

Rollinson, Bruce (2008)

Vegetable production in Ohakune -  
managing drought risk

# Vegetable Production in Ohakune - Managing Drought Risk



**Kellogg Rural Leadership Programme**  
Bruce Rollinson

## Table of Contents

Foreword.....	2
Research Purpose .....	3
Introduction.....	4
Location Map.....	6
Executive Summary.....	7
The 2008 Drought.....	8
Impact of Climate Change .....	10
The Immediate Future.....	10
The Long Term Situation .....	11
How did local growers work together, and with the regional council to gain the necessary consent approvals?.....	14
Timetable of Events .....	14
Supporting Commentary .....	16
Resource Consent Application Process .....	17
Consent Options .....	18
Preferred Option.....	18
Outstanding Issues.....	19
In Summary! .....	20
What are the water allocation issues?.....	21
Conceptual Approach to Water Allocation.....	21
Surface Water Allocation Limits – Ohakune District (Whau 1 & 3).....	22
Water Fight – Community Relationships.....	23
Commercial Vegetable Growers .....	23
Pastoral Farmers.....	24
Residential Households .....	24
Other Industries.....	24
Recreation Users.....	24
Media .....	24
The Headlines .....	25
Regulators - Regional & District Councils .....	26
The One Plan Threat! .....	26
Water Allocation Restrictions.....	26
What are the economic benefits of irrigating vegetable crops? .....	28
The Market .....	28
2008 Vegetable Prices.....	28
Investment.....	30
Typical Operating Costs – Hard Hose Irrigation System .....	31
What are the vegetable crop tolerances to drought?.....	33
Crop Water Requirements.....	35
When to Start Irrigating .....	36
References.....	37
Acknowledgments .....	38

## Foreword

In January 2008, while attending the first stage of the Kellogg Rural Leadership programme, I was frequently in communication with our commercial growing business back in Ohakune dealing with what would become my phase two project. Having no idea of this at the time, my initial thoughts for a project were going to be around the topic of reinventing consumer desire for traditional vegetable crops.

However, one of the most severe droughts in decades was taking hold in our district and across New Zealand in summer safe areas not usually affected by drought.

Vegetable crops were beginning to stress at their peak growth stage and weather forecasters had no significant rainfalls in sight until very late autumn or even early winter. This would be too late to promote crop development.

Our team back in Ohakune who were managing operations were communicating their concerns about the crops to me. Their tone was clear. We needed to act immediately without delay.

Commercial vegetable growers in the Ohakune district are determined and independent by nature. Like all farmers they are hard working and tolerant to most elements thrown at them.

With this determination and thousands of cubic metres of fresh water in snow fed streams running from the mountains to sea, growers proceeded to irrigate their crops in an attempt to produce a marketable yield. In doing so they knew they were somewhat isolated from the watchful eye of the regulators, Horizons Regional Council (HRC) in Palmerston North.

This course of action was not new to growers. They had the equipment and knowhow and had undertaken irrigation on and off in this exact manner for a number of years without any consequence.

However, it was known to growers that sooner or later HRC would catch up and they needed to be prepared for this or any subsequent consequences. Knowing when to put their hands up and surrender the situation was critical. Ongoing non compliance would have been met with absolute aggravation of the HRC.

The objective for all growers concerned was how they could become compliant in future years. Towing equipment around in the middle of the night to avoid being seen was no longer any fun.

This report analyses some key issues around the 2007/08 drought from an Ohakune vegetable grower's perspective. Serving on the Executive of the Ohakune Growers Association (OGA), I became personally involved in all of the discussions and negotiations with HRC in trying to find a solution for irrigation in the Ohakune district. Because of this role, this report also reflects my personal opinions and also touches on some wider issues surrounding the drought, the various complications and a way forward for when the next dry period effects vegetable production in the Ohakune district.

## Research Purpose

The purpose of this report is to obtain further knowledge and analyse some of the issues commercial vegetable growers in Ohakune faced during the 2007/08 drought. The report explores some of the options for future irrigation opportunities and tools to assist growers make more informed decisions about irrigation. It also provides a framework of how growers worked through the regulation and consent process and specifically explores the following research questions.

What are the individual and cooperative measures that commercial vegetable growers can take to manage the risk of drought?

- How did local growers work together, and with the regional council to gain the necessary consent approvals?
- What are the water allocation issues?
- What are the economic benefits of irrigating vegetable crops?
- What are the vegetable crop tolerances to drought?

WATER, WATER  
EVERYWHERE,  
AND NOT A  
DROOP TO DRINK!



KROT '08

*Krot – A cartoonist who sketches for the local newspaper. Sketches commissioned for Kelloggs 2008*

## Introduction

The Ohakune district, its geography, soil types and weather conditions make it one of New Zealand's most desirable growing areas for the traditional vegetable crops of potatoes, carrots, parsnips, Brussels sprouts and swedes.

During the 100 year history of growing vegetables in the district, up to forty commercial growers producing a diversity of crops have produced vegetables for the North Island domestic market. Carrots have also been grown for export to Asia and Japan.

Today, only fourteen family owned growing and packing operations remain. They are larger specialised operations producing one of two vegetables lines. The smaller less specialised operations have over time become uneconomic.

At the outset of this project it is critical to put in perspective the scale of irrigation of commercial vegetable crops in the Ohakune district.

It is distinctive from most irrigation undertaken throughout New Zealand for these reasons:

- The total volume of water required for irrigation is very small in scale. In 2008, six commercial growers irrigated approximately 200ha of potatoes, 40ha of Brussels sprouts and 40ha of carrots. This scale is relatively small. By land area, it is similar in size to one average sized dairy operations requirement for irrigation. However the actual water used is significantly less because it is intermittent and only applied to the crop in two or three passes.
- Irrigation of vegetable crops is not required for three out of five growing seasons.
- When irrigation is required for vegetable crops in Ohakune, it has been only for a period of between two and four weeks. The exception was the 2008 summer when autumn rains did not arrive until late April. This extended the irrigation period out to 12 weeks.
- Irrigation is only an absolute backstop in late summer/autumn when average summer rainfalls are usually more than sufficient to carry crops through the season.
- This is not a fixed irrigation system. Growers are in one week and out the next. Current practice is to apply two applications per crop at the critical growth stage.
- Growers operate a highly mobile operation moving from property to property on annually leased blocks for crop rotation.
- The irrigation takes are surface water from mountain streams and tributaries flowing out from the Tongariro National Park. Most of these streams then flow into the Whangaehu river catchment where the water is deemed totally unusable because of the natural outflow of acidic water from Mount Ruapehu's crater lake.

During the 2007/08 summer from November until April, commercial vegetable growers in and around Ohakune all had one issue in common. With exception of one grower operating under fixed take consent, all other growers that irrigated did not have any water take consents.

So why is this? Everywhere throughout New Zealand irrigation water takes clearly require the necessary approvals?

The answer to this question is straight forward, even if it holds little substance. In recent history, the regulators, HRC, have never taken action during the very intermittent history of irrigation of commercial vegetable crops around the district. I suspect that should this drought not have been so prolonged and that if HRC had not received complaints about irrigation, that no action would have been taken. This has certainly the experience over the last couple of decades.

Generally, Ohakune is a summer safe area with good natural rainfalls. Its westerly facing aspect means that in the majority of seasons growers are battling the wet conditions to cultivate land and plant crops. In some years a dry period in February or March can occur. In the 100 year history of growing vegetables in Ohakune, irrigation has been used on and off for the last 40 years when some growers undertook limited irrigation.

In more recent years, irrigation of vegetable crops on a larger scale began back in 1998 when it occurred for a period of 3-4 weeks during February and March. This was again repeated during 1999 for a similar time. Since 1999 irrigation has only occurred in two other years for a three or four week period. The exception being this current year of 2008, when six irrigators operated for a period of ten to twelve weeks.

Individual crops are typically only irrigated with two 50mm applications during the period of soil moisture deficit and when the greatest crop development occurs. Rain has generally fallen before a third application is necessary. 2008 would be the only exception to this since irrigation began in the district.

The irrigator equipment used and best suited to the requirements of vegetable growers in the Ohakune district are hard hose systems ranging from 75mm-150mm. The hose is unwound from a reel and to begin irrigation the build up of water pressure operates a turbine to self rewind. A nozzle of between 14-28mm in diameter on the gun at the end of the hose is typically applying from 9-18 litres/sec. An average 6ha block may take 3 (18hour) days to apply 30-50mm. This hard hose system is also used because of its ability to be transportable between leased blocks. Potatoes and Brussels sprouts are very rarely grown in the same location from year to year as they require the land to be retired and are grown on rotation. This is one of a number of reasons why land is leased across the district. From season to season any one grower's crop will be in different locations on different farms.

The water sensitive crops grown in Ohakune are potatoes, Brussels sprouts and to a lesser extent carrots and parsnips. All these crops have very high input costs of production. In dry years and particularly over the months from January to March, irrigation significantly helps in achieving productive and marketable yields.

## Location Map



## Executive Summary

The 2008 drought experienced over much of New Zealand had a significant impact on the Ohakune district and its vegetable production. Commercial vegetable growers in and around Ohakune are well use to dealing with the impact of a short dry period, but dealing with a prolonged period with almost no rain during some months was completely foreign to them.

Irrigation has previously been undertaken during those short dry periods to carry crops through until the next rains. It is a very distinctive type of irrigation. It is small in scale, highly mobile, intermittent, serves as a backup and operates in a unique part of New Zealand with plentiful water.

With this history, growers proceeded to carry out irrigation as they had previously done in the very few years that it has been required. As the drought became prolonged so did the requirement for irrigation and with this the watchful eye of the regional council focussed on the Ohakune district.

So what was the issue for the regional council? No growers had consents to irrigate! At this point eight months of explaining, discussions, meetings and negotiations began between the Ohakune Growers Association and Horizons Regional Council. A number of options were considered to determine the appropriate water consent options and to determine future water allocation possibilities between individual growers.

Complicating these discussions between the two parties was the new threat of the Proposed One Plan. This a new regional plan that takes a highly regulated approach to all types of farming. Commercial horticulture growing would now require consents to farm should the Plan proceed. As the same personalities were involved in both the irrigation negotiations and pre-hearing discussions on Proposed One Plan, both issues became clouded and discussions unproductive.

The actual water allocation issues for the district were not complex. Horizons Regional Council had undertaken all the science relating for surface water abstraction and had this at their fingertips. For this reason, consents could proceed non-notified and growers could identify water allocation opportunities into the future.

Reduced crop yields resulting from the drought produced a bonanza of a price paid to growers for some produce lines. Coupled with limited supply of winter vegetables from other regions, prices became even more inflated. With this true market supply/demand model, growers even questioned the worthiness of irrigation when prices received more than compensated for yield reductions.

The individual crop tolerances to these extremely dry conditions varied considerably. Key indicators to crop tolerance included soil moisture, evapotranspiration, crop maturity and root structure. Measuring the crop requirement for water can be as simple or as technical as required. This report attempts to outline a practical approach and an understanding of the key variables commercial vegetable growers may wish to utilise along with some tools to assist measurement and when to begin irrigating.

## The 2008 Drought

The 2007/08 summer was one of the five driest summers since records began in 1908. It ranked third driest in a series of years including 1908, 1948, 1978 and 2008, (NIWA Cliflow Database, 2008).

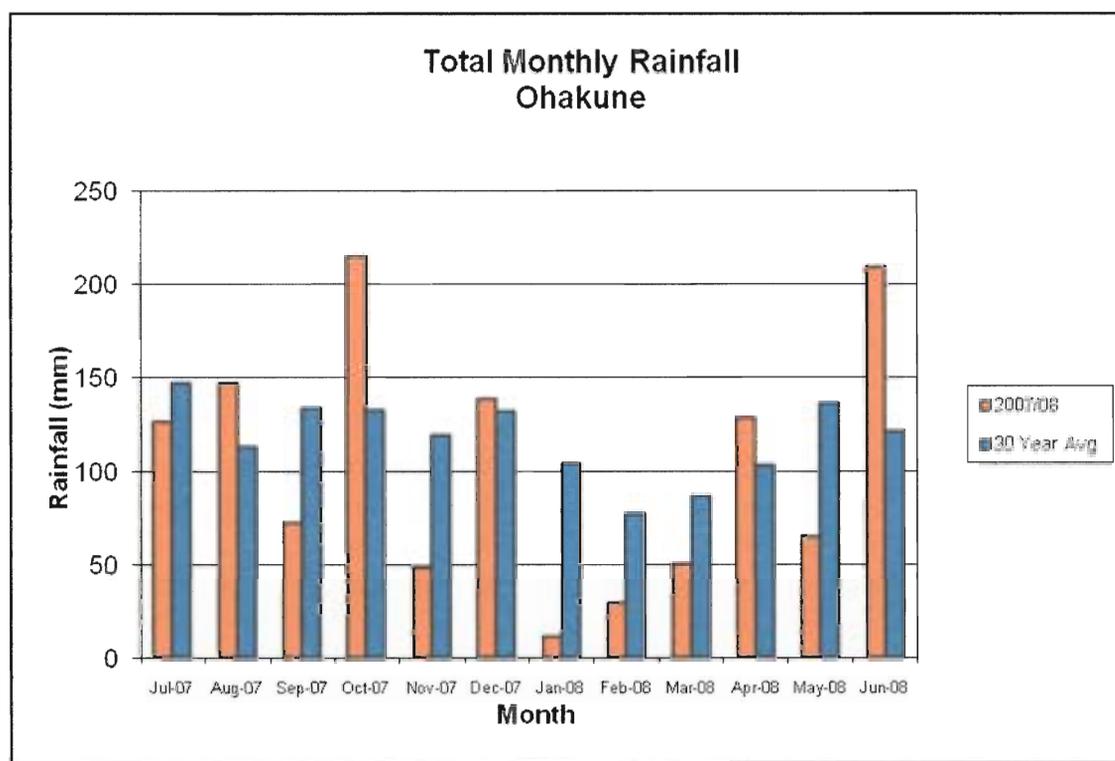
Figure 1, illustrates the monthly rainfall for 2007/08 as compared with the monthly average of the last 30 years for the district. While the October 2007 rainfall was well above the average, warning signs came in November 2007 when there was very unseasonal warmer and dryer conditions with less than half the annual rainfall failing to arrive.

The average annual rainfall to November was already in deficit. This deficit continued to worsen all the way out until June 2008.

The January 2008 rainfall was the worst in recorded history, at only 12mm. This was followed by insignificant rains in February and March.

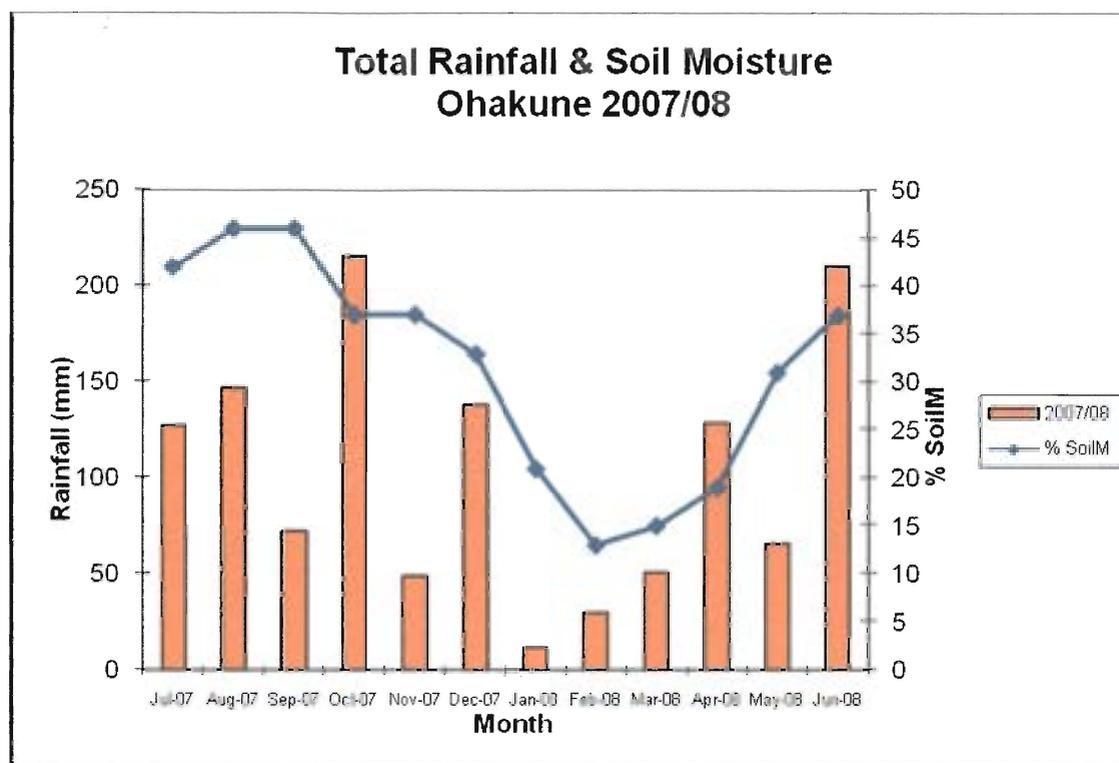
While the April 2008 rainfall figure looks healthy, almost all of it did not arrive until the last week of the month.

Figure 1.



Data Source: NIWA Cliflow Database

Figure 2.



Data Source: NIWA Cliflow Database

So how does all this data relate to growing commercial vegetable crops? The vegetable crops are planted from October through to December when they need good soil moisture levels to establish themselves.

Following this establishment, usually smaller frequent rainfalls are all that is needed to bring crops to maturity. Vegetable crops are great utilisers of moisture and while these smaller rainfalls may not impact much on pasture growth, they are vital to vegetable production.

The lack of rainfall at the critical times was making it difficult for crop establishment, and then significantly reduced soil moisture, (figure 2) made it difficult for these crops to produce good marketable yields. For example potatoes can put on upwards of 10,000kg/ha of weight per week during tuber development, (Crop & Food Research). Without a good healthy and leafy canopy and sufficient soil moisture this was always going to be a struggle.

The usual situation for Ohakune and one the reasons why its climate is great for growing vegetables, is the average annual rainfall is over 1450mm. The district usually experiences local “heat showers” during summer. Unfortunately this did not happen in 2008. The prevailing North West and westerly weather pattern had been turned on its head with the La Nina weather pattern delivering what rain was forecast for New Zealand to the north and east of the North Island.

## Impact of Climate Change

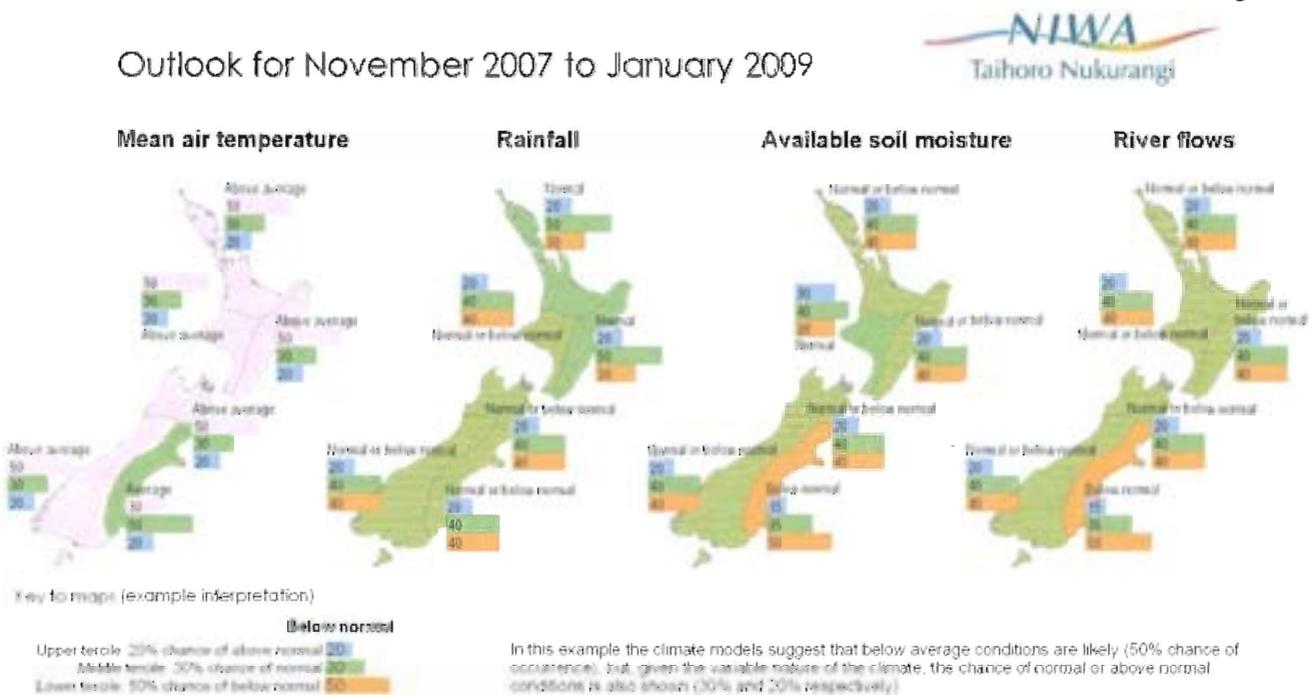
The weather data and information obtained from the National Institute of Weather and Atmosphere (NIWA), climate database demonstrates the 2007/08 summer was extremely dry for Ohakune.

It would be simple and convenient to put this drought down to as “one off” and won’t be experienced for many years to come. This may well be the case but in these times when climate change has more relevance and awareness, it is important to look ahead and what the future predictions are.

### The Immediate Future

NIWA’s seasonal outlook for the 2008/09 summer released in October 2008, *Figure 3*, is for long settled periods with dryer warmer conditions in the west and central North Island including Taranaki, Wanganui, Manawatu and Wellington. Above average temperatures are likely overall. Normal or below normal rainfall and stream flows are likely, with near normal soil moisture levels, (*NIWA Climate Centre October 2008*). The Ohakune district could again be looking at dry conditions this summer with the only positive indicator being normal soil moisture.

Figure 3.



## The Long Term Situation

For the very long term outlook, the Ministry of Environment (MOE) have looked at the NIWA research and models for the future to determine the impacts of climate change on regional New Zealand. If current trends and the future outlook do eventuate, *Figure 4*, illustrates that the district is more likely to have higher annual mean rainfalls of between 2.5-5.0 percent over the next forty years and right out until 2099.

However, on further analysis this does not tell the full story. The latest model, *Figure 5*, predicts there will be even more marked seasonality and suggest, increased westerlies in winter and spring will bring more rainfall in the west of both islands and drier conditions in the east and north.

Conversely, there will be decreased frequency of westerly conditions in summer and autumn, with dryer conditions in the west of the North Island and possible increases in rainfall for Gisborne and Hawkes Bay, (*Ministry for the Environment, Preparing for Climate Change –A Guide for Local Government, July 2008*).

Is this what vegetable growers experienced over 2007/08. It is particularly interesting because the winter and spring that followed this year were significantly wetter with highest snowfalls ever recorded at Mt Ruapehu's ski area.

The question commercial vegetable growers are asking themselves is will this extreme weather event become more frequent? And how to they better prepare and manage this risk in future?

Should this be the future growers will need to adapt many of their crop management practices to minimise crop exposure to such an extreme event. Changes could include:

- Looking at more drought tolerant vegetable crops or other produce opportunities.
- Growing more drought tolerant cultivars or varieties.
- Investing further in irrigation.
- Growing crops in areas in the district where plentiful surface water is available to irrigate.
- Looking at the planting timing and crop maturity so that drought has less impact.

Figure 4.

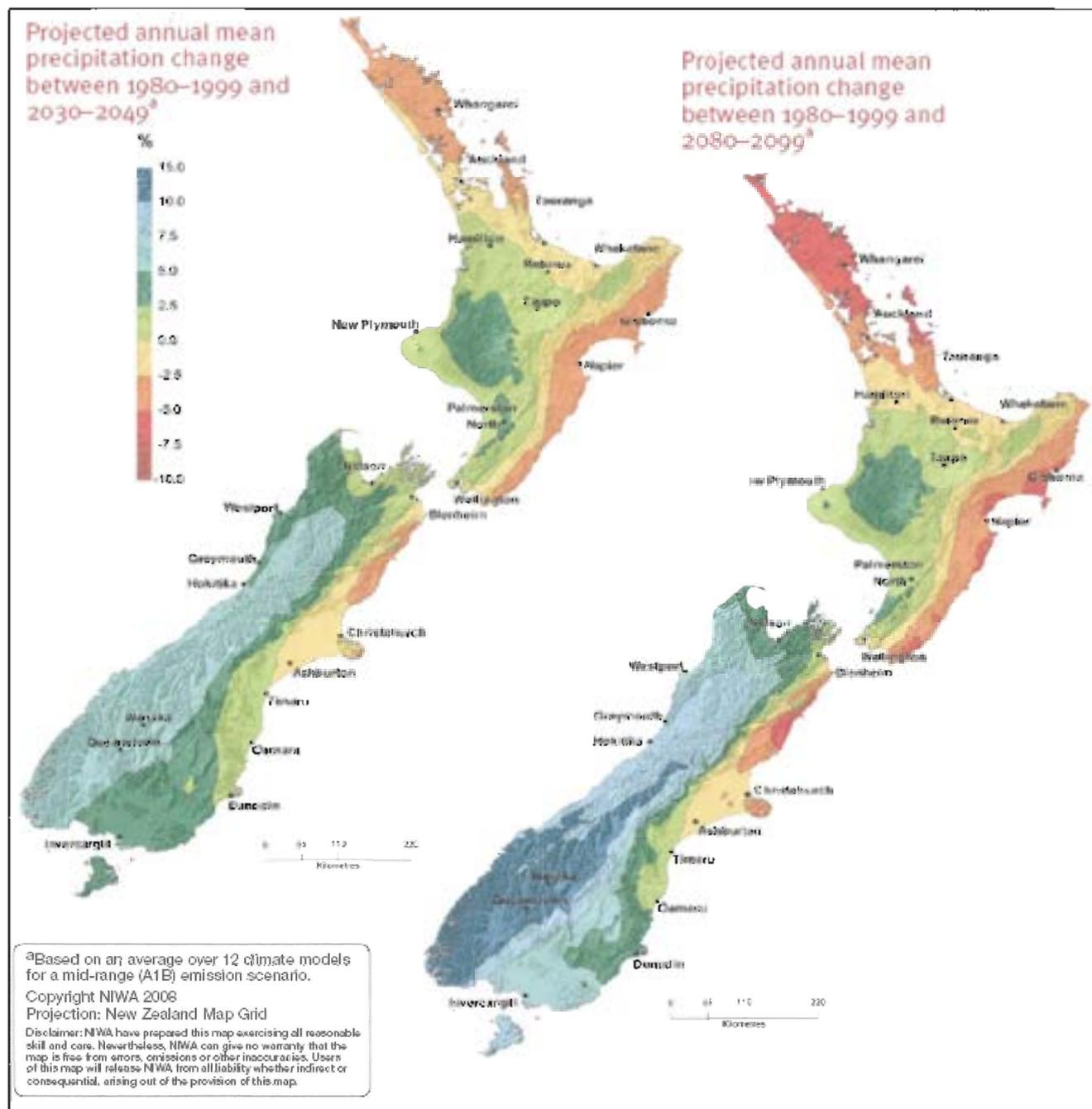
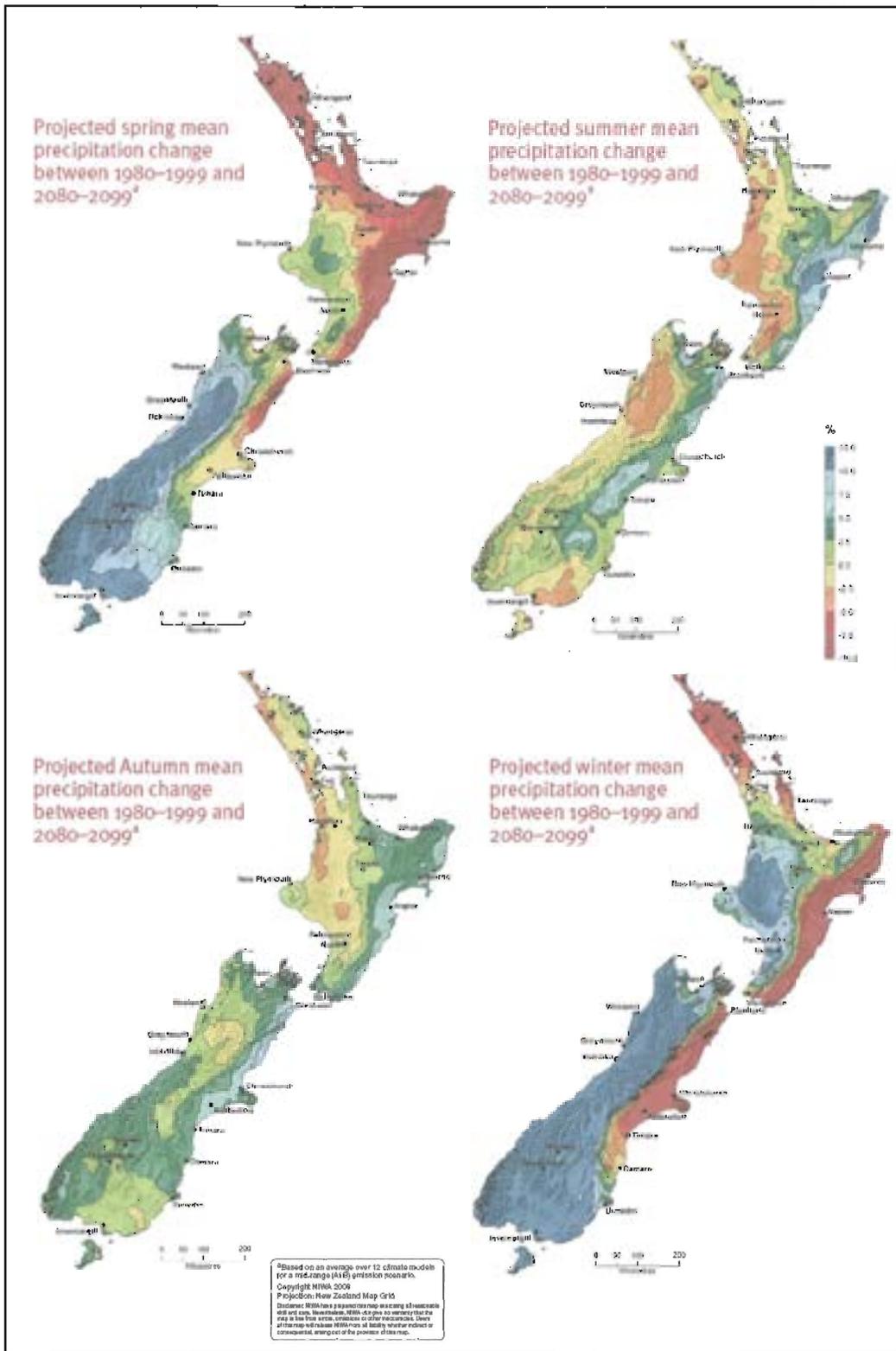


Figure 5.



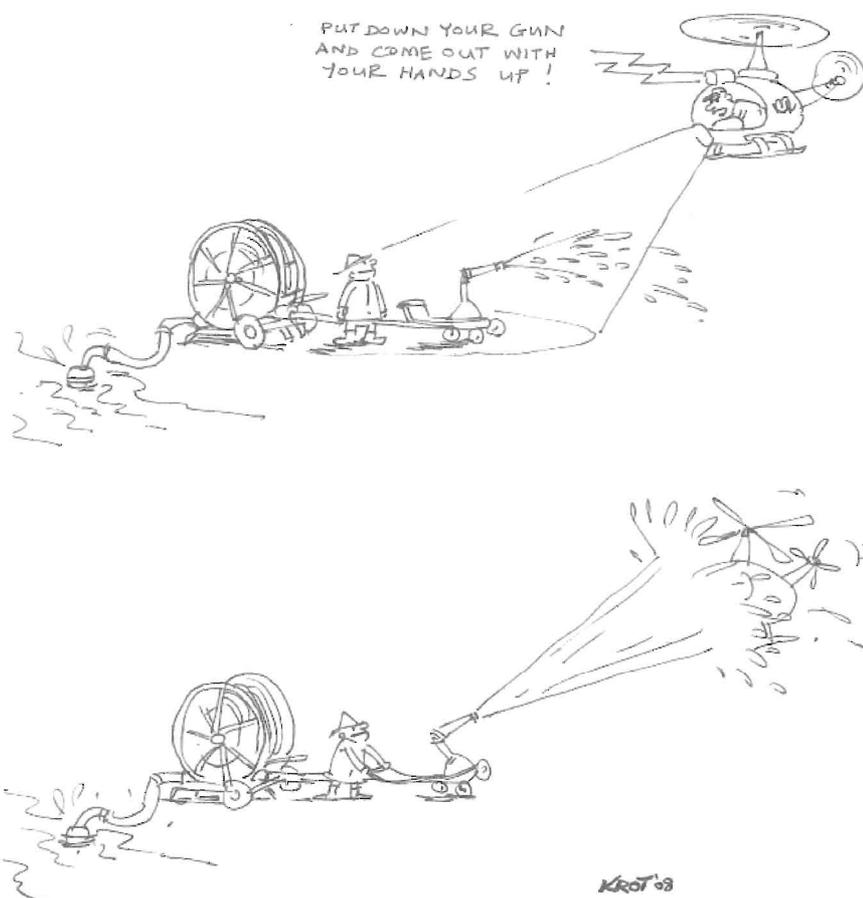
## How did local growers work together, and with the regional council to gain the necessary consent approvals?

To demonstrate the sequence of meetings and negotiations between the OGA and HRC, the following table provides a summary of the key issues and discussions that took place during 2008.

### Timetable of Events

January 2008	With very low summer rainfalls since November and soil moisture deficits continuing to decline, irrigation of some commercial vegetable crops (Potatoes and Brussels Sprouts) in the Ohakune district begins.
February 2008	HRC receive reports and complaints from individuals and organisations that vegetable crops were being irrigated in the district.
March 2008	HRC compliance officers begin to investigate and collect evidence in the form of photographs including the hire of a helicopter to view any non compliance, dubbed the infamous <b>“Eye in the Sky”</b> .
April 2008	Non compliance issues exposed to the media by HRC who sound warnings that abatement notices, fines and ultimately prosecutions may be taken. OGA respond with its own media campaign stating the facts from its point of view.
April 2008	Commercial growers cease irrigating to begin discussions with HRC about future compliance. It was considered by growers that it was better to play ignorant and plead for forgiveness and negotiate later! Growers did not wish to go down the prosecution track. They wished to be consented and get on with growing vegetables.
April 2008	First meeting between the OGA and HRC went over the previous history of irrigating in the Ohakune district. It focussed on the specific needs of growers and some irrigation consent options HRC could consider.
May 2008	This second meeting that took place focussed on growers obtaining individual consents on stretches of water on passing through various properties and working together as growers scheduling water use where limited allocation was available. HRC made a commitment to provide a <b>“clean slate”</b> for growers by removing abatement notices previously issued.

July 2008	Using various mapping options available, growers that wished to irrigate identified the various irrigation draw points on the rivers and streams and sent these to HRC so that an allocation plan could be developed.
October 2008	Water allocation meeting took place to review the draw points that had been lodged on these various catchments. Green, orange and red zones were then identified. Green being an “ok to go” zone, orange being a scheduled, “b type” or limited allocation zone and red being fully allocated zone. HRC then assisted growers complete all consent applications to be considered non notified. That is the applications are not put out to the public for notification. <i>Figure 6.</i>
November 2008	Consent approval to be issued within 21 days in time for any irrigation requirements for the 2008/09 growing season.



## Supporting Commentary

It was during the 2008 drought that the growers quickly realised the only option available to them in future seasons where irrigation would be required, was to gain the necessary resource consents.

Now more than ever, the watchful eye of HRC would be focussed on any non compliance. The alternative option for growers continuing without consents will be the real possibility of prosecution and all its costs and related stresses.

It was the goodwill of both the growers, who appreciated their current situation of being non compliant as a weak position and HRC who wanted to make sure that growers complied in future years, which provided the willingness to explore all the options and establish a way forward.

For the small number of growers involved in irrigation, the importance of working together would prove critical over the coming months and negotiating with HRC for the coming seasons. From this weak position of individual non compliance, the group approach by growers provided some leverage during discussions. HRC appreciated the benefits of working with a group. They could achieve much more in dealing with all potential irrigators in one hit.

The first discussions with HRC provided an opportunity to meet formally with the OGA and discuss a number of options to obtain water consents for the future that would hopefully meet the flexible needs of this distinctive type of irrigation.

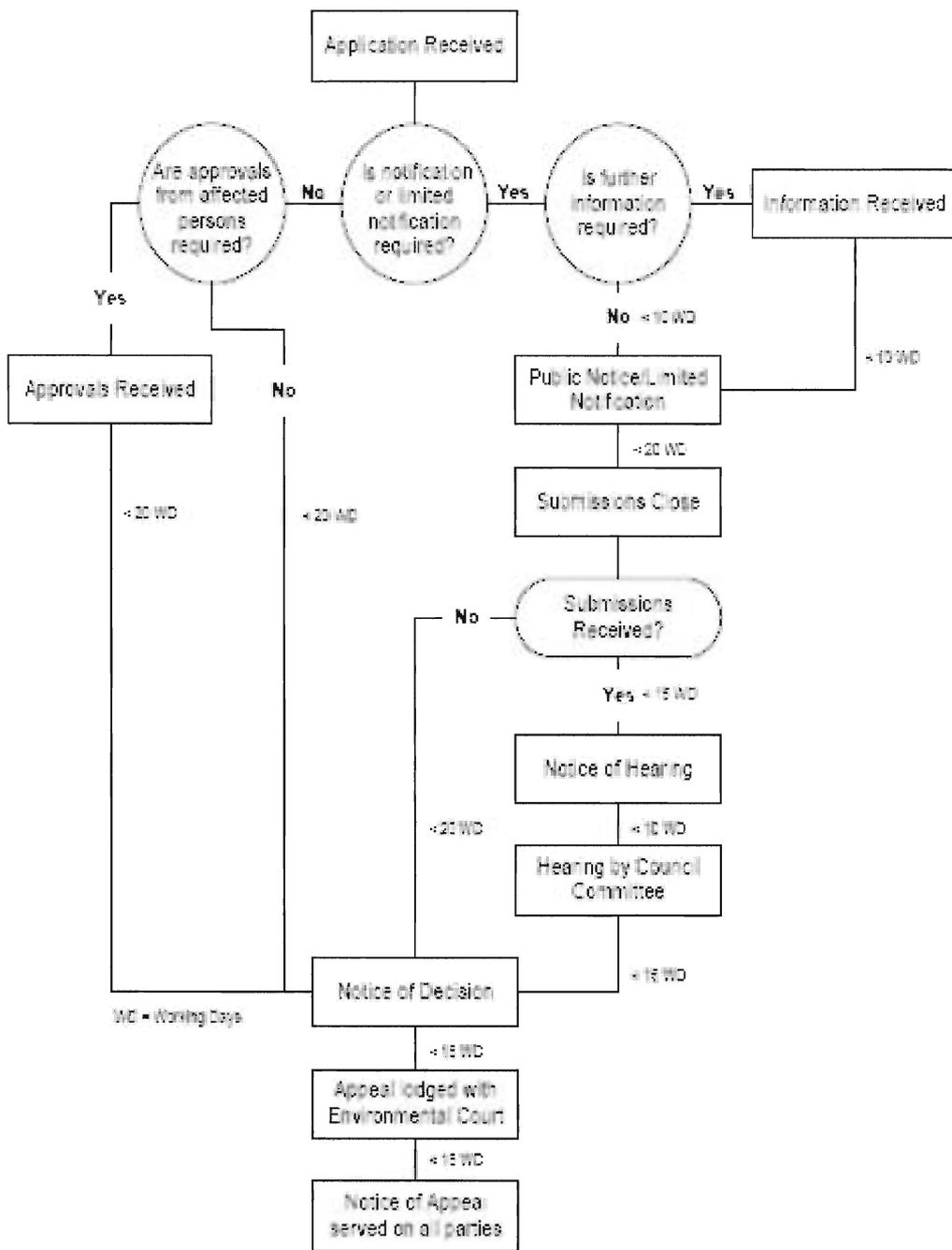
It was agreed future discussions could only take place if growers voluntarily stopped irrigating. Growers obliged. This was an easy decision as by this time it would have been too late to have any effect on crop yields. Any crop at this stage (April 2008), not irrigated that was stressed would not benefit from further irrigation.

As a measure of goodwill, HRC said they would not proceed with any prosecutions and would only fine growers for non compliance. The abatement notices issued by them would also be withdrawn and all growers would begin with a clean slate. This commitment was made by HRC chairperson and regulation group manager. For growers this all seemed to be fair and reasonable. It was an opportunity to form a new level of trust between themselves and HRC.

In October 2008, just when the new consent applications were being worked through, the OGA asked HRC to confirm the commitment about the abatement notices been withdrawn. HRC decided to change this commitment and place a condition on these abatement notices being withdrawn with the provision that they would only be withdrawn once growers had gone through the 2009 season without any infringements. On the face of it, this may seem reasonable condition. However all this achieved was that the OGA feels it has again created a climate of mistrust and suspicion. Agreements made at the very highest level being dishonoured have impacted on prehearing discussions on the proposed new regional plan, Proposed One Plan, *Page 26*.

Resource Consent Application Process

Figure 6.



Source: [horizons.govt.nz](http://horizons.govt.nz)

## Consent Options

One positive aspect arising out of discussions between HRC and the OGA, was the fact any irrigation consents lodged would be processed non notified. *Figure 6*, illustrates just how much simpler the process is under non notification. As recent as 2007, all applications being considered were publically notified. This change had only been brought about by HRC having most, if not all, of the water flow information and necessary related science on the district's streams. They can then allocate an agreed percentage of that flow, *Page 22*.

The irrigation consent options included:-

- Individually held water allocation consents.
- A single catchment consent held by an organisation such as the OGA.
- Water allocation for these catchments held by HRC which can then allocated at the time of need.

Type of Consent	Advantages	Disadvantages
<b>Individual Grower Consent.</b>	<ul style="list-style-type: none"> <li>• Grower owns water right.</li> <li>• Self responsibility for compliance.</li> <li>• Less complicated applications.</li> <li>• No allocation complications.</li> </ul>	<ul style="list-style-type: none"> <li>• Overall costs per consent issued.</li> </ul>
<b>Global Catchment Consent.</b>	<ul style="list-style-type: none"> <li>• Chance of some cost savings for growers.</li> </ul>	<ul style="list-style-type: none"> <li>• Shared responsibility for others non compliance.</li> <li>• Allocation complications.</li> </ul>
<b>Horizons Held Allocation.</b>	<ul style="list-style-type: none"> <li>• Water would available into the future when surface flows are fully allocated.</li> </ul>	<ul style="list-style-type: none"> <li>• Administratively complicated.</li> <li>• Grower trust. Would water be allocated at the time of need?</li> </ul>

## Preferred Option

After significant discussion between the OGA and HRC it was agreed the preferred consent option was for growers to hold individual consents. The issues that were considered in choosing this option are summarised in the above table.

Initially it was thought that one global consent held by the OGA covering all the streams in the district would be a logical consent option. Even the possibility of HRC holding this consent and issuing allocation to individual growers was considered.

However, as the details about how such consents might work emerged, it became clear that growers would be better off to apply for their own individual consents. The main concern being, should one grower not comply, the entire OGA would be responsible.

Future positive relationships between growers may risk turning negative. The collective responsibility of all compliance issues even considering the benefits of cost and time associated with individual consents was outweighed by self responsibility of individuals.

The benefits of growers working together were still not lost. All individual consents were to be considered together by HRC and in the wider context of allocation therefore the benefits of cost and time would still be achieved along with grower cooperation and a higher level of assistance from HRC.

The cooperative approach in applying for consents also puts growers in a position to strategically apply for water across the district. This allows allocations to be transferred between growers in future years as they move around the district on crop rotation. This approach somewhat insulates growers from the future risk of the available water being fully allocated.

### Outstanding Issues

In October 2008 irrigation consent applications that had been lodged were being processed by HRC for the coming season. A commitment of processing these within 20 days from the point of receipt of application in accordance with the non notified time frame had been made.

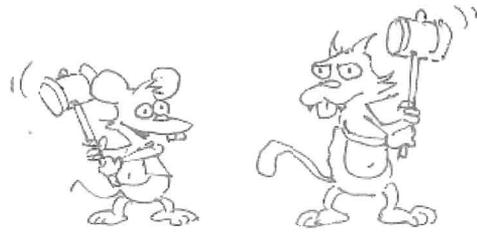
From the outset of discussions, the OGA has been at pains to point out to HRC this is a distinctive type of irrigation. It is small in scale, highly mobile, used only for a limited time and only used in limited years.

The OGA have two main unresolved issues which it is considering as high priorities to resolve with HRC.

1. An individual consent is required by HRC for each stream and tributary to a catchment. A consent is then granted for 10 years or until the common catchment expiry date. The objective of the OGA was for more flexibility and for each individual grower to be issued a single consent. This be reviewed on an annual basis and related to streams and tributaries where they would be requiring water.
2. Growers are required to pay annual monitoring fees and charges for each individual consent they hold on years when no irrigation is undertaken.

Further discussions with HRC in November 2008 provided some relief around these concerns. HRC agreed to a maximum payable application fee of \$5000 for up to 10 individual consents for the term of those consents. This is 11 years which is the next common catchment expiry date. Further to this, on years where the consent is not used a \$250 fixed charge per consent applies and on years it is used it will be \$650 per consent. This outcome means that while growers will be holding a number of consents they were not being charged ridiculously high fees.

In Summary!



THERE HAS TO BE  
A BETTER WAY....



NGST '08

## What are the water allocation issues?

In all situations where commercial growers have undertaken irrigation in the Ohakune district, the water takes or draw points have been from surface water of streams and tributaries in the Whangaehu catchment.

HRC overall objective for surface water allocation in the region is described in the technical reports to the proposed One Plan. In its basic form, it can be best described as illustrated in *Figure 7*. Its focus is on allocating the resource in a way that best meets the needs of these three groups:

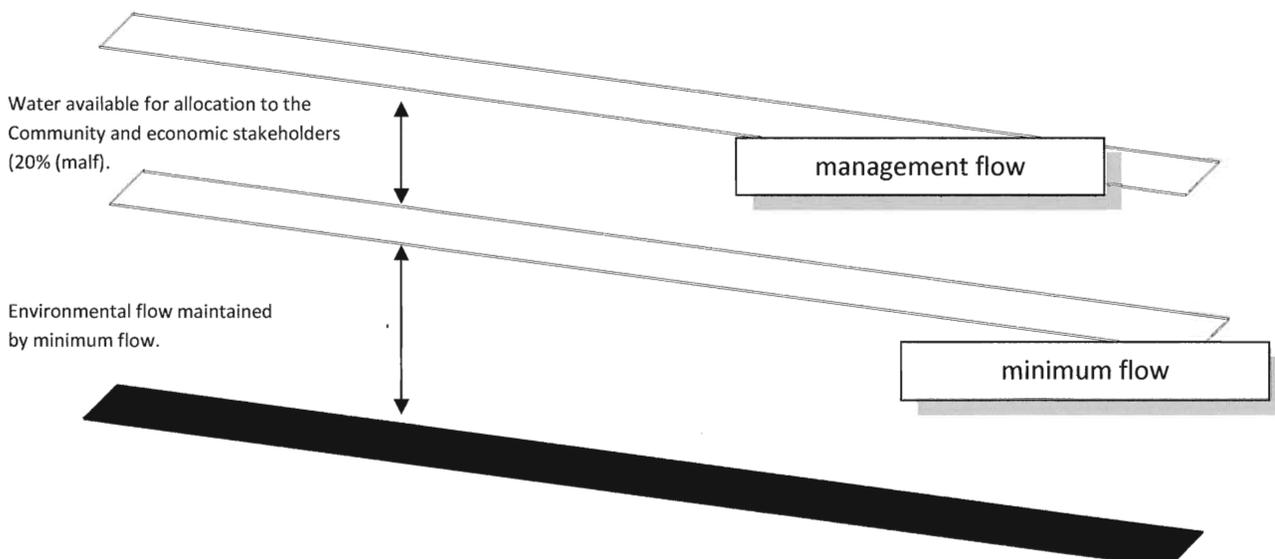
- Community
- Economy
- Environment

The vast majority of streams and tributaries across the district flow into the main Whangaehu catchment. Excluding those with water protection orders, an allocation of 20% of the mean annual low flow (malf) is the maximum quantity of water available for allocation; *Figure 8* details the malf of Whau 1 & 3. These are the streams growers *irrigate* from in the Ohakune district.

This minimum flow provides for protection of environmental values. It is conservative by nature and can be reviewed when the full allocation limits are reached.

### Conceptual Approach to Water Allocation

*Figure 7.*



(HRC – technical report to Proposed One Plan, volume 1)

All water consent applications are considered on a first come, first serve basis. The merits of this approach are interesting and attract significant debate. It does not take into account issues such as sustainability or the economic return on the use of water that has been allocated over other projects that could miss allocation in future years. It is only a matter of time before all potential water allocation in the district is reached. Allocation to agriculture alone in the Manawatu Wanganui region has increased over 300% in the years 1997-2004 or from 90,000 m<sup>3</sup>/day to 300,000m<sup>3</sup>/day, *State of the Environment Report 2005 HRC*. I would suspect this to be substantially higher in 2008.

There is some flexibility around the use of surface water at any one time. That is when a consent holder is not using an allocation they can may make provision for a separate user to utilise this water. It is these primary and these secondary takes, often referred to as **A** or **B** consents that commercial vegetable growers in the district are also considering in their applications to make best use of all water available.

Water harvesting or the building of dams to hold water during peak flows is encouraged by HRC and is a good option for land owners that have catchments central to land used for vegetable production. In most circumstances this is not practical with much of the horticulture land being leased.

### Surface Water Allocation Limits – Ohakune District (Whau 1 & 3)

Figure 8.

Zone code	Sub-zone	Sub-zone code	Minimum flow (m <sup>3</sup> /s)	Flow monitoring site	Flow monitoring site map reference	Cumulative core allocation limit (m <sup>3</sup> /s)
<b>Cumulative allocable volume (Whai 1 + Whai 2 + Whai 3 + Whai 4 + Whai 5 + Whai 6)</b>						<b>20% of MALF of Whai 6</b>
Whai 7	Lower Whanganui	Whai 7a	MALF			20% of MALF
	Coastal Whanganui	Whai 7b	MALF			20% of MALF
	Upokongaro	Whai 7c	MALF			20% of MALF
	Matarawa	Whai 7d	MALF			20% of MALF
<b>Cumulative allocable volume (Whai 1 + Whai 2 + Whai 3 + Whai 4 + Whai 5 + Whai 6 + Whai 7)</b>						<b>20% of MALF of Whai 7b</b>
Whau 1	Upper Whangaehu	Whau 1a	9.790	Whangaehu at Karoi	S21: 216 864	2.175
	Waitangi	Whau 1b	0.475	Waitangi at Tangwa	T21: 316 866	0.105
	Tokiahuru	Whau 1c	4.340	Tokiahuru at Whangaehu Junction	S21: 217 870	0.960
<b>Cumulative allocable volume (Whau 1)</b>						<b>2.175</b>
Whau 2	Middle Whangaehu	Whau 2	MALF			20% of MALF
<b>Cumulative allocable volume (Whau 1 + Whau 2)</b>						<b>20% of MALF of Whau 2</b>
Whau 3	Lower Whangaehu	Whau 3a	13.240	Whangaehu at Kauangaroa	S22: 045 397	2.940
	Upper Makotuku	Whau 3b	0.100	Makotuku at SH49a Bridge	S20: 103 011	0.023
	Lower Makotuku	Whau 3c	MALF			20% of MALF
	Upper Mangawhero	Whau 3d	MALF			20% of MALF
	Lower Mangawhero	Whau 3e	2.520	Mangawhero at Ore Ore	S21: 045 794	0.560
<b>Cumulative allocable volume (Whau 1 + Whau 2 + Whau 3)</b>						<b>2.940</b>

(HRC – Proposed One Plan, Schedule B)

## Water Fight - Community Relationships

In a district that has abundant water resource, the significant dry period experienced over the 2007/08 summer did bring into focus a resource that has always been taken for granted.

One of the most interesting aspects worth further examination during this prolonged dry period was the interrelationships within the community. Individuals living in the townships of Ohakune, Raetihi or Waiouru, other farmers, industries and authorities all had strong opinions and were experts about water use and all had a view on growers irrigating vegetable crops.

It would be fair to say these opinions purely reflected their personal situations and circumstances. There was little reflection or analysis by any of these individuals or groups about the facts of the situation or effects now and into the future

## Commercial Vegetable Growers

In hindsight the OGA regrets not lobbying hard for emergency type consents to be issued during the drought so irrigation could continue. Its relative weak negotiating position brought about by operating without consents somewhat forced the OGA to concede its position and cease irrigation as required by HRC.

Neither, the growers or HRC were prepared for onset of such a severe drought. This lack of any progress at the time of need by the regulators and district authorities is concerning. What was clearly demonstrated was complete misunderstanding of the economic and community effects this drought could deliver. A totally inflexible approach was adopted at a time that required progressive thinking.

It is firmly the opinion of the OGA that delivering both a positive and sustainable outcome was possible for everyone because of the following facts:

- *Growers were not consented to irrigate, but by HRC's own admission, there was actually abundant water available in most catchments and tributaries for irrigation over much of the summer.*
- *Given there was water available, why was there not any emergency measure or temporary consent that could have been issued to allow growers to irrigate?*
- *There were no competing water users for this excess surface water.*
- *There was potential that when growers could not irrigate, that it could have lead to loss of community investment and jobs.*
- *What would the cost of vegetables be to North Island consumers if these crops were not irrigated?*

Those growers with irrigation capability are those who have generally been prone to the effects of drought in previous dry years and are growing the more drought susceptible crops of potatoes or Brussels sprouts. Those growing carrots and parsnips which are root crops do not have irrigation capability and unlikely to do so in future years as these crops were not greatly effected. Some evidence suggested these crops in a dry year were not susceptible to the usual disease pressure and yielded higher than they otherwise would have in an average

rainfall year. There was a positive degree of cooperation and information sharing among all growers about crop development during the drought. Growers needed this reassurance and ability to work together during a stressful time.

### **Pastoral Farmers**

There are no sheep or beef operations in the district that undertake any form of irrigation. This is because the normal summer rainfalls are more than sufficient to ensure good grass growth. Irrigation of grass for any form of pastoral farming in this district other than dairy is simply uneconomic under today's stock prices. However, as vital stock drinking water dried up in the form of springs and small creeks a certain amount of resentment and envy was shown towards vegetable growers.

### **Residential Households**

The watering of gardens and washing cars had been restricted during the drought. This was a massive upheaval in the life of town folk. These folk were moderately disgusted that irrigation of vegetable crops was being carried out in the rural areas. It was no coincidence that many of the complaints to HRC came from within these communities. Debates between the farming sector supporters and educated but ignorant townie environmentalists were ongoing.

### **Other Industries**

Other than the timber and pulp mills based locally, few other major users of water exists in the district. These businesses are large multinational organisations. The non complying vegetable grower irrigation activity was of no consequence to them as they were not competing for the same water that growers were using.

### **Recreation Users**

Natural and abundant water is available in the district even during periods of significant drought. This is because of the summer snow melt. There is not significant recreational demand on these waterways by commercial operators as compared with the catchments on the north eastern side of the Tongariro National Park such as the Tongariro river. A small number of trout fishing enthusiasts do frequent local rivers. There did not seem to be any conflict with other water users, although Fish and Game New Zealand would have been taking particular interest in river flows and irrigation activities.

### **Media**

Emotion and sadly not facts once again ruled here. Households were being asked to conserve and commercial growers were flouting the law. Little thought or publicity had gone into what those same consumers would be paying for their vegetables come winter. There was very little investigative reporting into the actual happenings and future consequence of the drought. All local media simply reported what was provided to them. So those organisations who had the most time to attend to press releases and state their view and the consequences of non compliance won the public opinion.

# Growers 'not the bad guys' in water fight

Waimarino vegetable growers are not the villains that some might think if they rely on information from Horizons Regional Council (see story Page 5), says Association secretary Bruce Rollinson.

He says that the water that has been used for irrigation amounts to less than half a percent of the total water catchment for the area and that local growers would not "suck a stream dry" to irrigate crops.

Mr Rollinson estimates that the maximum total water take that all the local growers would use was 88 litres per second and that this would be spread from Karioi to Horopito, so no one stream would be used for that total.

"We accept that (using) a 20-litre irrigator on a 20 litre per second stream is not acceptable," he added.

He conceded that few growers have the necessary resource consents, but that this was because it was almost impossible for them to gain consents. This was because the HmW process is tailored for fixed irrigation systems such as those used in the Manawatu area. Here, growers only use irrigators for 2-3 weeks in the year – except for drought years such as this season and this only happens about once every 8-10 years. They also use mobile irrigators because they use different land around the district.

Applying for an expensive resource consent to irrigate at specific sites that they may not then need was not an option, he said.

Mr Rollinson said the Growers were keen to talk to Horizons about the possibility of a single consent for the area for the Association, tied to an agreed code of practice.

He added that if they could achieve that, the growers could look at irrigation in a "more scientific way", irrigating

earlier and gaining more benefit from the water used.

The Growers believe it has become an emotive issue, fuelled by the sight of a few irrigators being used close to main roads. Mr Rollinson says there are only a few crops – potatoes and Brussels sprouts – that are irrigated.

"Ironically, we are usually trying to pump water off (the fields)."

## Ruapehu support

Ruapehu District councillors were in support of the growers when they discussed the drought at their meeting in Tauranga last Friday.

Mayor Sue Morris said that "surely there must be some leeway" with the rules, given the drought conditions that growers face, adding that the tributaries in question run into the Whangaehu anyway (which is acidic).

"Why not get some use out of the water first?"

## Working with staff

Growers Association chairman Peter Frew said they "have embarked on a process of working with the senior management of Horizons to come up with a proposal that will see a way forward for future vegetable irrigation requirements in our district".

Mr Frew also wanted to stress that growers' water requirements are not for constant intensive irrigation.

"An irrigator in action might look like a dramatic activity from the road. The fact is volumes are a lot lower than people may think. We are simply not big users and especially when you consider we may only use irrigators once in every three to five years, for a two to three week period."

"Everybody knows that in most years we have to work around frequent rainfalls to

Turn to Page 2

## Regulators - Regional & District Councils

One of the more interesting and diverse opinions came from our district and regional authorities. The district council which has a closer relationship with its constituents and fosters economic development were promoting the need for growers to be allowed to continue irrigating and retrospective consents issued. Employment and economic well being was critical to them.

HRC did not understand the seriousness of the whole situation and were not going to tolerate irrigating without consents. It is not known whether emergency measures could be introduced to allow irrigation to continue. It would seem there is some provision in proposed One Plan that could allow this to occur based on the economic survival of the community. There is no question that water was available.

## The One Plan Threat!

HRC new regional plan for the next decade is the much publicised One Plan. This new generation plan is being closely followed by other regional councils who are monitoring this lead to a more highly regulated approach to farming. It was during prehearing discussions with HRC on the level of control they wish to impose on commercial vegetable growing, including a proposed change from permitted activity status to a consented activity, that HRC reminded us that they were assisting with the irrigation project where there was significant non compliance. While this was not a direct threat, it was inferred that cooperation may discontinue if we continue to question and ask for the science behind the new regulation threat that One Plan would impose.

Very quickly the OGA moved to separate the two issues so they could be debated and negotiated on their own merits. This issue arose because the same personalities are the decision makers for both irrigation proposal and One Plan, which imposes further regulation on everyday growing activities such cultivation. HRC no doubt saw this as an opportunity to leverage cooperation from the OGA. It is a very difficult to build trust and negotiate irrigation options when the two issues, irrigation and proposed One Plan, are blurring where the focus should be. The OGA also feels the frustrating prehearing discussions it has had with HRC over proposed One Plan make relationship building almost impossible

## Water Allocation Restrictions

While the use of surface water has many advantages such as it allows multiple draw points, it is usually the first to feel the effects of water restrictions. This is because as previously described, minimums flows are imposed for environmental protection of all stream life forms. In utilising surface water, consented growers will need to keep a close eye on the stream flows and maximise their allocations as stream flows drop towards the restricted flows and dry periods take hold.

To assist growers, most major streams in the district have an automated flow measurement. To determine the current flow of a stream it is as simple as going online and looking at HRC website and going into the river flow information, *Figure 9*. Once a stream is selected, the flow information relating to that stream will be shown in the form of a graph. *Figure 10*. The streams restricted flow level will be illustrated should the stream flow be that low. Growers can keep a close eye on this information and irrigate when the water is available avoiding disappointment when restrictions are placed on the stream.

Figure 9.

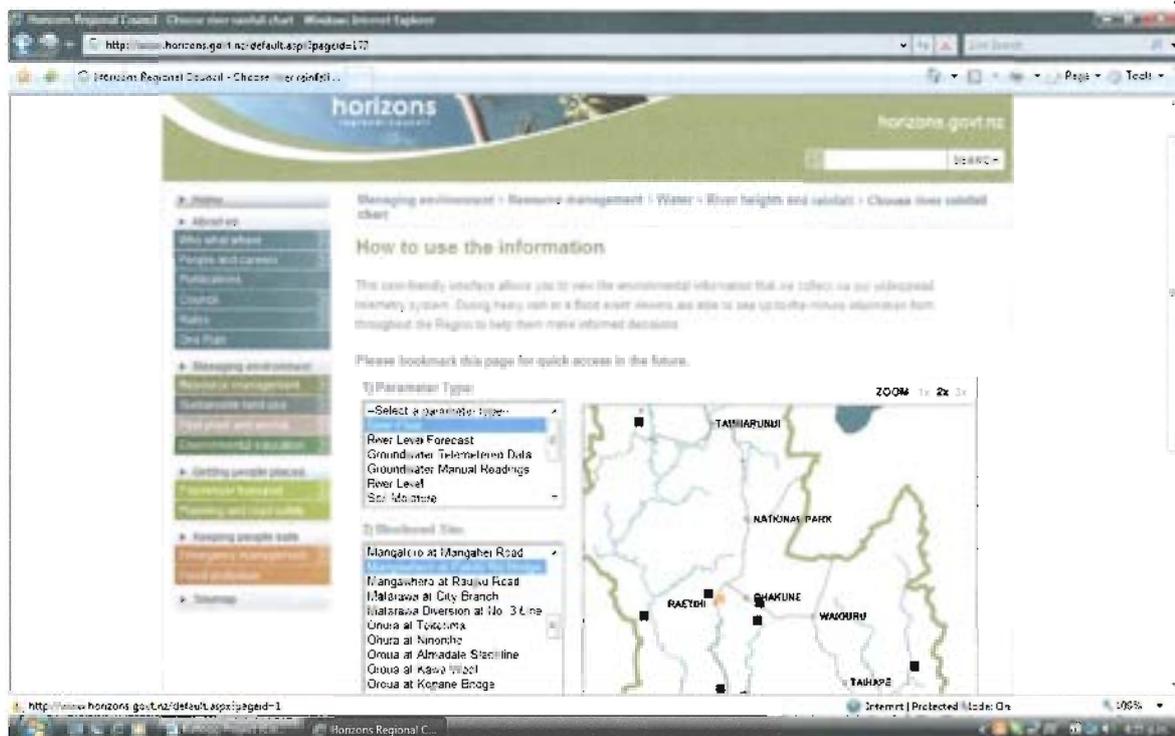


Figure 10.



## What are the economic benefits of irrigating vegetable crops?

There are a number of ways in which irrigation of vegetable crops contributes economic benefits. The primary focus for the producer is on profit. Whether the irrigation leads to an increase in profit or maintains previous profits, the secondary benefits of employment and investment within communities they live will also be realised.

### The Market

Commercial vegetable producers in the Ohakune district supplying the North Island domestic market operate in a true supply and demand market. Limited supply leads to increased prices and vice-versa.

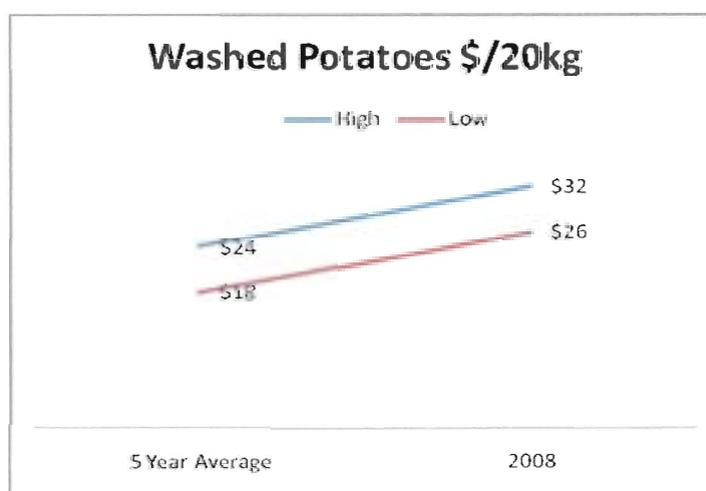
In lower production years such as that delivered by the 2008 drought, some vegetables market prices increased markedly. These supply conditions extended into the 2008 winter when, ironically, for the opposite reasons of heavy rain and cold conditions, there was a short supply of other vegetable lines.

Irrigation applied to a portion of the Ohakune potato crop for the North Islands domestic market lead to some increase in overall yield and subsequently supply. Although supply was still significantly short, potatoes were available to consumers at a lower price than they would have otherwise been if no irrigation took place to increase yields. In this situation, where potatoes also happen to be a staple food and not necessarily substituted with other vegetables, both consumers and growers benefited substantially from this irrigation.

### 2008 Vegetable Prices

A good example of this was with washed potatoes, *Figure 11*. Washed potatoes are the mainstay of the North Island supermarket trade. Prices paid to the grower over the previous five seasons had ranged between \$18-\$24 per 20kg bag. During 2008 the price ranged between \$26-\$32 per 20kg bag. The seasonal fluctuations in prices are represented by the High/Low lines on the graphs. This increase equated to more than a 25% increase in turnover and with minimal impact on costs, most of this turnover flowed through to the bottom line profit.

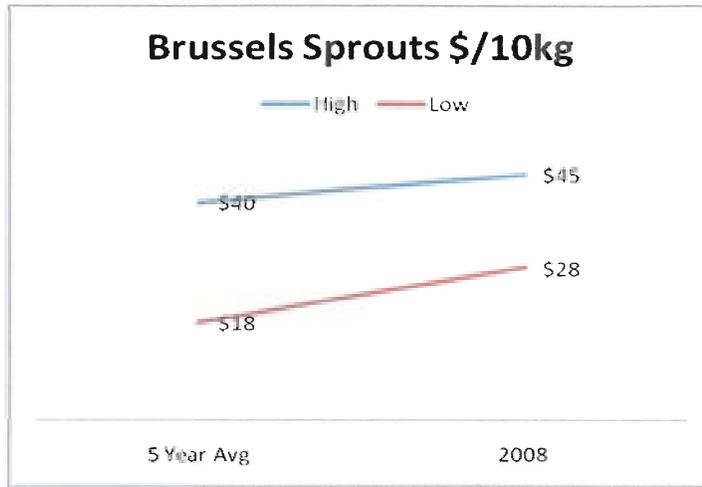
*Figure 11.*



Source: OGA 2008

The 2008 market conditions for Brussels sprouts grown in Ohakune were similar to potatoes in that shortages during the season lead to good prices paid to producers for the season's highs and lows. *Figure 12*. This return was magnified by the fact other green vegetables were short. Brussels sprouts while not to everyone's liking and not being a staple food were being substituted for other greens which assisted in keeping prices strong. Growers with irrigation were able to bring forward crop maturity to take advantage of these short supply windows.

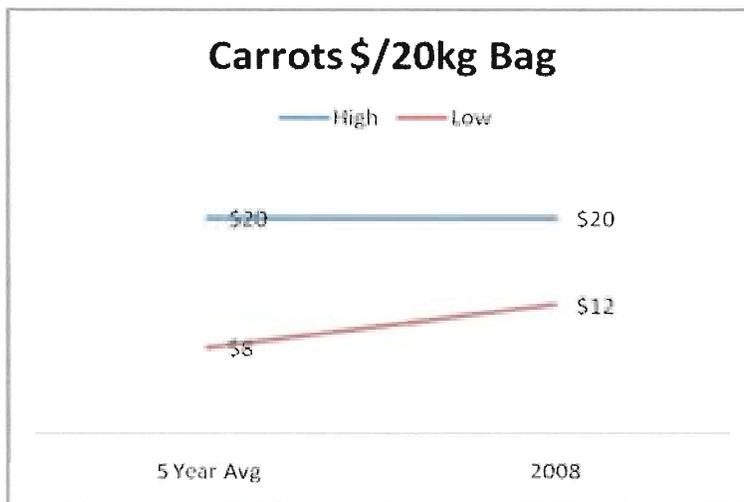
Figure 12.



Source: OGA 2008

The effects of the drought on carrot supply was not significant, *Figure 13*. This deep rooted crop was more tolerant to the drought conditions and was able to mine moisture from deep within the soil profile unlike Potatoes and Brussels Sprouts. Good marketable yeilds were reported by Ohakune growers. Prices recieved reflected this supply situation. (figure). The increase in season low price is attributed to carrots being substituted for other vegetables in short supply.

Figure 13.



Source: OGA 2008

For a potato grower with large output volumes, 2008 was indeed a very good year. Prices more than compensated for the yield lost in the drought. This raises a very interesting question. ***Would growers be better off financially not to irrigate?***

The main contributing factors that influence the answer to this question are almost impossible to predict at the time the grower would need to consider irrigating. Factors such as:

- How much yield/supply can growers lose before the price is unable to compensate this loss?
- How will product grading/quality be influenced?
- What will the price of other vegetable substitutes be?
- What are the volumes going to be from competing growers and competing regions?
- Will consumers cut spending on vegetables, (economic climate)?

The general consensus from growers seemed to be that while they had the ability to irrigate susceptible vegetable crops to lift yield, then they would. This was because irrigation is only a backstop measure and would never compensate for the loss of yield that natural rains would bring to these crops. Therefore supply would always be limited and operating in a true market environment growers irrigating would have both the price and volume advantage. This is one of the main motivating factors as to why growers invest in irrigation.

### **Investment**

The typical cost of investment in an average sized mobile hard hose system including irrigator, reticulation hose, and pump can range from \$50,000 - \$80,000. This does not include a mobile engine to drive the water pump as growers utilise tractors to do this.

It would be natural to think it is ultimately the net financial return from irrigation is what determines whether growers will invest in this activity. What is it that motivates growers to invest in substantial capital, annual running and consent costs?

The answer to this question is somewhat unexpected. It would be reasonable to say the before purchasing capital equipment to irrigate that growers in the Ohakune district did not undertake any financial analysis or look at future economic outcomes. Their decisions were based on the need to produce a marketable crop, or one with no financial return at all.

Another motivator to irrigate comes from the substantial investment and high input costs for vegetable crops such as land, fertiliser, soil preparation, seed and chemicals. This is no pasture based system. These very high input costs along with ongoing crops stress are too much to lose when something can be done to assist.

### Typical Operating Costs – Hard Hose Irrigation System

The operating costs of this type of irrigation system are not insubstantial. To put it into perspective, at \$2624.00 per hectare, *Figure 14*, the cost is similar to other input costs such as fertiliser.

#### Operating Costs (per irrigation hour)

Figure 14.

Variable Costs	Cost per irrigation hour
Energy (diesel) 12 litres/hour	\$18.00
Tractor/diesel engine, cost of capital	\$38.00
Labour (4 hours @ \$50 / 18 hour run)	\$11.11
Irrigator cost of capital	\$80.00
<b>Total per irrigation hour</b>	<b>\$147.11</b>
<b>Total per hectare (2 ha irrigated per 18 hour run)</b>	<b>\$1,324.00 per ha per run</b>
Applications/crop x2	<b>\$2,624.00 Total per hectare</b>
<b>Fixed Costs</b>	
Resource Consent – 11 Years	
Application fees (up to 10 consents).	\$5,000.00 maximum payable.
Annual Monitoring fees	\$650.00 per consent per year *when used
	\$250.00 per consent per year * when not used.

Source: Based on actual 2008 operating costs.

#### Economic Indicators

For growers to undertake further economic analysis, they could review their financial and sales records to clearly demonstrate to themselves whether irrigation is contributing positively to the bottom line. Such indicators that would be helpful in this process can be obtained from, *Best Management Guidelines for Sustainable Irrigated Agriculture*, a MAF technical Paper on irrigation. These indicators include:-

- Analysis of the annual net operating profit after tax (\$)
- Profit per unit of water used (\$/m<sup>3</sup>)
- Production/unit of water used (tonnes/m<sup>3</sup>)
- Quality of Produce % at each grading level
- Energy used to operate system (kWh)
- Energy used per volume of water (kWh/m<sup>3</sup>)
- Labour units per irrigated area (hrs/ha)

## The ultimate cost of non compliance.

The following media release featured on HRC internet site as a warning to water users on the likely action to be taken for any ongoing non compliance.

# Illegal water costs farmer \$24,500

Tue 16 Sep 08

Tampering with a farm water meter last summer has cost a Taranaki district dairy farmer almost \$25,000.

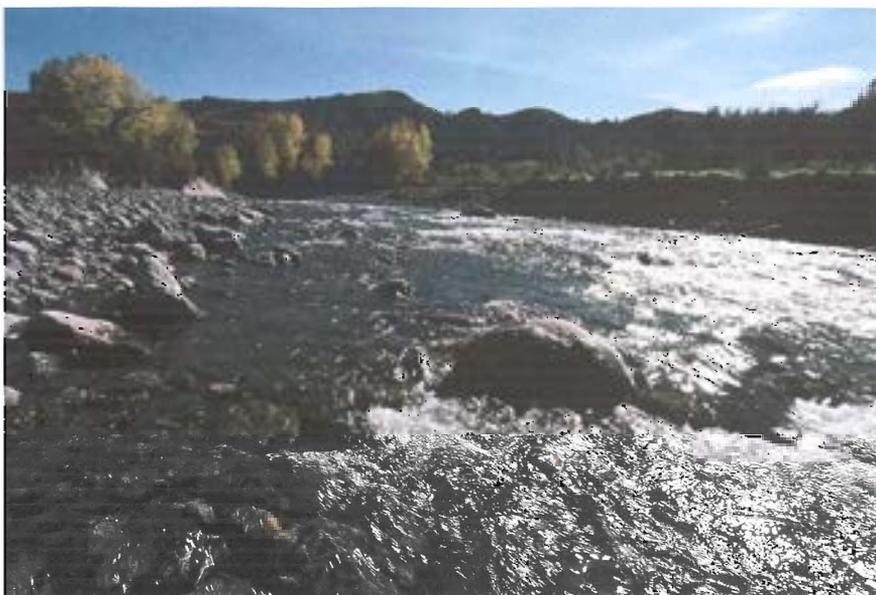
Palmerston North Judge Gregory Ross, who sentenced farmer Kevin John Harris [on Tuesday September 9] for illegally taking water from the Raparapawai Stream, near Dannevirke, said water resources as a whole were coming under increasing stress and people needed to be aware of the need to comply with the conditions of resource consents.

Judge Ross said Harris had ignored repeated warnings from Horizons Regional Council to comply with his consent and had continued to try to mislead the council into thinking he was not taking water from the stream by disconnecting his meter from the pipework. Horizons received misleading information from the remote monitoring telemetry unit on Harris's farm.

Horizons will receive 90 percent of the \$24,500 total fines and costs awarded against Harris. Judge Ross said the level of fines for the offending, in December 2007 and February 2008, was designed to send a strong general deterrent message to others that the sort of offending that led Harris to court would not be tolerated.

The fines included a \$5000 penalty for failing to comply with an abatement notice issued by Horizons in December 2007 that required Harris to comply with his consent. Judge Ross said failure to comply with abatement notices is a serious matter in itself and that people needed to comply with such notices within the stated timeframe rather than at their leisure.

Source: [horizons.govt.nz](http://horizons.govt.nz), September 2008



## What are the vegetable crop tolerances to drought?

Calculating sensitivity points for specific crops demonstrates there are any number of variables required to provide an accurate outcome that relates to what is actually going on in the paddock. It also requires good science and modelling to reflect what nature is delivering.

The main factors effecting drought tolerance of these vegetable crops includes:

- Soil moisture
- Transpiration rates or removal of water from soil by the plant released as water vapour.
- Plant root structure, fibrous or tap.
- Crop growth stage or maturity.

The more leafy crops of potatoes and Brussels sprouts showed the least tolerance to the dry conditions. The transpiration rates of these crops are very high and the root structures are shallow fibrous type feeders meaning these crops the first to feel the effects of dry conditions.

With just enough soil moisture to get seed beds established, the deep rooted crops such as carrots and parsnips were able to mine the necessary nutrients and moisture from deeper within the soil profile. With less surface leaf area, these crops have significantly less transpiration rates than potatoes and Brussels sprouts.

Another drought related factor that affected the yields of vegetable brassica's, the likes of Brussels sprouts and swedes, was the very high pest pressure of sucking and chewing insects. Lack of rainfall and warm temperatures provided a climate for these pests to thrive. This pest pressure and resulting damage to crop yield was greater than that resulting from lack of soil moisture.

Crop maturity during the 2007/08 drought was also a significant factor on crop yield. Later maturing crops were able to utilise some late rains to produce higher marketable yields and the early crops were well established heading into the drought. It was the mid season plantings that struggled to get established and then produce good quality marketable yields. Most growers were reasonably insulated from this mid season risk, with crops spread across the season.

The five commercial vegetable crops grown in Ohakune all demonstrated very different tolerances to the 2007/08 drought. *Figures 15 & 16*, illustrate the minimum soil moisture levels of the crops that were just sufficient enough to meet the water requirements of the plants.

Figure 15.

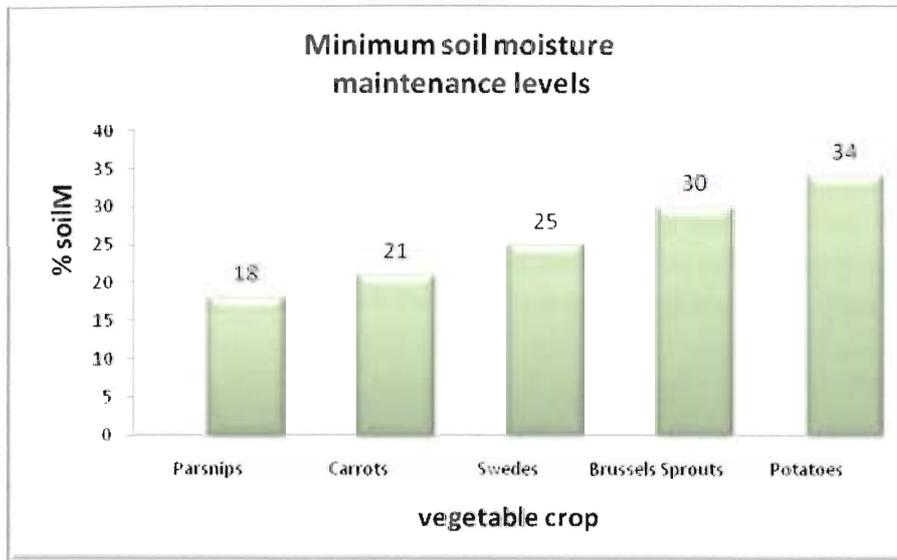
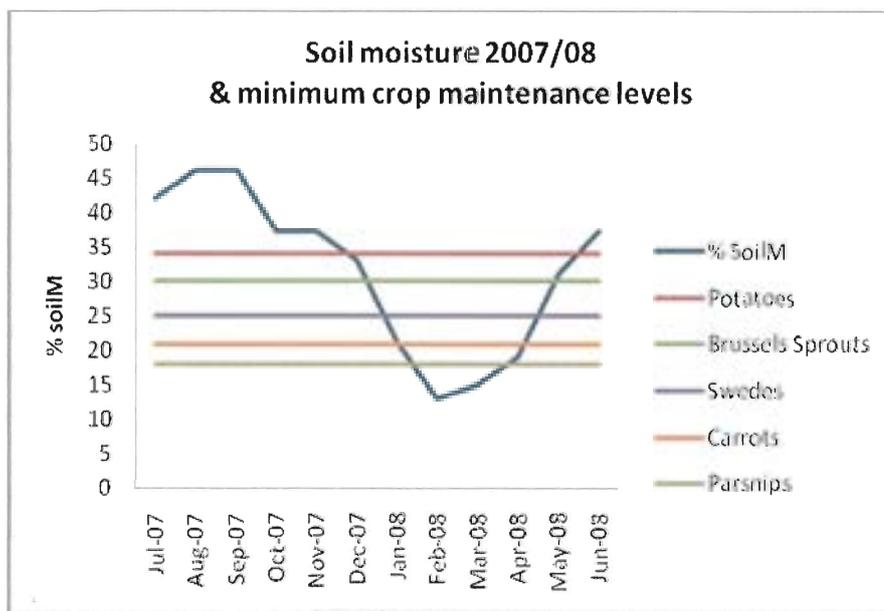


Figure 16.



It must be stressed that these crop sensitivity points are not based on a scientific model. They are observed data or points in time during the 2007/08 drought. Grower's crop monitoring records were used to determine when these vegetable crops required increased soil moisture and before any of the crops showed visual signs of stress. These points in time were then correlated to the daily soil moisture data from the local Ohakune weather station.

This method has deliberately been used to provide a local emphasis specific to the conditions experienced in the Ohakune district. It is relatively simple for growers to obtain this information with hourly soil moisture readings from the Ohakune weather station available from NIWA's Cliflow online Database. Once more, growers can develop this approach further in the actual field with measurement tools such as tensiometer.

Tensiometers measure soil moisture matric potential, or how tightly the water is held by the soil. This is the best indication of plant stress and growth and the readings specifically relate to the actual field. When about half the available soil water is used, the tension increases rapidly and the plant has to work a lot harder to take up the water. Growth rates are reduced and cease when the plant cannot take up any more, (Page Bloomer Associates NZ, Irrigation Management).

### Crop Water Requirements

The answer to this question around the actual water requirements of specific crops can be as simple or as complicated as you wish to make it. It can range from simple observations or complicated computer modelling which attempts to factor into account all the known variables.

There are some basic observations that growers should undertake during dry periods that will assist them in determining moisture requirements for crops. These include the basic fundamentals such as physically looking at soil moisture in the field, particularly the moisture around the root zone.

By combining these observations with local weather station data such as rainfall, soil moisture, and evapotranspiration, growers have a practical approach to irrigation timing. By the time growers see stress symptoms in plants, crop quality and yield will have already been seriously compromised.

There is a more scientific approach to irrigation, even if less practical to growers needs and in the Ohakune district. Less practical because of the technical understanding required around the science behind all the variables that are used in computer the modelling.

Hort. Research has developed a model known as the Soil Plant Atmosphere System to determine crop water use and they can calculate these for specific crops. The model has 30 year data sets of daily rainfall and climate data for a network of sites around the region and uses this as a basis to generate crop water use requirement information. The model also contains a range of soil types as well.

It works by relating the different crops requirements for water to the Potential Evapotranspiration. (PET) This is the amount of water that is known a reference crop has the potential to use. In New Zealand PET is based on pasture as the reference crop and all other crops are compared to this. PET is based on a crop coefficient which is then linked to the reference crop, growth stage, and crop water stress.

## When to Start Irrigating

Irrigation scheduling should be planned and based around the soil moisture; crops trigger point and the irrigator's capacity.

Knowing when to irrigate is one of the main decisions that is critical to the crops overall management. Previous decision making by growers in the Ohakune district has been based on what the grower sees and feels the situation is, or is likely to become. It is sometimes even based on when a competing grower or neighbour begins to irrigate. Hopefully

Certain weather patterns or lack of prevailing weather may also alert growers to a dryer than normal season is ahead. These practical measures assist when to start irrigating are also backed up with crop inspections, checking the soil and in some cases soil moisture levels. Seasonal forecasts are also checked regularly.

The decision about when to start irrigating has been mainly based on experience and a build up of knowledge during previous dry seasons which has enabled some growers to determine their crops trigger and stress points in relation to growth stage.

Growers of horticulture crops are usually advised to hold back from irrigating until soil moisture deficits begin to trend towards critical levels and when evapotranspiration is at its highest levels which tend to be from the middle to late summer.

One limiting factor in the Ohakune District to holding back irrigation until late summer could be the access to the water source. In late January 2008, irrigation restrictions were imposed on most catchments and tributaries in the Ohakune district.

This limiting factor will mean that growers will tend to take the more proactive approach of ensuring that good levels of soil moisture is being maintained and should river flow levels be trending towards a restriction levels then it will be important to be applying water before restrictions a put in place.

## References

*MAF Policy Technical Paper 00/05 June 1997 - Best Management Guidelines for Sustainable Irrigated Agriculture.*

*National Institute of Water and Atmosphere Research (NIWA).*

- *National Climate Centre.*
- *Cliflow Database.*

*Horizons Regional Council.*

- *Proposed One Plan.*
- *Proposed One Plan Supporting Documents.*
- *Watermatters - Water Users Online Information Database.*
- *www.horizons.govt.nz.*
- *State of the Environment Report of the Manawatu Wanganui Region, 2005.*

*Ministry for the Environment, Preparing for Climate Change –A Guide for Local Government, July 2008.*

*Hort. Research, Clothier & Green, Palmerston North – Irrigating for Efficient Water Use 1997.*

*Crop & Food Research.*

*Irrigation NZ Inc & MAF SFF, Irrigation Code of Practice and Irrigation Design Standards, 2002.*

*Page Bloomer, Irrigation Management – Soil Moisture Monitoring.*

*Ruapehu Bulletin, Robert Milne, 1 April 2008.*

*Krot – Ohakune cartoon character, 2008 Kellogg Rural Leadership Programme.*

## **Acknowledgments**

### **Ohakune Commercial Vegetable Growers**

*R & P Frew Family Partnership Ltd*

*G & S Deadman*

*Brian Eades Ltd*

*M & M Taylor*

*Kim Young & Sons*

*Snow Country Gardens Ltd*

*Kath Lee Jones - Fruitfed Horticulture Supplies.*

### **Horizons Regional Council**

*Garrick Murfitt (Chairperson)*

*Greg Carlyon (Group Manager Regional Planning & Regulation)*

*Jon Roygard (Science Manager)*

*Raelene Hurdell (Science Support)*