – distribution by activity 2008-2009

Surface water is the predominant source for pasture irrigation. 48 of the 54 consented water abstractions are for abstractions from rivers and streams (Figure 3). Groundwater abstractions are mainly used as supplementary irrigation water as the relative low yields from Taranaki's aquifers are not sufficient to run an entire irrigation system.

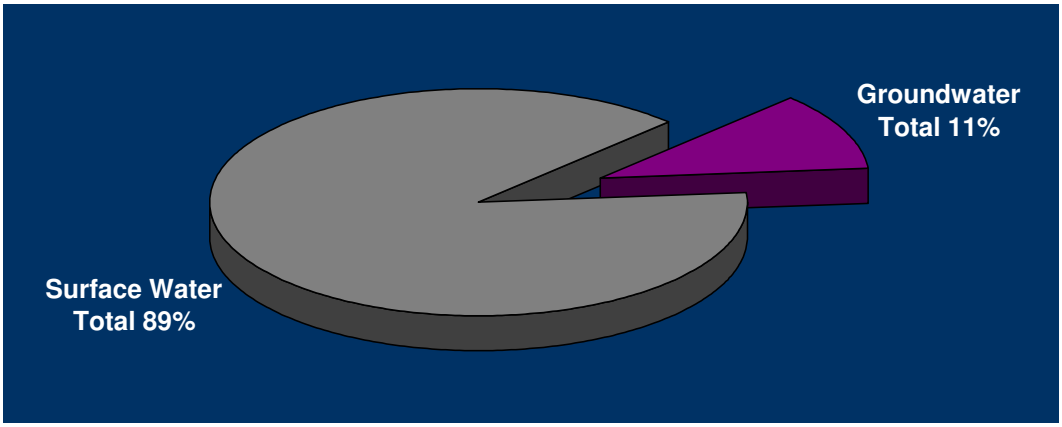

Figure 3 Source of water for pasture irrigation in Taranaki during the 2008-2009 period

Table 1 lists all the irrigation water consents issued by the Council to June 2009 classified by type and source.

Table 1 Total consents granted for irrigation water in Taranaki to June 2009

Consent	Consent Holder	Source	Type of use
0017-2	Manaia Golf Club	Surface Water	Recreational
0124-4	Kaitake Golf Club Inc	Surface Water	Recreational
0132-2	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

Consent	Consent Holder	Source	Type of use
0189-3	AI & KJ Williams	Surface Water	Pasture Irrigation
0270-2	Westown Golf Club Inc	Surface Water	Recreational
0278-3	NRGE Farms Limited/Oceanview Trust	Surface Water	Pasture Irrigation
0464-3	Oakura Farms Limited	Surface Water	Horticultural
0497-3	OJ & FH Wood	Surface Water	Horticultural
0639-2	IR Ogle	Surface Water	Horticultural
0647-3	IG Cassie	Surface Water	Horticultural
0714-2	GD & HM McCallum	Groundwater	Pasture Irrigation
0721-2	IN & AM Aiken	Groundwater	Horticultural
0880-3	IHC New Zealand Inc	Surface Water	Horticultural
1193-3	Vickers B & NM & Church G & CG	Surface Water	Horticultural
1194-3	Hakanoa Properties Management Limited	Surface Water	Horticultural
1223-3	EO & CP Lander	Surface Water	Horticultural
1253-3	KA & RD Southall	Surface Water	Horticultural
1356-2	SW & SM Carr	Surface Water	Horticultural
1721-3	Manukorihi Golf Club Inc	Surface Water	Recreational
1877-2	Te Ngutu Golf Club	Surface Water	Recreational
1879-3	Dairy Developments Ltd / Wairau Nurseries	Surface Water	Horticultural
2138-2	WM & MP Schrader	Surface Water	Pasture Irrigation
2612-2	Duncan & Davies Nursery Ltd	Surface Water	Horticultural
3171-3	Little Knoll Greenhouses	Groundwater	Horticultural
3312-2	GH Lance	Groundwater	Horticultural
3859-2	Living Light 2000 Limited	Groundwater	Horticultural
4450-1	Waitara Golf Club Inc	Surface Water	Recreational
4494-1	CT & J McDonald	Surface Water	Pasture Irrigation
4513-1	PG & BM Bourke	Surface Water	Pasture Irrigation
4783-1	Kohi Beach Farm Limited	Surface Water	Pasture Irrigation
4993-1	Sanderson H & R Trust	Surface Water	Pasture Irrigation
4994-1	H & RA & J Sanderson	Surface Water	Pasture Irrigation
5057-1	Mitchfam Farm Limited	Surface Water	Pasture Irrigation
5128-1	KL Gray	Surface Water	Pasture Irrigation
5306-1	S & M Kapuni Contractors Limited	Surface Water	Horticultural
5568-1	Cornwall Farms	Surface Water	Pasture Irrigation
5570-1	Kaihihi Trust	Surface Water	Pasture Irrigation

Consent	Consent Holder	Source	Type of use
5571-1	Jimian Limited	Surface Water	Pasture Irrigation
5623-1	WD & SC Morrison	Surface Water	Pasture Irrigation
5636-1	Schrider Family Trust	Surface Water	Pasture Irrigation
5696-1	Kokako Road Limited	Surface Water	Pasture Irrigation
5709-1	KG & CJ Sole	Surface Water	Pasture Irrigation
5773-1	Goodin FJ & Sons Limited	Surface Water	Pasture Irrigation
5778-1	Mara Trust	Surface Water	Pasture Irrigation
5781-1	Waikaikai Farms Limited	Surface Water	Pasture Irrigation
5791-1	Ionic Farm Limited	Surface Water	Pasture Irrigation
5797-1	Pihama Farms Limited	Surface Water	Pasture Irrigation
5807-1	Dickie Roger Family Trust	Surface Water	Pasture Irrigation
5813-1	Richards R J & S B Family Trust	Surface Water	Pasture Irrigation
5827-1	Walker & McLean Partnership No 1	Surface Water	Pasture Irrigation
5829-1	Julian RM & MC Family Trust	Surface Water	Pasture Irrigation
5830-1	CC Bishop	Surface Water	Pasture Irrigation
5840-1	Gibbs G Trust	Surface Water	Pasture Irrigation
5863-1	Geary AR Trust	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	Pease David Family Trust	Surface Water	Pasture Irrigation
5905-1	NA & KM McColl	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
6136-1	Crawford AM & TF Trust	Surface Water	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	Jordan JA & MP Trusts Partnership	Surface Water	Pasture Irrigation
6430-1	Ellingworth Margaret Trust	Surface Water	Pasture Irrigation
6486-1	Quintus LM & PC Family Trust	Groundwater	Pasture Irrigation

Consent	Consent Holder	Source	Type of use
6628-1	JW & MT Hamblyn Family Trusts	Surface Water	Pasture Irrigation
7161-1	A & A Fleming/Kinaki Trust	Surface Water	Pasture Irrigation
7231-1	Waimate Fields Limited	Surface Water	Pasture Irrigation
7243-1	Waiwira Trust	Surface Water	Pasture Irrigation
7270-1	Leighurst Lands Limited	Surface Water	Pasture Irrigation
7346-1	Spenceview Farms	Surface Water	Pasture Irrigation
7372-1	Pukeone Partnership	Surface Water	Pasture Irrigation

Most of the pasture irrigation in Taranaki takes place within a 10 km-wide belt of coastal land stretching from Oakura to Waverley, with the rest of sites located between Inglewood and Eltham (Figure 5). Increasing distance from the coast generally correlates with increasing altitude and rainfall, and therefore less need for irrigation.

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 fulfill crop water requirements.

The geographical patterns for the development of irrigation in the coastal region, respond to a combination of meteorological, topographical and soil conditions; lower rainfall rates, small streams, exposure to drying winds, and the presence of lighter, freer-draining soils, particularly sandy, 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 use peaking in January and February; 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 in during the summer season and where it is only possible to achieve irrigation through water harvesting and storage.

1.2.4 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).

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 modeling 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 modeled 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.

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

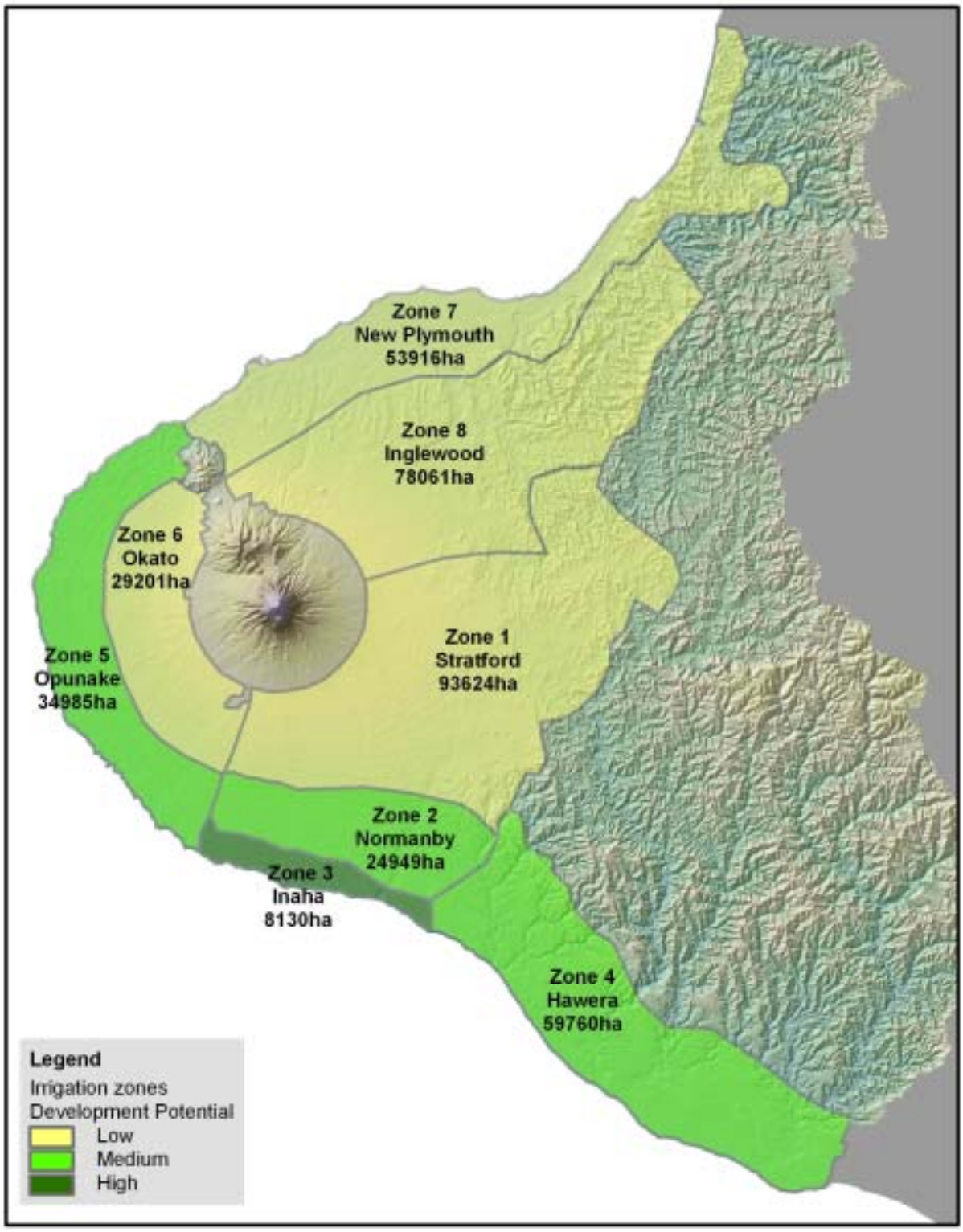

Figure 4 Pasture irrigation zones and development potential

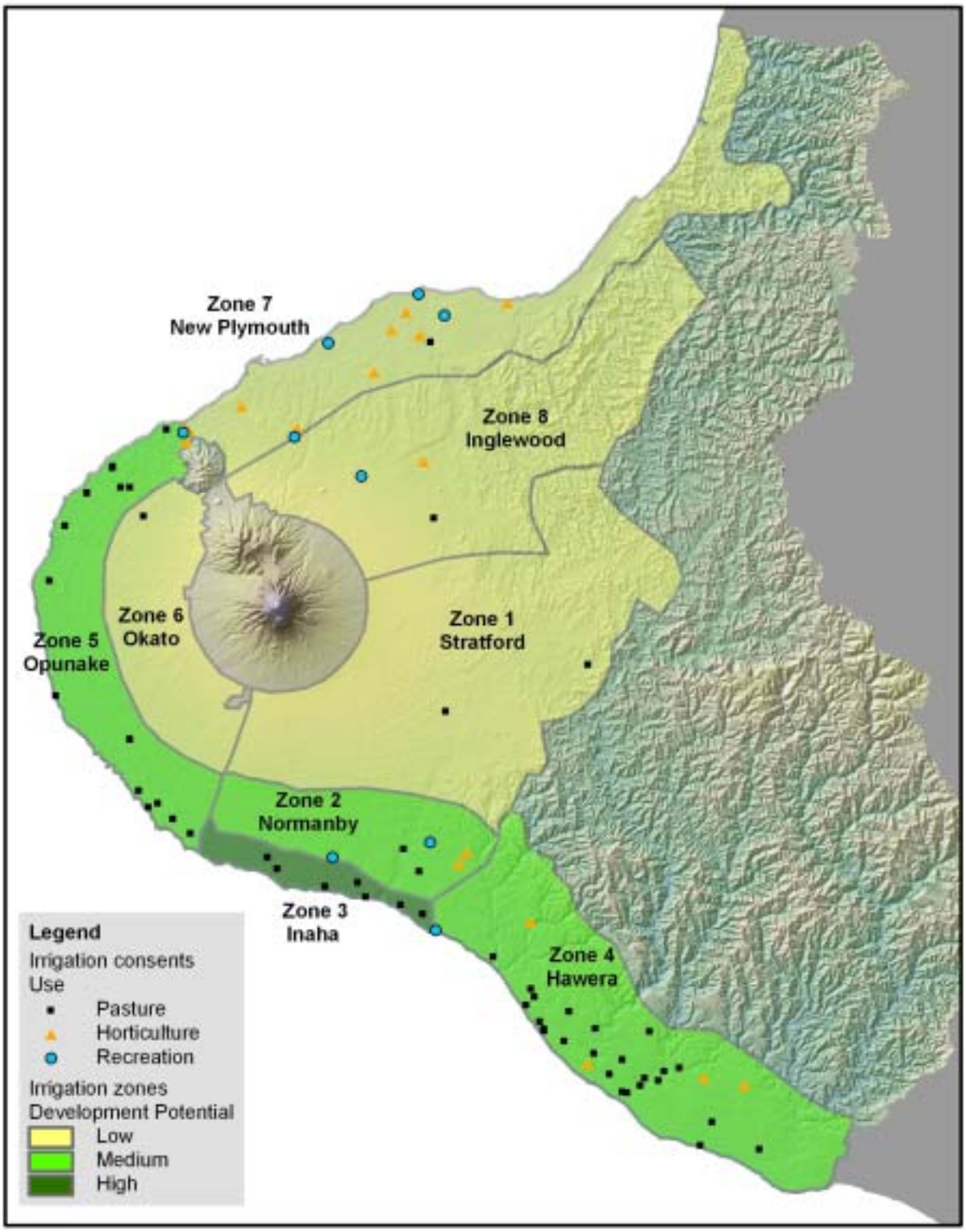

Figure 5 Distribution of all the consented water takes, defined by use, within the eight zones to 30 June 2009

1.2.5 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 into the pressurised category; within this type of system, there are subclasses 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 (Photo 1)

- low capital cost;
- K-lines particularly suited to windy conditions due to sprinkler cowling;
- easily adapted to existing farm layouts and topography;
- allows low application rates;
- low operating pressures;
- high maintenance;
- high labour input to shift (*drag and drop*);
- K-line systems are simple in construction and are relatively easy to operate;
- consists of flexible hoses line designed to ease irrigation applications;
- the main characteristic of the system is a series of small, sturdy plastic pods protecting a small sprinkler firmly attached to special low density polyethylene pipe.

Photo 1 Mosaic of pictures depicting K-line systems

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

- high capital cost;
- large circular irrigating area;
- allows versatility in application rates and return periods;
- low operating pressures;
- low maintenance;
- Low labour input;
- centre pivots have become very popular all over the world;
- most are provided with automatic controls and metering equipment;
- frequently desirable on steep, rocky, or uneven soils;
- not ideal where energy may be undependable or expensive.

Photo 2 Centre pivot system in South Taranaki

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

- winch driven irrigators that drag a soft hose;
- low capital cost;
- the rotation of the boom usually drives the winch;
- may cover a large irrigating area;
- simple operation;
- allows some control with application rates;
- poor performance in windy conditions;
- uneven application, particularly at end or runs;
- not suited to irregular farm layout (*boom irrigators only*);
- high operating pressures (*hard hose gun irrigators only*).

Photo 3 Travelling irrigator

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

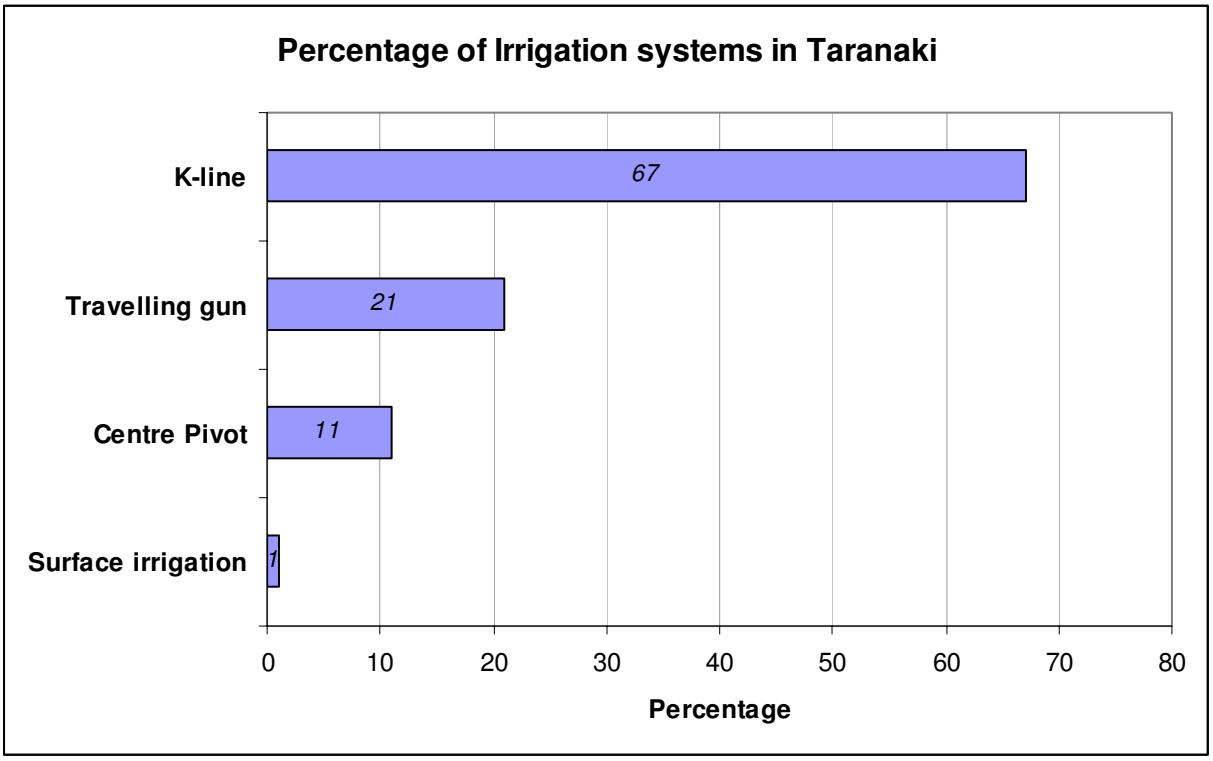

Figure 6 Percentages of irrigation system types in Taranaki

1.2.6 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 tests are conducted for new projects.

1.2.7 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. 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 flow in rivers and streams. During these periods, the Council closely monitors river flows and the exercise of water permits.

Most of the 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 Regional Freshwater Plan for Taranaki states that at least 2/3 (brown trout) habitat at

mean annual low flow (MALF) is to be retained in rivers and streams. For many smaller waterways, 2/3 habitat roughly equates to 2/3 MALF, however, the cut-off flow level on many irrigation abstraction consents is generally set at MALF. It is the responsibility of the consent holder to ensure compliance with consent conditions at all times.

Under certain tide and stream flow conditions in the coastal reaches of some waterways, sea water travels upstream. Pumping under these conditions could draw saline or brackish water which would pose undesirable consequences on the equipment, crop and soil.

Groundwater abstractions

Groundwater levels in coastal bores should be maintained proportionally to the depth to saline water interface from mean sea level and the height of the piezometric surface above mean sea level and should be monitored to avoid the risk of sea water intrusion.

Fortunately in Taranaki, the risk of salt-water intrusion, in general, is not a concern but the Council has started to consider closer monitoring as the demands on groundwater resources along the coastal belt increases; this will inevitably incorporate a saltwater intrusion monitoring system to provide advance warning using water level and water quality data from a number of critical bores.

Groundwater abstracted behind the saltwater front is typically 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 irrigations, as the soil moisture decreases, the salts in the soil concentrate to several times the initial value in the irrigation water.

Poor crop growth due to irrigation with saline water is usually due to the osmotic stress caused by the total concentration of salts rather than due to specific ions. Irrigation water containing a high ratio of sodium to calcium and magnesium can adversely affect soil structure (sodicity) and highly saline water can impair plant growth, although the effects of salinity are very situation specific (ANZECC 2000).

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 fertilizer application regimes is required to minimise the risk of groundwater contamination and surface water with nitrates.

Implementation of riparian management plans, planting of riparian margins, and fencing can help reduce contamination of surface water by nitrates in runoff or soakage from irrigated pasture.

1.2.8 Streamflow measurements

In order to check for compliance with consent conditions set to safeguard the intrinsic values of Taranaki's streams, minimum flows are to be complied with and maintained at all times. To establish compliance the Council undertakes streamflow measurements by indirect and direct methods at control points usually upstream and downstream of water abstraction points.

Photo 4 Installation of a staff gauge at a new control point

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

Flow is measured by the speed of a small propeller 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 measures are carried out under different flow conditions until a rating curve is developed. A rating curve is the result of a very approximate relationship between a staff gauge (water level) and a flow rate. Once the rating curve has been developed, discharge values can be obtained by just reading the staff gauge. Rating curves have to be constantly updated with additional stream-gauging to compensate for any shifts or changes in the stream cross section.

Photo 5 Streamflow measurement using a wading rod and propeller

1.3 Irrigation water permits to June 2009

The number of active resource consents for freshwater abstractions for irrigation purposes to June 2009 is 80. This is a decrease of two from the previous monitoring period 2007-2008. During the period under review, two new consents were granted and four new applications for water for irrigation purposes were received. Table 3 lists the new consents for irrigation granted during 2008-2009.

Table 3 New, renewed and surrendered irrigation water consents during 2008-2009

	Consent Number	Consent Holder	Catchment	Stream
New Consents	7346-1	Spenceview farm	Kaikura	Kaikura
	7372-1	Pukeone Partnership	Waitotora	Waiau
Renewed Consents	1877-2	Te Ngutu Golf Club	Waihi 5	Waihi 5
	5623-1	WD & SC Morrison	Whenuakura	Whenuakura
	5876-1	GA & RJ Dorn	Punehu	Punehu
	6486-1	Quintus LM & PC Family Trust	Patea	Patea
Surrendered Consents	0617-2	DA & DG Keene	Urenui	Urenui
	2366-2	Eden Gardens	Tangahoe	Tawhiti 1
	4856-1	LD & SE Adamson	Otahi 1	Otahi 1

One consent was transferred between July 2008 and June 2009, this was consent 5696. The land holder is now Kokako Road Limited, it was previously held by Kohi Meats Limited.

Four resource consents were renewed during 01 July 2008 and 30 June 2009 (Table 3). Several current consents are scheduled to be renewed in June 2010. A renewal of a resource consent is always considered as a new application for which a complete assessment of environmental effects has to be provided along with the application.

During the monitoring period, there were three consents surrendered.

1.4 Climatological data and irrigation requirements

The Taranaki Regional Council provides live on-line data on soil moisture, precipitation and temperature via its website. Eight sites along the southern coast and throughout the hill country provide 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 and contributing to the base flow of groundwater discharges. 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 water.

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, subsequently, crop (pasture) water requirements. Crop water requirements can be defined as the depth of water needed to meet the water loss through evapotranspiration of the crop. The methods for calculating evapotranspiration from meteorological data require the knowledge of climatological and physical parameters.

In order to know the irrigation requirements for pasture production, the amount of water needed to compensate for evapotranspiration and the amount of rainfall are required. To avoid crop water stress, rainfall and irrigation must be sufficient to meet the pasture's 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:

a) only the amount of water required by the plant is applied
b) leaching of nutrients is minimised
c) pasture quality is optimised
d) the benefit of rainfall and irrigation is maximised
e) the environmental impacts are minimised
f) costs are reduced

1.4.1 Droughts in Taranaki

Droughts are a normal, recurrent feature of climate. This phenomenon occurs almost everywhere though its 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 2008-2009 summer period was wetter than the previous year, with rainfall percentages for the region ranging between 87 and 118% of normal. This was

predominantly due to the higher precipitation in February; up to two times the normal rainfall. In particular, around Patea and Hawera, 222 and 223% respectively of normal precipitation was recorded.

Mount Taranaki recorded above normal rainfall for the five month (summer irrigation) period, which meant that the rivers were generally running above normal flows. In turn, this enabled the irrigators to utilise their water takes for a longer period, before being required to cease abstracting due to low flows. Figure 7 shows the distribution of rainfall from 1 November 2008 to 31 March 2009.

Climate change scenarios suggest that Taranaki may experience more severe 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 Taranaki region indicate a slight increase in the annual accumulated potential evapotranspiration (in mm), with a higher 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.

When there is substantial rainfall to recharge the moisture levels in the rivers, lakes and soils, droughts are considered to be broken. Soil water reserves are replenished first, followed by streamflow, reservoirs and lakes, and groundwater. Drought impacts may diminish rapidly in the agro-pastoral sector because of its reliance on soil water, but linger for months or even years in other sectors dependent on stored surface or subsurface supplies. Groundwater users, who are often the last to be affected by drought during its onset, may be the last to experience a return to normal water levels[2].

1.5 Monitoring programme

1.5.1 Introduction

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

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.

[2] National Drought Mitigation Center, Nebraska, USA.

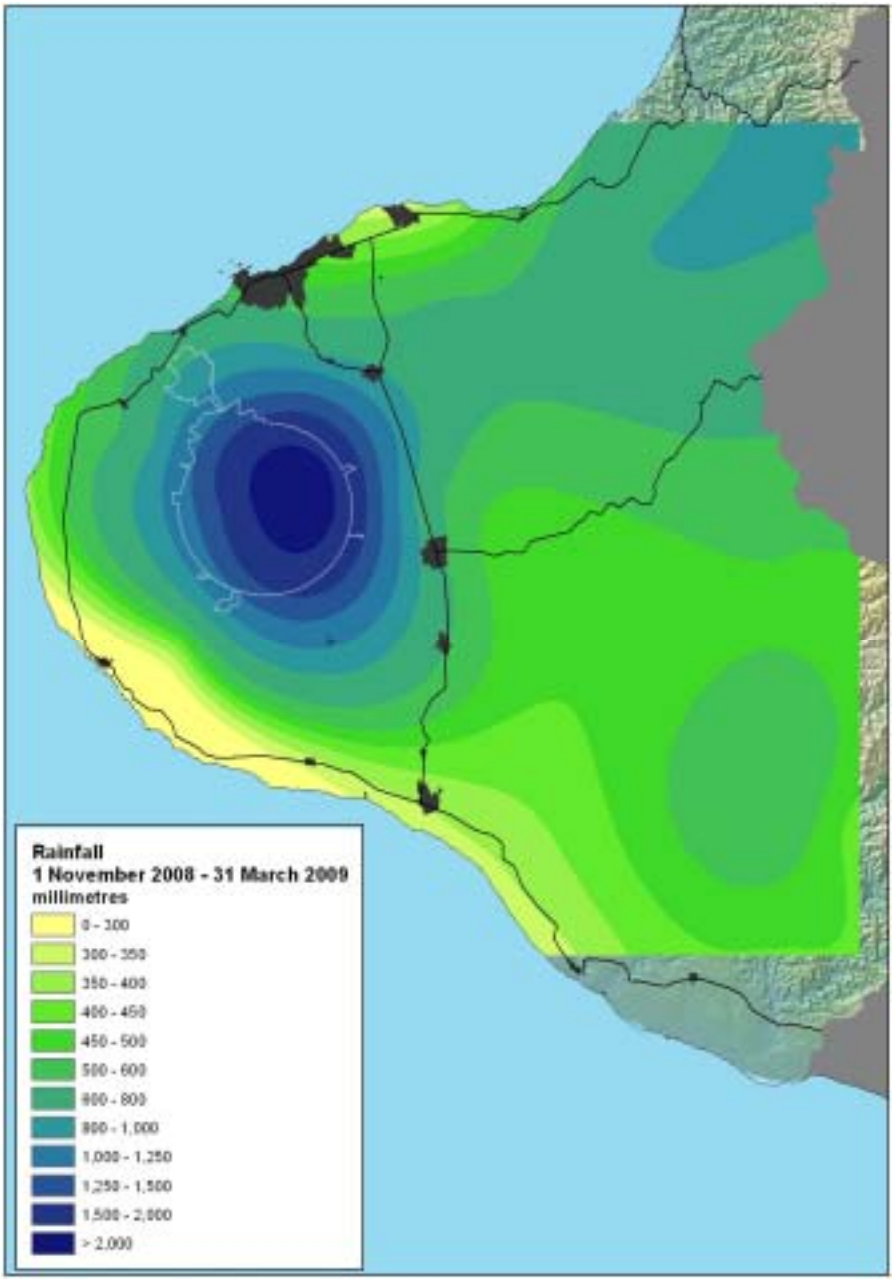

Figure 7 Distribution map of the total rainfall recorded from 1 November 2008 to 31 March 2009

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. Monitoring necessarily increases in drier years.

The 2008-2009 monitoring programmes for irrigation water permits are comprised of three primary components; liaison with consent holders, site inspections, and data review and assessment for compliance. In the next sections, a brief discussion of these components is presented.

1.5.2 Programme liaison and management

There is generally a significant investment of time and resources by the Taranaki Regional Council in ongoing liaison with resource consent holders over consent conditions and their interpretation and application, in discussion about monitoring requirements, preparation for any reviews, renewals, or new consents, advice on the Council's environmental management strategies and the content of regional plans, and consultation on associated matters.

In 2008-2009, due to the wetter than expected February, the flows in the streams remained above the consented cut-off limits for longer, meaning there were less farms required to stop irrigating than in the previous year. During periods where the flows in any catchment's waterways drop below the mean annual low flow, the Council endeavours to closely work with the consent holders to achieve full consent compliance.

1.5.3 Site inspections

During the period under review, the Council endeavoured to inspect all the surface water compliance monitoring programmes in place. Additionally, the "non-otherwise monitored" activities comprising golf courses and horticultural irrigation schemes were also inspected.

The 2008-2009 pasture irrigation monitoring programmes provided for an annual inspection of each pasture irrigation abstraction site, to assess/evaluate compliance with consent conditions. 98% of the irrigation consents were inspected during the 2008-2009 period.

Site inspections are focused on the overall set-up of the irrigation equipment's intakes structures; visual inspections for appropriate screenings, flow gauges, fences, planting of riparian vegetation, flowmeters and datalogger devices are carried out on the basis of 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 are 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 7.

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

For sites where no dataloggers are fitted, assessments of water takes for the 2008-2009 year were carried out by a combination of data obtained from the consent's holder records and information derived from previous computerised calibration checks of the pump discharge rate when the systems were operating during the summer period; these calibrations took place during the irrigation seasons of 2003-2005.

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

1.5.4 Abstraction records

A special condition of all irrigation water abstraction permits **requires the consent holder to keep a record of abstraction.** This key information is necessary in order for the Council to assess consent compliance, and determine actual water use.

The Council annually reminds consent holders (in July) requesting that their abstraction records be provided for the forthcoming year ending 30 June. The daily irrigation record should include:

(1) date/time when the pump was operated;
(2) water meter reading at start and end of each day; and
(3) 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 2008-2009 irrigation water use, were not required to submit annual hard copy records to the Council for the review period. Data logged on the dataloggers were downloaded in the field by Council staff.

By the end of the 2008-2009 irrigation season, 22 dataloggers had been fitted to consent holder water pumps. During 2008-2009, no flowmeters were installed on irrigation systems.

The list of consent holders who have their intake systems equipped with dataloggers and their installation date can be found in Table 4.

The information derived from the flowmeters is important to the Regional Council to help manage the resource more sustainably and assess compliance – this is particularly important in drier localities or in water shortage times. 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[3]. The information shows water managers the difference between what is allocated and when and how the resource is actually used.

If a water meter is not installed following the manufacturer's instructions and specifications, the data is not reliable as large errors may occur. The error produced by a valve installed immediate 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. Photo 6 below shows an example of a good installation of a flowmeter.

[3] Water Programme of Action Ministry for the Environment.

Photo 6 Properly installed flowmeter

The proposed National Environmental Standard (NES) for Measurement of water takes is still being drafted into regulation at the time of writing this report. The NES will help improve the management of fresh water in Taranaki by ensuring accurate measurement of water takes. The standard is expected to set minimum requirements for the installation and operation of new water measuring and recording devices, and for the transfer of data to regional councils. More specifically, the NES is expected to assist the sustainable management of New Zealand's water resource by:

- setting minimum requirements for all new water measuring devices that are installed, and
- defining situations where water measuring devices are compulsory[4]

There have been concerns that some flowmeter installations have been inadequate[5], which compromises accuracy. Irrigators need to be confident that their investment will work accurately and effectively. Under the standard to be introduced it will be the responsibility of the Regional Council to determine the standard and compliance of specific installations, therefore it is advocated that a reputable contactor be hired for the installation of flowmeters and dataloggers and that a Council officer inspects these installations.

It is imperative that the installation of the flowmeter is in accordance with the manufacturer's specifications. Water turbulence can greatly reduce the accuracy of a flowmeter. There are many flowmeters installed that do not comply with the minimum technical requirements for installation and therefore the readings given are not correct. Likewise, many of the water meters installed are approaching the end of their operating life and an overhaul may be needed.

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[4] Ministry for the Environment: http://www.mfe.govt.nz

[5] Good installation leaves sufficient straight length of pipe between gate valves, elbows, bends etc and the flowmeter to ensure that there is no turbulence in the water passing through the meter; turbulence greatly reduces the accuracy of water meters.

Appendix II presents a preliminary draft of the guidelines for flowmeters for the Taranaki Regional Council.

Table 4 Dataloggers installed to June 2009

Consent	Holder	Datalogger serial Nº	Installation date	Malfunctioning
0164	JR & DM Baker	302100407	Dec-05	Yes
0714	GD & HM McCallum	41084139	Nov-08	No
1721	Manukorihi Golf Club Inc	AG3-0114	Nov-08	No
1877	Te Ngutu Golf Club	AG3-0029	Nov-08	No
2138	Schrader WM & MP	302100367	Feb-05	No
4494	McDonald	302100256	Dec-03	Yes
4783	Kohi Beach Farm	302100215	Dec-03	Yes
5128	KL Gray	302100111	Sep-04 reset	No
5636	Schrider Trust	407100574	Nov-05	Yes
5696	Kokako Road Limited	-	Nov-08	Missing
5709	KG & CJ Sole	302100120	Dec-03	No – but disconnected
5778	Mara Trust	302100436	Dec-05	Yes[6]
5876	RJ Dorn	407100749	Jan-06	Yes, has been replaced with an iRIS 150
5896	Kohi Investments Limited	41081080	Nov-08	No
5898	Pease David Family Trust	41081095	Feb-08	No
5950	WD & SC Morrison	302100398	Mar-05	No
5973	DR & AJ Gibson	30210042	Dec-03	Yes[5]
6159	Pinehill Land Company Limited	302100277	Nov-04	No
6193	Cradles Farm Trust No 2	30210050	Dec-03	Yes – missing
6430	Ellingworth Margaret Trust	302100434	Nov-05	No
6486	Quintus LM & PC Family Trust	302100143	Dec-03	Yes
6628	JW & MT Hamblyn Family Trusts	407100784	Jul-06 replaced	No

All of the dataloggers were checked and the data downloaded where possible. One unit was found disconnected from the flowmeter which constituted a breach of the consent condition requiring the keeping of records of abstraction. There continued to be several issues with faulty dataloggers; 36% experienced problems during 2008-2009. Consents holders were advised of this situation on the inspection notices following the inspections.

The Council has started to recommend other alternatives for datalogging as the overall performance of the *Hydroflow*™ units has not been satisfactory. Also, the *Hydroflow*™ dataloggers only have a battery life span of approximately 7 years and many of these dataloggers in use are fast approaching this. Council staff have advised the appropriate consent holders of this fact and it is expected that remedial action will be taken prior to the next irrigation season.

[6] Datalogger is faulty, as it is constantly recording that water is being taken.

Per the monitoring programmes the Council's staff gather, review and collate water abstraction records. All records are entered into the Council's databases and are available upon request.

The results of the 2008-2009 annual abstraction data review are summarised in Section 2 of this report.

2. Results

Results of compliance monitoring of water abstractions for irrigation purposes in 2008-2009 are given below. The background to the monitoring programmes was given in previous introductory sections.

During the year, 45 out of a total of 54 current consents to take and use water for pasture irrigation were exercised. Eleven consents were not exercised, with 8 of those not yet operative.

The results of the monitoring carried out in 2008-2009 are given below in sections 2.1 to 2.7 and summarised in Tables 5 to 10. Separate tables are given for groundwater and surface water abstractions.

2.1 Site inspections

During the 2008-2009 irrigation season, the Council carried out compliance monitoring inspections at 61 sites (Table 5), compared to 54 inspections carried out for the 2007-2008 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 1.2.8. 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).

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 5 lists the consents inspected during the period being reviewed and reported on.

Table 5 Sites inspected during 2008-2009 for consent compliance

Consent	Consent Holder
0017-2	Manaia Golf Club
0124-4	Kaitake Golf Club Inc
0132-2	Hawera Golf Club Inc
0164-2	JR & DM Baker
0184-3	Inglewood Golf Club Inc ()
0189-3	AI & KJ Williams
0270-2	Westown Golf Club Inc
0278-3	NRGE Farms Limited/Oceanview Trust
0714-2	GD & HM McCallum
1193-3	Vickers B & NM & Church G & CG
1223-3	EO & CP Lander
1721-3	Manukorihi Golf Club Inc

Consent	Consent Holder
1877-2	Te Ngutu Golf Club
2138-2	WM & MP Schrader
3171-3	Little Knoll Greenhouses
4450-1	Waitara Golf Club Inc
4494-1	CT & J McDonald
4513-1	PG & BM Bourke
4783-1	Kohi Beach Farm Limited
4993-1	Sanderson H & R Trust
4994-1	H & RA & J Sanderson
5128-1	KL Gray
5568-1	Cornwall Farms
5570-1	Kaihihi Trust
5571-1	Jimian Limited
5623-1	WD & SC Morrison
5636-1	Schrider Family Trust
5696-1	Kokako Road Limited
5709-1	KG & CJ Sole
5773-1	Goodin FJ & Sons Limited
5778-1	Mara Trust
5781-1	Waikaikai Farms Limited
5791-1	Ionic Farm Limited
5797-1	Pihama Farms Limited ()
5807-1	Dickie Roger Family Trust
5813-1	Richards RJ & SB Family Trust
5827-1	Walker & McLean Partnership No 1
5829-1	Julian RM & MC Family Trust
5830-1	CC Bishop
5840-1	Gibbs G Trust
5863-1	Geary AR Trust
5876-1	GA & RJ Dorn
5878-1	Woollaston Family Trust Partnership
5887-1	A & EN Barkla
5896-1	Kohi Investments Limited
5898-2	David Pease Family Trust
5905-1	NA & KM McColl
5950-1	WD & SC Morrison
5973-1	DR & AJ Gibson
6026-1	JR & DM Baker
6136-1	Crawford AM & TF Trust
6159-1	Pinehill Land Company Limited

Consent	Consent Holder
6193-1	Cradles Farm Trust No 2
6292-1	New Plymouth Golf Club Inc
6429-1	Jordan JA & MP Trusts Partnership
6430-1	Ellingworth Margaret Trust
6486-1	Quintus LM & PC Family Trust
6628-1	JW & MT Hamblyn Family Trusts
7161-1	A & A Fleming/Kinaki Trust
7243-1	Waiwira Trust
7270-1	Leighurst Lands Limited
TOTAL	**61**

2.2 Non-exercised consents

Of the 80 resource consents granted to date for water abstractions for irrigation purposes, 11 were not exercised during 2008-2009 (Table 6). Several consents were granted in the middle or towards the end of the irrigation season and the systems were not operative during the season.

Table 6 Consents non-exercised during 2008-2009

Consent	Consent Holder
4513-1	PG & BM Bourke
5057-1	Mitchfam Farm Limited
5813-1	Richards R J & S B Family Trust
5830-1	CC Bishop
5905-1	NA & KM McColl
6136-1	Crawford AM & TF Trust
6429-1	Jordan JA & MP Trusts Partnership
7161-1	A & A Fleming/Kinaki Trust
7231-1	Waimate Fields Limited
7346-1	Spenceview Farms
7372-1	Pukeone Partnership

2.3 Residual flow compliance

The 2008-2009 irrigation season was a busy one for the Council's hydrological unit as the weather conditions called for close and frequent monitoring of waterway's ecological flows[7]. During the period under review compliance with residual flow conditions for surface water abstraction sites were assessed 34 times in 16 waterways. Flow gaugings were carried out between 12 January and 27 March 2009.

[7] Ecological flows are defined as the flows and water levels required in a water body to provide for the ecological function of the flora and fauna present within that water body and its margins. (Ministry for the Environment 2008)

Table 7 lists the consents assessed for residual flow compliance and the dates of the monitoring.

Table 7 Stream gaugings carried out for residual flow compliance

Gauging No	River	Site	Stage	Flow (l/s)	Date/Time	Consent No.
6990	Otahi 2	Ihaia Rd	0.510	123	27/Mar/2009 13:37	5973-1
6988	Kaihihi	SH45	0.298	425	27/Mar/2009 10:52	5128-1, 5570-1, 5773-1, 5778-1
6985	Ouri	SH45	0.395	266	23/Mar/2009 14:03	5791-1
6984	Taungatara	SH45	0.316	586	23/Mar/2009 13:23	5829-1
6975	Taungatara	SH45	-	638	18/Mar/2009 12:32	5829-1
6969	Wairoa	D/S of Dam	0.108	111	17/Mar/2009 11:16	5807-1
6966	Kaikura	Proposed Dam (7346)	0.635	140	13/Mar/2009 13:18	7346-1
6965	Waiau 2	Above Proposed Dam (7372)	0.475	137	13/Mar/2009 10:24	7372-1
6936	Inaha	Lower Inaha Rd	0.388	225	09/Feb/2009 14:41	5887-1
6935	Waiokura	SH45	0.248	160	09/Feb/2009 10:33	5827-1, 5840-1
6934	Mangatengehu	SH3	-	73[8]	07/Feb/2009 15:02	7270-1
6933	Mangamawhete	SH3	-	207[8]	07/Feb/2009 14:06	7270-1
6932	Waikaikai	5781-1	-	4.45	05/Feb/2009 13:59	5781-1
6931	Mangaroa	d/s Schrider Take site	0.151	41	05/Feb/2009 12:08	4494-1, 5636-1, 7243-1
6930	Kokako	Kokako Rd	0.602	48[8]	05/Feb/2009 10:32	5896-1
6927	Otahi 2	Ihaia Rd	0.478	57[8]	04/Feb/2009 9:58	5973-1
6926	Taungatara	SH45	0.289	481[8]	04/Feb/2009 11:26	5829-1
6925	Inaha	Lower Inaha Rd	0.398	256	04/Feb/2009 13:39	5887-1
6924	Makuri	Toko Rd	0.255	145[8]	02/Feb/2009 11:07	5878-1
6922	Wairoa	D/s Dam	-	287	28/Jan/2009 10:02	5807-1
6921	Wairoa	Kohi Beach Farm	0.301	201	28/Jan/2009 11:51	4783-1
6920	Kaikura	Proposed Dam (7346)	0.642	142	02/Feb/2009 13:21	7346-1
6918	Kaihihi	SH45	0.267	369	02/Feb/2009 11:35	5128-1, 5570-1, 5773-1, 5778-1
6916	Ouri	SH45	0.373	211	02/Feb/2009 10:34	5791-1
6915	Oeo	5797-1	0.408	88[8]	02/Feb/2009 11:36	5797-1
6906	Waiokura	SH45	0.260	219	27/Jan/2009 12:16	5827-1, 5840-1
6898	Makuri	Toko Rd	0.300	249	26/Jan/2009 14:24	5878-1
6897	Waiau 2	Above Proposed Dam (7372)	0.525	126	22/Jan/2009 12:36	7372-1
6896	Waiokura	SH45	0.275	194	21/Jan/2009 14:56	5827-1, 5840-1
6889	Makuri	Toko Rd	0.321	289	16/Jan/2009 10:52	5878-1
6888	Makuri	Toko Rd	0.329	306	15/Jan/2009 15:50	5878-1
6881	Kaihihi	SH45	0.320	515	12/Jan/2009 14:34	5128-1, 5570-1, 5773-1, 5778-1
6878	Otahi 2	Ihaia Rd	0.501	108[8]	12/Jan/2009 11:26	5973-1
6877	Taungatara	SH45	0.305	638	12/Jan/2009 12:44	5829-1

The periods when the stream gaugings activities take place coincide with the periods of low flows. Of the 34 gaugings, eight were found to be breaching the residual flow requirement set out by the consent, meaning the irrigators were required to stop taking until further notice. Photo 7 shows a stream gauging activity taking place downstream of one of the consented water takes.

[8] When the flow in the stream was gauged as being below the irrigators' cut-off limit.

Photo 7 Stream gauging

2.4 Compliance with abstraction rate and volumetric limits

Compliance with abstraction rate and volume is assessed for all the consent holders from whom data is available[9]. Compliance with abstraction rate limits was determined either by direct measurement or by working it out from records provided as discussed earlier.

Of the consents for which data were received, 83% were within compliance for flow-rate allocation. Non compliance with consent conditions for abstraction rate is discussed further in section 3.

During the monitored period five consent holders submitted their records after the deadline of 31 July and 14 consent holders did not submit records to the Council; details on these consents are reported under section 2.5.

Table 8 displays the information for consents that were found to be in breach of the allocated flowrate or volumetric amount at any time during the exercising of the consent during the 2008-2009 review period. It is considered that a consent condition breaches abstraction limits when the exceedance is greater than 5% of the consented limit.

[9] Some dataloggers presented problems during 2008-2009 and therefore the data was not available.

Table 8 Consents breached for exceeding allocation limits during 2008-2009

Consent	Holder	Source	Breach	Compliance
1721	Manukorihi Golf Club Inc	Surface Water	Rate	No[10]
5950	WD & SC Morrison	Groundwater	Volumetric/Rate	No[11]
5973	DR & AJ Gibson	Surface Water	Volumetric	No[12]
6026	JR & DM Baker	Groundwater	Rate/Data	No[13]
6292	New Plymouth Golf Club	Surface Water	Data	No[14]
6628	JW & MT Hamblyn Family Trusts	Surface Water	Volumetric	No[15]

2.5 Record keeping compliance

For the 2008-2009 review period, abstraction records were received **on time** from all but **19** water abstraction consent holders who exercised their permits. Written notifications and telephone calls received advising the non-exercising of consents were also taken *as provision of records*. Consents holders who have dataloggers fitted to their intake systems are exempted from providing data to the Council as the data collection is yearly undertaken by Council's staff as part of the compliance monitoring programmes. In the 2008-2009 season, it was found that four of the dataloggers had malfunctioned (Table 9).

Table 9 Dataloggers that failed in 2008-2009

Consent	Holder
4783	Kohi Beach Farm
5778	Mara Trust
5973	DR & AJ Gibson
6486	Quintus LM & PC Family Trust

The 19 consent holders from whom data **were not** received in time are listed in Table 10.

[10] Breached rate, only allowed to take at a maximum rate of 4.8 L/s (5.04 L/s with 5% error), but on numerous occasions was taking at 6.7 L/s.

[11] Both volume and rate were breached for the entire irrigation period.

[12] Both volume and rate were breached on six occasions. Maximum rate and volume allowed is 16 L/s and 1383 m3/day respectively.

[13] Records were incomplete, so were unable to determine the exact amounts taken each day; however with the records that the Council did receive, the consent holder breached the flow rate allowed.

[14] Required to supply pumping hours/rates as stated in the special conditions of the resource consent. This has not been supplied.

[15] Can only take at a rate of 19.0 L/s if irrigation is to be undertaken over a 24 hour period. If the pumping rate is to be set at 22.8 L/s, irrigation can only take place for 20 hours a day. The volume was exceeded on numerous occasions.

Table 10 Consents for which data were not received by the Council at 31 July 2009 for the 2008-2009 irrigation season

Consent	Consent Holder	Received late ?
0017-2	Manaia Golf Club	**Never**
0164-2	JR & DM Baker	**Datalogger faulty 2007-08, so were required to supply records. None were received.**
1223-3	EO & CP Lander	**Never**
4993-1	Sanderson H & R Trust	Yes, received 7 August 2009
4994-1	Sanderson H & R Trust	Yes, received 7 August 2009
5568-1	Cornwall Farms	**Never**
5570-1	Kaihihi Trust	**Never**
5623-1	WD & SC Morrison	**Never**, datalogger to be installed.
5709-1	KG & CJ Sole	**Never**, datalogger disconnected 2007-08.
5797-1	Pihama Farms Limited	**Never**
5807-1	Dickie Roger Family Trust	Yes, received 2 August 2009
58271	Walker & McLean Partnership No 1	Yes, received 22 October 2009
5829-1	Julian RM & MC Family Trust	Yes, received 12 January 2010
5840-1	Gibbs G Trust	**Never**
5863-1	Geary AR Trust	**Never**
5878-1	Woollaston Family Trust Partnership	**Never**
5887-1	A & EN Barkla	**Never**
6193-1	Cradles Farm Trust No 2	**Never** – datalogger removed.
7270-1	Leighurst Lands Limited	**Never**

Consent holders whose data is not received will be issued with abatement notices with the requirement to keep manual records or install dataloggers to account for their water abstraction permit.

2.6 2008-2009 irrigation water use

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 2008-2009, 82% of the irrigation systems were not yet operational. Only two consents were not exercised even though the irrigation systems were in place.
- Compared with previous years, there were more breaches for exceeding limits on allocated rates and volumes in spite of the fact the season was not as dry as 2007-08.
- All the golf clubs exercised their water rights during 2008-2009.
- Two new consents for pasture irrigation were granted during the period under review.

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

2.7 Register of incidents

The Taranaki Regional Council operates and maintains a register of all complaints or reported and discovered excursions from acceptable limits and practices, including non-compliance with consents, which may damage the environment. The register ['unauthorised incident register'] includes events where the consent holder concerned has itself notified the Council. The register contains details of any investigation and corrective action taken.

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

In the 2008-2009 monitoring year, there were no incidents recorded by the Council that were associated with the consent holder's water abstraction

3. Discussion

In drafting and reviewing conditions on water take permits and in implementing monitoring programmes, the Taranaki Regional 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 Resource Management Act to assess the effects on the environment from the exercising of consents.

Improving the **efficiency of water use** is a key outcome sought 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 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 monitored. Measuring actual water used is part of demonstrating and measuring progress towards more efficient water use[16].

3.1 Discussion of consent holder performance

Each year the Taranaki Regional Council assesses consent holder performance 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 only five (9%) of the consent holders breached limits for rate/volume abstracted, while one did not supply all the required information as shown in Table 8. There have now been nine dataloggers that have either started to show signs of failure or are now faulty. With water abstractions in Taranaki being of relative minor amounts when compared with other regions of the country, the Council considered the options available for a compact and economic datalogging device and originally recommended the installation of the *Hydroflow*™ units. Most of these units have been installed for over five years. However, during 2008-2009 there were increasing examples of units malfunctioning.

The Council has been committed to explore new alternatives for data-logging devices and recommends the same type of instruments used by the Council for its own hydrological monitoring stations. It is anticipated that as more already deployed *Hydroflow*™ units begin to breakdown, their replacement with more reliable units will be promoted.

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 Taranaki Regional Council have specific conditions about the installation of a water meter devices. A reliable and accurate flowmeter is crucial to providing good information to the consent holder and the Regional Council alike.

[16] Ministry for the Environment – Proposed National Environmental Standard for Water Measuring Devices.

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 measurement in cubic meters
- Include a pulse output that is compatible with the dataloggers recommended by TRC.
- Have sufficient pipe length for TRC to use a strap-on meter for periodic checks. Pipe length should be at least 10 times the diameter before the meter and 5 times the diameter after the meter or manufacturer's specifications.
- 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 Taranaki Regional 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.

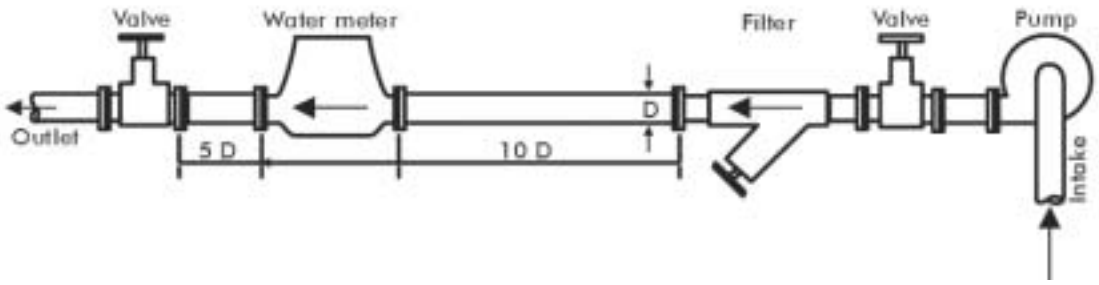

Figure 8 Flow-meters: Pipe layout recommendations

3.1.1 Compliance issues

Five 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.

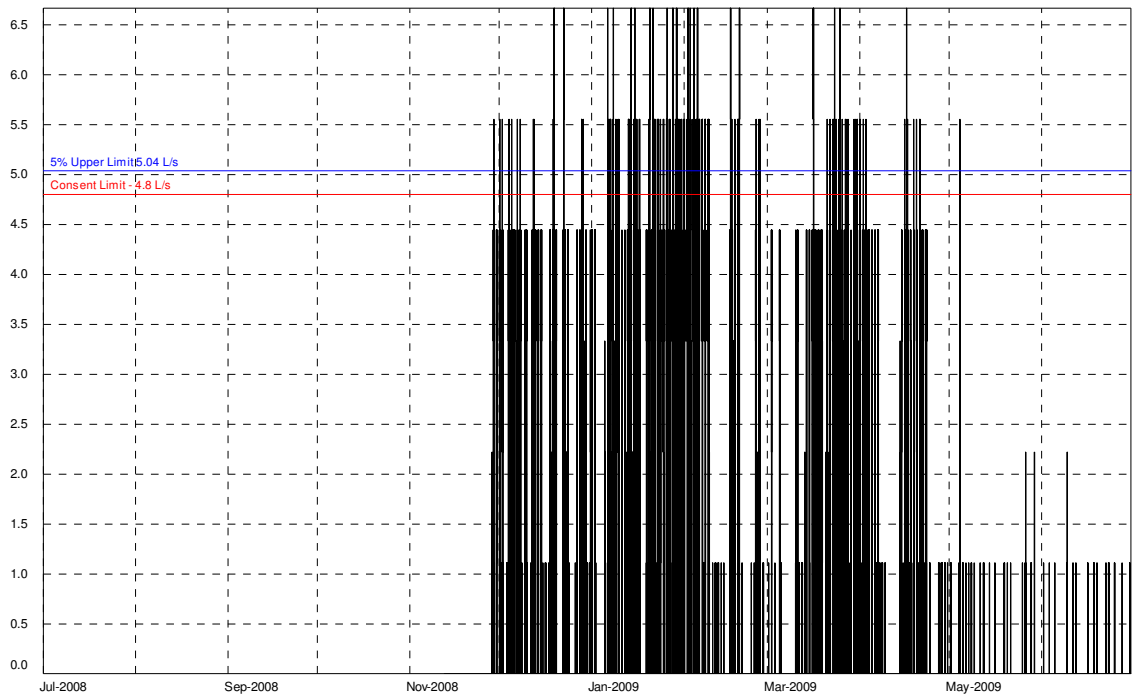

Figure 9 Amounts and dates of exceedance of rate of abstraction for consent 1721

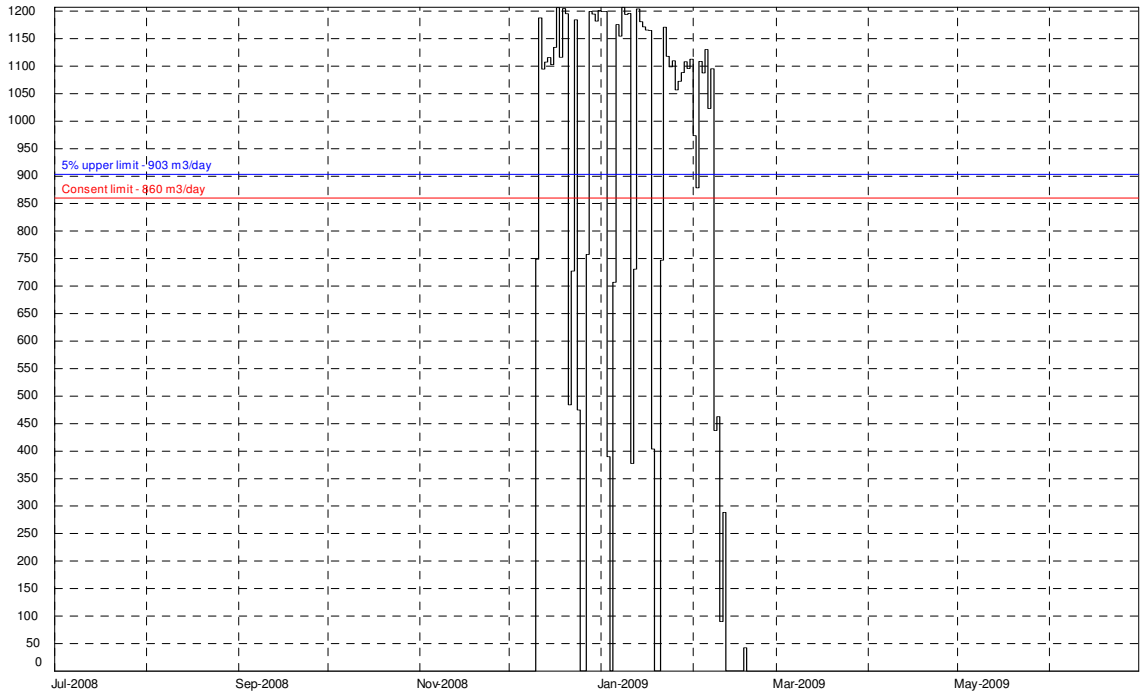

Figure 10 Amounts and dates of exceedance of daily volume of abstraction for consent 5950

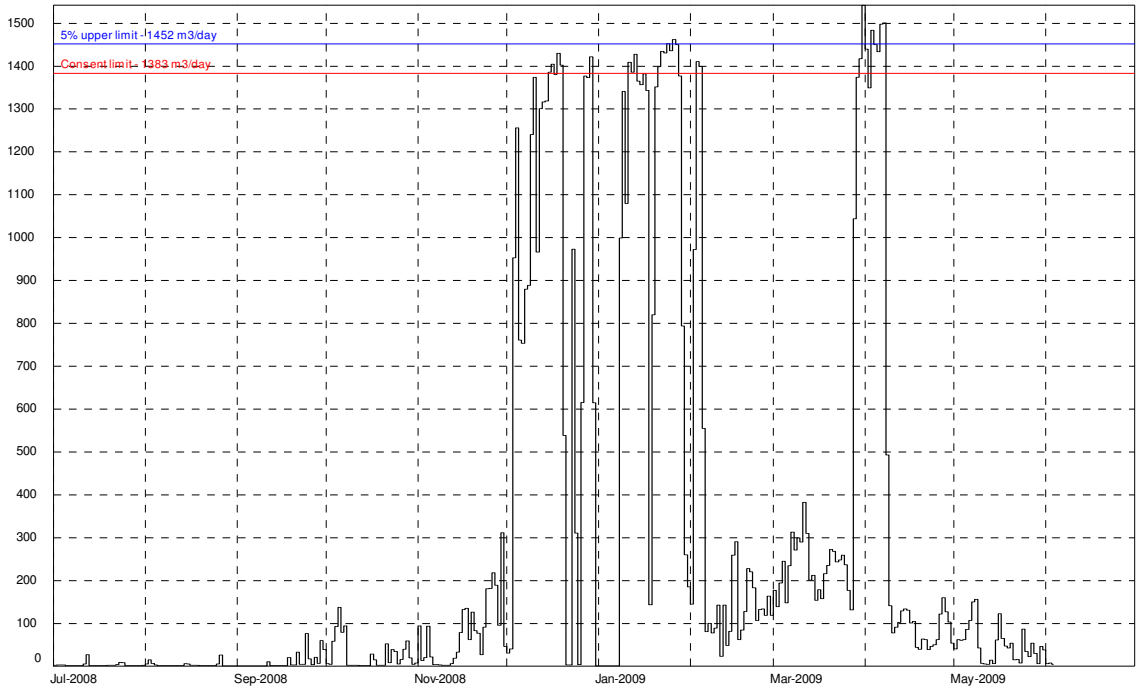

Figure 11 Amounts and dates of exceedance of daily volume of abstraction for consent 5973

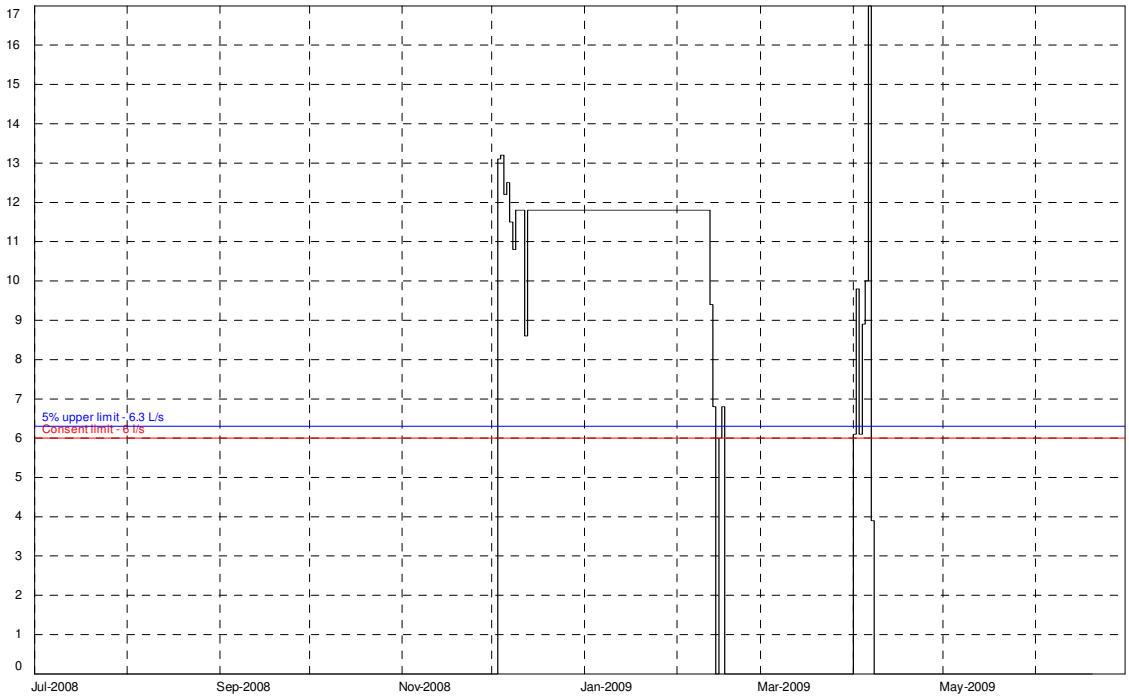

Figure 12 Amounts and dates of exceedance of rate of abstraction for consent 6026

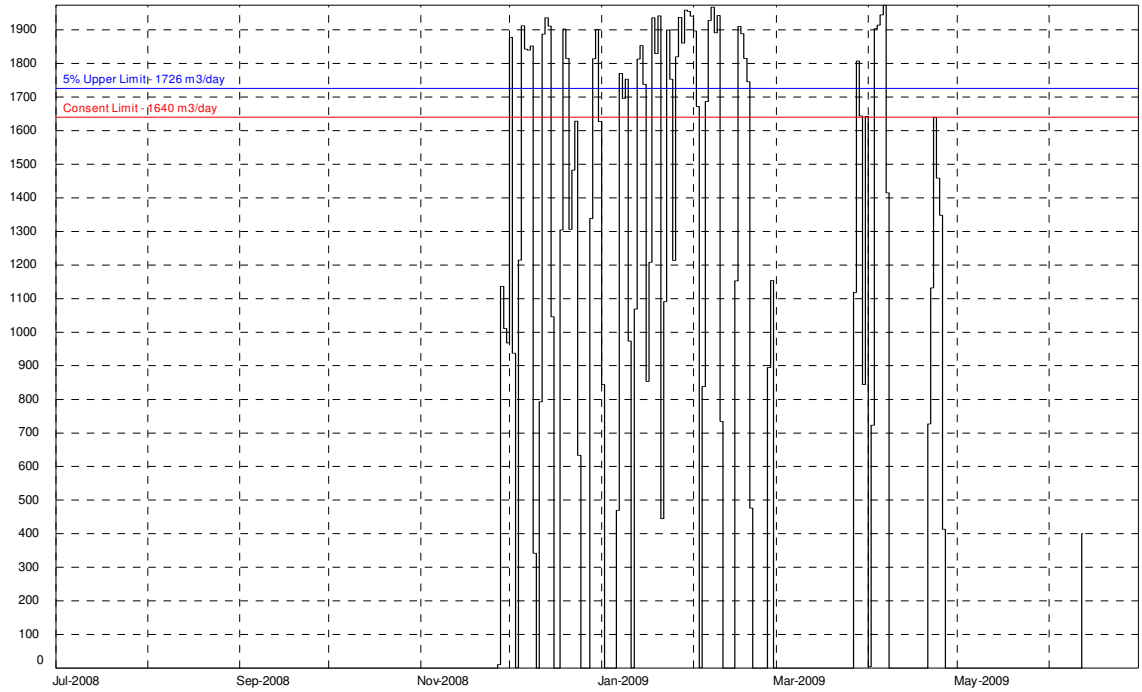

Figure 13 Amounts and dates of exceedance of daily volume of abstraction for consent 6628

3.2 Evaluation of performance

During the year under review a good level of environmental performance and compliance was demonstrated by most irrigators. The five consents holders that exceeded their consent limits generally exceeded it on a long term basis, but these actions did not result in any significant adverse environmental effects.

Nevertheless, improvement will be required in complying with consent conditions for allocated abstractions for the following consent holders:

1721 Manukorihi Golf Club Inc
5950 WD & SC Morrison
5973 DR & AJ Gibson
6026 JR & DM Baker
6628 JW & MT Hamblyn Family Trusts

Improvement will be required in complying with consent conditions for abstraction records for the following consent holders:

0017 Manaia Golf Club
0164 JR & DM Baker
1223 EO & CP Lander
5568 Cornwall Farms
5570 Kaihihi Trust
5623 WD & SC Morrison
5709 KG & CJ Sole
5797 Pihama Farms Limited
5840 Gibbs G Trust
5863 Geary AR Trust

5878 Woollaston Family Trust Partnership
5887 A & EN Barkla
6193 Cradles Farm Trust No 2
7270 Leighurst Lands Limited

Issues with dataloggers which may include replacement of units are due for:

0164 JR & DM Baker
4494 CT & J McDonald
4783 Kohi Beach Farm Limited
5636 Schrider Family Trust
5696 Kokako Road Limited
5709 KG & CJ Sole
5778 Mara Trust
5973 DR & AJ Gibson
6193 Cradles Farm Trust No 2
6486 Quintus LM & PC Family Trust

3.3 Recommendations from the 2007-2008 annual report

In the 2007-2008 Annual Report, it was recommended:

1. THAT the level of monitoring of pasture irrigation water permits in 2008-2009 remains unchanged from that undertaken in 2007-2008.

2. THAT the irrigation report incorporates data for irrigation for golf clubs and for horticultural activities as well.

3. THAT the council produce information sheets for the general public on Flowmeters and Datalogger/Telemetry in order to assist the general public in the selection and installation of water metering devices.

4. THAT the installation of dataloggers be compulsory for water takes permits that authorise irrigation.

Recommendations 1 and 2 were completed for the period under review.
Recommendation 3: The Council has decided to wait until the NES is made official to reproduce information regarding guidance on flowmeters/dataloggers/telemetry.
Recommendation 4 has become one of the standard conditions for water abstraction for irrigation purposes.

3.4 Alterations to monitoring programmes for 2009-2010

In designing and carrying out the monitoring programmes for water abstractions for irrigation water in the region, the Taranaki Regional Council has taken into account the extent of information made available by previous authorities, its relevance under the Resource Management Act, the obligations of the Act in terms of monitoring of the taking and use of fresh water and effects, and subsequently, reporting to the regional community the scope of assessments required at the time of renewal of permits.

4. Recommendations for 2009-2010

1. THAT the level of monitoring of pasture irrigation water permits in 2009-2010 remains unchanged from that undertaken in 2008-2009.

2. THAT the consent holders whose dataloggers are coming to the end of their life are made aware of this situation so that improvements in compliance at all times with consent conditions are achieved.

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MAF 1997: Best Management Guidelines for Sustainable Irrigated Agriculture. MAF Policy Technical Paper N^{o} 00/05, ISBN 0-478-20050-1. 47 pp.

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TRC 2003: A preliminary evaluation of surface water availability and demand for pasture irrigation purposes in Taranaki. Unpublished report by Taranaki Regional Council, July 2003, 14 pp.

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Taranaki Regional Council 2004: Pasture irrigation monitoring Annual Report 2003-2004. Technical Report 2004-63.

Taranaki Regional Council 2005: Pasture irrigation monitoring Annual Report 2004-2005. Technical Report 2005-70.

Taranaki Regional Council 2006: Pasture irrigation monitoring Annual Report 2005-2006. Technical Report 2006-04.

Taranaki Regional Council 2007: Pasture Irrigation Compliance Monitoring Annual Report 2006-2007. Technical Report 2007–55.

Taranaki Regional Council 2009: Irrigation Water Compliance Monitoring Annual Report 2007-2008. Technical Report 2008-84.

Water meter guidelines. Environment Waikato Regional Council

Appendix I

Example surface water abstraction permit for pasture irrigation

Consent 7270-1

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

Please quote our file number on all correspondence

Water Permit

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

Name of Consent Holder:	Leighurst Lands Limited 2401 Mountain Road R D 10 INGLEWOOD
Consent Granted Date:	28 May 2008

Conditions of Consent

Consent Granted:	To take and use water from the Mangatengehu and Mangamawhete Streams, both tributaries of the Manganui River in the Waitara catchment for pasture irrigation purposes at or about (NZTM) 1708757E-5659198N
Expiry Date:	1 June 2021
Review Date(s):	June 2015
Site Location:	Mountain Road, Tariki
Legal Description:	Lots 2 & 3 DP 6301 Lot 2 DP 17083 Blks V & IX Huiroa SD
Catchment:	Waitara
Tributary:	Manganui Mangamawhete Mangatengehu

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

General conditions

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

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

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

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

Special conditions

1. The total volume of water taken from either of the Mangatengehu or Mangamawhete Streams shall not exceed 1,036 cubic metres per day, at a rate not exceeding 12 litres per second.

2. The abstraction from the Mangamawhete Stream shall stop when flow at the SH3 reaches 226 litres per second.

3. The abstraction from the Mangatengehu Stream shall stop when flows in these streams at the SH3 reaches 189 litres per second

4. Abstraction shall cease when the flow in the Mangamawhete Stream just upstream of the confluence with the Manganui River reaches 415 litres per second.

5. Before exercising this consent the consent holder shall install, and thereafter maintain, a water meter and a datalogger that measures and records the rate and volume of water taken to an accuracy of ± 5%.

6. The consent holder shall make available electronic records of water taken to the Council at a frequency and in a format to be advised by the Chief Executive, Taranaki Regional Council.

7. A staff gauge shall be installed and a low flow rating curve established and maintained that determines the flow in the Mangatengehu Stream and in the Mangamawhete Stream. The cost of the gauging sites establishment and operation shall be met by the consent holder.

8. Notwithstanding the terms and conditions of this consent 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.

9. The consent holder shall ensure that the intake structure is appropriately screened to avoid the entrainment of fish, with the screen having gaps no greater than 5 millimetres.

10. This consent shall lapse five years after the date of issue of this consent, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1](b] of the Resource Management Act 1991.

11. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2015, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Signed at Stratford on 28 May 2008

For and on behalf of
Taranaki Regional Council

Director-Resource Management

Appendix II

Preliminary draft of Council guidelines for flowmeters installation

Flowmeter guidelines – Surface and groundwater abstractions

ENVIRONMENTAL MANAGEMENT

MOST RESOURCE CONSENTS FOR WATER TAKES ISSUED BY THE TARANAKI REGIONAL COUNCIL HAVE SPECIFIC CONDITIONS ABOUT THE INSTALLATION OF A WATER METER DEVICE (FLOWMETER)

A fit for purpose, reliable and accurate flowmeter is crucial to providing good information to the consent holder and the Regional Council alike. Purchase and installation of the meter is the consent holder's responsibility, so there are some important things you need to consider when choosing a flowmeter

The installation of a flowmeter benefits you and is required to comply with environmental regulations.

WHY HAVE A FLOWMETER?

A good flowmeter is needed to accurately measure the amount of water being used. Measuring water is a requirement for:

a) Monitoring: Metering is used by authorities to monitor individual consent holders use against abstraction permits, to find out how much water is being extracted from the system and to demonstrate compliance with regulations.

b) Distribution: Metering is necessary to manage delivery of water because it allows measurement of how much water is used in each part of the system, be it for irrigation, consumption or other uses.

c) Management: Water metering is essential for calculating the efficiency of the system and to identify and minimise losses.

d) Environmental purposes: Metering assists in resource accounting and monitoring what is actually being taken from natural systems. This helps to ensure minimum flows are maintained in natural waterways, meeting legislative and environmental requirements that help protect our streams and groundwater, while allowing use of our resource.

CHOOSING A FLOWMETER

A number of issues need to be discussed with your contractor when deciding which type of flowmeter is the most suitable for your activity.

WATER SOURCE

Do you take your water from a waterway that has high contents of silt and weeds, and highly variable flow rates. Do you take it from a surface or groundwater source?

PRESSURE HEAD

How much head do you have? Do water levels fluctuate during a season? How much head does the flowmeter need to properly work?

FLOW RANGE

What is the flow range of the abstraction throughout the year? Most meters have a minimum flow below which they cannot provide an accurate reading. Large meters may give erroneous readings when the flow reaches the lower end of the flow range. Meters continually operated in the high flow range wear out and fail much quicker than meters that operate in the middle of their flow range. The flowmeter should be sized based on the flowrate to be abstracted.

ACCESS TO POWER

Does the unit need power? What type of power does it need? Can it work appropriately and accurately on solar power? Does it need batteries or does it even need power at all?

ACCURACY

You will need to choose a meter with a minimum of +/-5% accuracy. Remember that a meter will only be accurate if the environmental conditions meet all the manufacturer's requirements of flow profile, temperature, humidity, flow range, vibration water quality etc.

ACCESS TO METER

Meters can be buried, with some manufacturers providing special containers for just this purpose; however, this can cause access problems for you and the Council. It is preferable that meters be installed so they are accessible at all times. In particular, the Council requires access to the meter itself and the straight length of pipe before and after the meter.

LONGEVITY

What is the average operating life before overhaul is required? Mechanical and electromagnetic meters have very different average operating life. A water meter needs to be reliable and give accurate readings at all times. The operating life of any meter will always depend on water quality and the situation the unit is used in.

PULSE OUTPUT

What is the level of required accuracy? What units are the data calibrated in? Can a datalogger/telemetry link be used to record the pulse output? The flowmeter output should comply with Regional Council requirements.

COST

One of the most important things to decide on is the cost. Generally, the more accurate and reliable the meter, the more expensive it is. However, the purchase price is not the only consideration; also consider the cost of installation, maintenance, data collection, calibration and longevity. A cheap meter will generally require greater maintenance and calibration.

TRC REQUIREMENTS

TO COMPLY WITH TARANAKI REGIONAL COUNCIL REQUIREMENTS, THE WATER METER SHOULD:

- ✓ Have an accuracy of +/-5% under field conditions. When you purchase a flowmeter and have it installed, ask for a calibration certificate.
- ✓ Be simple to operate and read
- ✓ Be tamper-proof and sealed.
- ✓ Be capable of continuous measurement with a read-out in cubic metres.
- ✓ Include a pulse output that is compatible with our dataloggers recommended by TRC.
- ✓ 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 Taranaki Regional Council within 30 working days of the installation to certify that the flowmeter has been installed to the manufacturer's specifications.

INSTALLATION OF FLOWMETERS

Installing your flowmeter in accordance with the manufacturer's specifications is essential for your meter to be as accurate as it claims. 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. This may also be part of your consent conditions.

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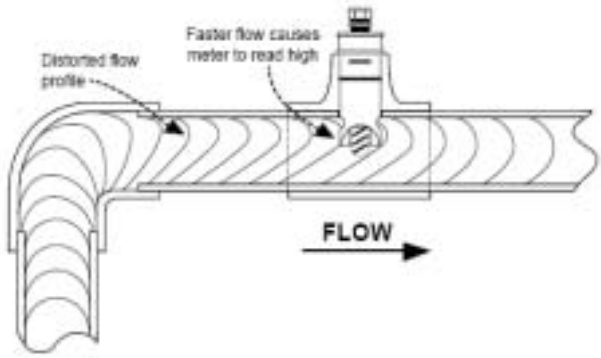
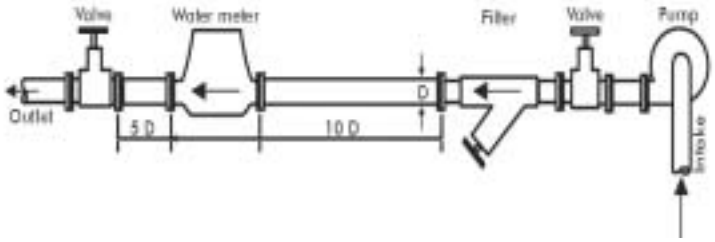


INSTALLATION

- ✓ Installation should strictly comply with the manufacturer's installation instructions.
- ✓ The accuracy of all measuring devices must be independently verified every five years.
- ✓ We suggest at least 10 diameters of straight pipe run upstream and 5 diameters of straight pipe run downstream of any flow meter installation to achieve proper accuracy.



FLOW METERS: PIPE LAYOUT RECOMMENDATIONS

TYPES OF FLOWMETERS

SPECIFICATIONS	ELECTROMAGNETIC FLOWMETER	MECHANICAL INSERT METER (PADDLE OR TURBINE)
Accuracy	+/-0.15% - 2%	+/-2% - 5%
Reliability and tamper proof protection	Very High	Medium
Flow rate indication available	Yes	Yes - with data logger attached
Remote reading capability	Yes	Optional
Average operating life before overhaul (dependant on water quality)	20 years	4 years
Pressure (head) loss	Negligible	400mm (insertion type meter) Negligible (paddle type meter)
Resistance to blockage	Very High	Medium
Resistance to blockage with weed	High	Medium
Relative installed cost	Medium	Relatively low
Water quality	Can cope with silty water	Prone to wear with continued exposure to silty water

Note: This table is only a guide. Always contact manufacturer for complete details and specifications

READING YOUR WATER METER

Once your flowmeter has been properly installed, you must read and record the data at regular times if you do not have a data-logger installed. Standard consent conditions provide for daily recording of water abstractions.

Always record the reading and the time when the reading was made.

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ELECTROMAGNETIC METER

Consists of a section of pipe with a magnetic field around it and electrodes to detect electrical voltage changes. Electrodes in the probe detect the voltages generated by the flowing water. Measurement of the voltage is then converted to velocity so flow rate can be derived. This type of meter is produced in a range of standard sizes and flow capacities.

ADVANTAGES

- High degree of accuracy (+/-0.15%-2%) and consistent over full flow range.
- Wide flow range and no obstructions of flow.
- Robust with only minimal routine maintenance required.
- No moving parts.

DISADVANTAGES

- Power supply required.
- Electronic components vulnerable to lightning damage.
- Repairs require skilled technician and specialised equipment.

MECHANICAL INSERT METER

An impellor is rotated by water passing through the meter, which is translated to a volumetric reading. The mechanism is calibrated by an adjustable device that is preset and security sealed. These meters are available in various sizes and have to be full of water during measuring.

ADVANTAGES

- Reliable and accurate means of measurement providing meter is correctly installed.
- Relatively low initial cost.
- In-line maintenance with simple, efficient mechanism.
- Headworks replacement readily available.

DISADVANTAGES

- Mechanical parts can be damaged, making frequent accuracy testing necessary.
- Prone to wear in silty water, potentially resulting in loss of accuracy and need for replacement.
- Some headloss possible.
- Short useable life.

POOR INSTALLATION

Meter too close to elbow

Meter too close to control valves, T and in only one branch of distribution pipes

Meter too close to elbow, gate valve and insufficient straight length of pipe

GOOD INSTALLATION

Good installation

Good installation, sufficient straight length of pip between flowmeter and fittings and bends

Flowmeter installation in a mobile pump

References

Water meter guidelines. Environment Waikato Regional Council

Flowmeters, Systems and requirements explained. Environmental Canterbury

Choosing a Flowmeter. Horizons Regional Council

Seametrics Technical Bulletin. Flow Meter Installation: Straight Run

If you require further explanation of the information in this pamphlet please contact:

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