# HOW TO ACHIEVE SUSTAINABLE FRESHWATER USE IN VINEYARDS. MARLBOROUGH: A CASE STUDY

A Thesis presented in partial fulfillment of the requirements for the degree of Master of Resource and Environmental Planning at Massey University

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2010

# ABSTRACT

Much public attention has been given lately to the concept of sustainability, a notion which is increasingly viewed as a desirable goal of viticulture development and environmental management. The emergence of the sustainability concept has seen a concomitant rise in the interest of its measurement. It has been suggested that through the analysis of regulatory and non-regulatory methods, the attainment of how sustainable freshwater use in vineyards can be assessed.

Regulation has to date been the policy tool of choice in regards to environmental protection. While regulation is often necessary, non-regulatory approaches may, in some circumstances, serve as useful supplements to an effective regulatory regime.

There are a number of stages to achieving the aim of this research. The first is designed at galvanising New Zealand's will to stride out down the sustainability road through the development of the sustainable vineyard concept. Investigations into regulatory freshwater policies were undertaken to assess the relative efficacy of such methods in guiding vineyards in sustainable freshwater use. The research then explored the elements of freshwater use as they relate to non-regulatory methods for achieving sustainable environmental outcomes. Qualitative research was undertaken through the instigation of an email questionnaire and semi-structured interviews to provide an understanding of freshwater use in vineyards within Marlborough.

The research focuses on the discussion of the methodological considerations which are important in developing a working framework for assessing how vineyards achieve sustainable freshwater use. The ideal properties and characteristics of sustainability are identified and critically examined. An evaluation of the different types of regulatory and non-regulatory policies on freshwater management are considered. Both regulatory and non-regulatory methods were seen to be significant in developing an operational framework, as they are capable of representing the management of freshwater use and sustainability practices in vineyards.

It is observed that the policy goal of both regulatory and non-regulatory organisations in achieving sustainable freshwater outcomes generally cannot be attained to the full satisfaction of all the dimensions of sustainability. Rather, sustainable freshwater use could be considered as a ‘road’ and not a fixed destination. Along the way, trade-offs and balances have to be made. It is up to individual vineyard managers to weight the various alternatives, with the policy and decision makers providing information upon which rational choices can be based.

This research demonstrates the efficacy of regulatory and non-regulatory methods in guiding sustainable environmental outcomes. It appears that the ‘ideals’ of policies, as outlined in the literature and data collected, recommend an overall adaptive management approach if achieving sustainable freshwater use is the ultimate goal.

## ACKNOWLEDGEMENTS

Firstly I would like to thank Dr. Jeffrey McNeill for his guidance and assistance as my supervisor. I have appreciated the professionalism and enthusiastic encouragement he brought to the task.

Secondly, as with any piece of research work, a number of people provided helpful advice and input. While it is clichéd to say so, there are too many people to thank everyone individually. I would therefore like to extend a general statement of my gratitude to all of those people who provided information, gave up their time and provided advice and expertise on various parts of this research. I would especially like to thank those people who are constantly inundated with requests from students and still manage to provide information and guidance.

Finally, I would especially like to acknowledge the loving support, unlimited patience and encouragement that my Mum, Dad and Kieran have given me, not just throughout my Masters, but through the rest of my university years.

Thank you to you all.

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## ABREVIATIONS

| | |
|---|---|
| BIAC | Business and Industry Advisory Committee to the OECD |
| EEC | European Economic Community |
| EUREP-GAP | European produce retailers-good agricultural practice |
| IUCN | International Union for Conservation of Nature and Natural Resources |
| MDC | Marlborough District Council |
| MfE | Ministry for the Environment |
| MUIED | Massey University Institute for Executive Development |
| NGO | Non Government Organisation |
| NWASCA | National Water and Soil Conservation Authority |
| OECD | Organisation for Economic Co-operation and Development |
| RMA | Resource Management Act 1991 |
| RPS | Regional Policy Statement |
| SCRCA | Soil Conservation and Rivers Control Act 1941 |
| SFR | Sustainable Flow Regime |
| SWAG | Sustainable Winery Advisory Group |
| SWNZ | Sustainable Winegrowing New Zealand |
| WARMP | Wairau/Awatere Resource Management Plan |
| WCED | World Commission on Environment and Development |
| WCS | World Conservation Strategy |
| WINZ | New Zealand Winegrowers |
| WSCA | Water and Soil Conservation Act 1967 |

# 1.0 INTRODUCTION

This section outlines the key components of this study, including the nature of the problem in the context of the sustainability concept, freshwater use and vineyards. The rational behind the investigation, the research aim and objectives that the present study is to address and the research structure are outlined.

## 1.1 Background and Motivation

New Zealand, like many other countries, is taking up the challenge and is attempting to introduce the concept of sustainability into management and legislation regimes. But can the theoretical concept be applied in reality, particularly in the context of freshwater use and vineyards?

Regional councils have a legislative responsibility to carry out sustainable freshwater management under the Resource Management Act 1991. Non-regulatory management initiatives are also basing their programmes around sustainability. What does this actually mean and what are the implications for decision making?

These questions are ones which are continuously being raised, and for which there appears no easy solutions. It is the search for some answers which has provided the inspiration for this study.

## 1.2 Conceptual Context

With the development of the certification programme Sustainable Winegrowing New Zealand (SWNZ) in 1995, viticulture in New Zealand became codified. As a result there is an active debate among academics, vineyard owners, environmentalists and others as to what defines sustainable freshwater use. Some consider it to be a philosophy, others consider it to be guided by vineyard practices, some view it as being governed by management strategies, and others argue about whether it is strictly related to vineyard

production or also encompasses sociological issues. Then there is the question about sustainability – for how long?

In most regions, like Marlborough, land based industries including viticulture are highly important in the economic sector. Vineyards provide a considerable opportunity for employment with the wine produced being a big source of export earnings. The viticulture sector therefore plays a key role in Marlborough's continuing development. However vineyards do not operate in a vacuum. Each vineyard is part of a complex system, which in turn can effect or be impacted by economics and even global ecological processes A systems perspective involves viewing multiple factors when considering freshwater use in vineyard.

Freshwater sustainability seems to be a challenge to policy and decision makers at both regulatory and non-regulatory levels. While the vineyard is an essential interface between ecological and social systems, most of its development is greatly influenced and motivated by economic considerations. Sustainable freshwater use depends on the consideration of and balances between these systems, and whether appropriate information regarding these factors is available.

Sustainable freshwater use seems to be the prime goal of Marlborough's viticulture industry. However achieving such a goal is not an easy task. Matters are further complicated as there is no measuring rod to evaluate progress towards this sustainability goal. The effectiveness of both regulatory and non-regulatory policies towards the achievement of this goal requires rational choices that can only be made if policy and decision makers possess adequate information.

By necessity, Marlborough vineyard owners are continually required to adjust and refine their systems of land use in response to changes largely beyond their control (e.g. climate, market fluctuations, legislation, changing needs and perceptions of society). Through such adjustments viticulturalists endeavour to ensure their vineyards remain viable, ideally in a way that does not unduly compromise the productive integrity of land

or the quality of the wider environment. Perhaps it is of little surprise that vineyards are frequently implicated with examples of environmental degradation, and are constantly threatened by market access restrictions and greater legal compliances relating to freshwater use.

Ironically, it is the very climate that allows Marlborough to produce such iconic wines that in turn threatens the industry. Water, or the lack of it, it is fair to say has delayed the growth of the wine industry in recent years. That may seem a strange comment to make, given the phenomenal growth of the industry in the past decade. However, the reality is the growth may have been even higher if water had been on tap, so to speak, for large tracts of land away from the boundaries of rivers in the region.

A step towards achieving sustainable freshwater use in vineyards is when all objectives, obligations, and requirements associated with a vineyard system are fulfilled in a reconciliatory way. Regulation has to date been the policy tool of choice as regards achieving this end. While regulation is often necessary, non-regulatory approaches may, in some circumstances, serve as useful supplements to an effective regulatory regime.

Achieving sustainability is also dependent on the ability of management to adjust to change, particularly as it relates to refining or redesigning land use in a way that generates a profit without compromising land integrity and environmental quality. This difficulty will increase as the vineyard environment becomes more complex, dynamic and demanding especially in a water short region like Marlborough. The situation is likely to grow worse as the change of climate intensifies weather fluctuations, including the frequency and severity of droughts. It is in these circumstances that a clearer understanding of regulatory and non-regulatory methods for achieving sustainable environmental outcomes must be pursued.

The viticulture industry is one of Marlborough's most important contributors to exports and economic wealth, and to ensure long-term prosperity of the region. "Maintenance of vineyard and grape production should be based on ecologically and economically

sustainable viticultural practices" (Sustainable Winegrowing New Zealand, 2009). Despite this official recognition of the importance of sustainability, vineyards still remain dependent on inputs from external sources especially freshwater use along with management practices. The indefinite availability of freshwater is uncertain and its continued use has serious environmental repercussions giving doubts to sustainability in the long-term. The main issue here is recognising and providing for the dynamic inter-relationships between land, water and people.

## 1.3 Rationale

The rational for this study stems from the weak understanding of sustainability in relation to vineyards. Sustainability is an agreeable albeit ambiguous concept, subject to problems of multiple interpretation and misappropriation. This study seeks to investigate how regulatory and non-regulatory methods can achieve sustainable freshwater use in vineyards.

## 1.4 Research Objectives

The objectives of this study are:

- To identify the logic for, components of and challenges facing environmentally sustainable freshwater use in the vineyard context;
- To explore the elements of sustainable vineyards and freshwater use as they relate to the non-regulatory organisation SWNZ;
- Identify the strengths and weaknesses of non-regulatory methods for achieving sustainable environmental outcomes;
- Evaluate regulatory freshwater policies of Marlborough and how they align (or not) with non-regulatory policies on freshwater in relation to vineyards; and
- Assess relative efficacy of non-regulatory and regulatory methods to achieve sustainable freshwater use in vineyards.

## 1.5 Research Structure

As this part of Chapter One shows, this research covers a broad spectrum of concepts and a number of objectives to investigate.

The second chapter outlines the research design and methods used to address the aim, objectives and research questions to be examined. There is a discussion on the selection of one case study area and the main methods used to obtain information. The main sources of information are from questionnaire responses and interviews from selected participants, from local government plans, and from other literature either produced by Marlborough District Council, SWNZ or written by external sources.

The task for Chapter Three is to review the relevant literature and to discuss the concepts associated with sustainability, freshwater, and regulatory and non-regulatory management regimes.

In Chapter Four vineyard system components and processes are outline followed by a discussion of New Zealand viticulture. The chapter concludes with a review of viticulture and freshwater issues in Marlborough, the case study area.

A review of New Zealand's institutional arrangements pertaining to water management is undertaken in the fifth chapter. Past institutional arrangements are examined to provide context of how regulations have changed in comparison to current institutional arrangements. Non-regulatory initiatives are also discussed as part of Chapter five as these programmes are increasingly being incorporated into resource management decision making.

Findings from the questionnaire and interviews are presented in Chapter Six. The questionnaire responses identify a range of perceptions held by various people regarding regulatory and non-regulatory methods in achieving sustainable freshwater use in vineyards. The interview findings are summarised results from a number of semi-

structured interviews conducted with council staff, vineyard managers and a resource management consultant.

Chapter Seven discusses the key issues which emerged from the research results and literature review.

The limitations of this research are discussed in Chapter Eight and suggestions are put forward for future research on this topic.

The final chapter evaluates the research findings in terms of the aim and objectives outlined in this chapter. Recommendations are made concerning how various approaches should be incorporated into freshwater management into the future. The research design is also reflected upon in Chapter Nine.

# 2.0 RESEARCH DESIGN

This chapter outlines the research design and methods used to evaluate how regulatory and non-regulatory methods can be used to achieve sustainable freshwater use in vineyards, the aim of this research. One case study area (Marlborough, New Zealand) has been selected for this research. A discussion of the methods that were used to gather information is presented. Finally this chapter outlines why a questionnaire and interviews were selected to form components of the research. The process used, including the rationale for the design of the questionnaire and interviews, the implementation technique, collation and coding of the data obtained from the responses and subsequent techniques used to analysis the acquired information are also discussed.

## 2.1 Information Gathering

Information on sustainability as a concept and as it relates to sustainable freshwater use, regulatory and non-regulatory methods of controlling resource use, along with Marlborough as a case study area were all analysed so as to achieve the aim and objectives of this research.

Brown (1989) stated that the term sustainability in relation to freshwater use was an interesting concept, as it captured a diverse set of concerns regarding the utilisation of a natural resource. The popularity of the notion of sustainable freshwater use presents problems, as it represents many things to many people. The ambiguity of the use of the idea is outlined in Chapter 3 of this research and hinders possible implementation, as various stakeholders perceive a different end-state when they refer to and discuss the same concept. Information gathered was therefore to discover any variation in perspectives regarding the sustainability issue in a broad sense then more specifically in relation to freshwater use and vineyard systems.

Information for this research was gathered from a range of sources and analysed using a mixture of quantitative and qualitative methods. This provided an inter-method approach

to answering the research aim, where "two or more methods of different methodological origin are used to assess the same issue" (Sarantakos, 1993, p45). Together the methods used provide a means to show any gaps between freshwater management using regulatory and non-regulatory methods, and what has actually been implemented at the ground level, as revealed through the questionnaire and interview responses.

### 2.1.1 Documentary Analysis

Documents (such as local and national government material, academic research, journals, non-regulatory articles, industry magazines and newspaper reports) were read and considered in the early stages of research development to aid in the construction of the research design and literature review chapter. This theoretical approach was chosen as it clarifies issues surrounding the sustainable management of scarce resources. Furthermore, documentary analysis provides clarification of past, present and future changes for the environmental protection of, in this instance, freshwater use in vineyards.

### 2.1.2 Miscellaneous Material

Various miscellaneous documents were also examined. The basis for selecting material was whatever was available and relevant. Such information produced by MCD was their own initiative rather than that necessarily required by statute. Water Resource Technical Reports, for instance, have become popular at the regional level in New Zealand (McAlister, 1993). These were available for the case study area and outline the status of the regions freshwater resources past and present as well as presenting long term goals. Policy documents and recent articles produced by the non-regulatory organisation SWNZ were also analysed so as a comparison of the relative efficacy of such documents in guiding sustainable freshwater use could be undertaken. A literature review also provided the information in identifying the available options for water allocation and management as outlined in Chapter 5.

## 2.2 Case Study Selection

Viticulture is one of Marlborough's leading economic sectors with vineyards relying heavily on freshwater input for irrigation during hotter months. Marlborough is a dry, water short region and is characterised as having important issues surrounding freshwater use. As more and more vines have been planted, the drain on the regions water resources has become stretched. Analysing Marlborough's freshwater management through regulatory and non-regulatory methods was therefore seen as appropriate for answering the research aim and objectives. Analysis on a catchment basis was rejected as the research would quickly become centred on differences in the region's river networks and on the specific viticulture aspects within catchments rather than the general regulatory and non-regulatory methods that underlie freshwater use in Marlborough. Choosing one case study area was necessary to provide a manageable research problem given the constraints of this research. The case study area was chosen on the basis of relevancy to the research topic as described by Sarantakos (1993) as purposive sampling along with the challenging water-short characteristics facing Marlborough's viticulture industry making it an ideal candidate for use. Chapter 4 provides a broad overview of viticulture and sustainability further tying the research topic to the case study area.

Once the case study area was selected a preliminary scan of the existing literature relating to Marlborough's constrained freshwater resources was made. From this preliminary scan identification of matters relating to freshwater use that were considered to achieve sustainable freshwater use was then undertaken. This then helped form the structure of the questionnaire.

### 2.2.1 Policy Documents

Policy statements and regional plans were gathered from MDC, the case study area. These were prepared to meet MDC's responsibilities under the RMA. Documents included MDC's Regional Policy Statement (RPS) and the MDC's Wairau/Awatere Resource Management Plan (WARMP).

The RPS and WARMP cover the case study area and represent the most obvious regulatory outline of how freshwater resources are to be managed. These documents contain MDC's aspirations to respond effectively to the challenges and issues of balancing cultural, ecological, economic and social goals for the sustainable management of Marlborough's freshwater resources. The WARMP, through its control of freshwater use through regulations, can have a major effect on how much water can be sustainably allocated and where it can best be used.

> Policies are the course of action to achieve the desired result and are what needs to be done to achieve an objective. Methods are the practical action by which a policy is to be implemented. An anticipated environmental result is the likely or intended result for the environment as a consequence of implementing policies (MDC, 1995).

### 2.2.2 Analysis of Freshwater Management Techniques

Analysis of freshwater management techniques was taken on a number of assumptions. First, 'issues' should relate to environmental matters which need to be considered to achieve the purpose of the RMA and SWNZ. 'Objectives' should state what MDC and SWNZ wish to see from the resolution from the issue (e.g. to ensure that water takes do not adversely affect water quantity in rivers). 'Policies' should relate directly to the relevant objective and say how the adverse effect is going to be dealt with. 'Environmental results' should articulate an understanding of the likely consequences of implementing objectives, policies and methods. They need to be useful and meaningful for the purpose of monitoring.

Analysis of freshwater management techniques was applied as a technique for evaluating the relative efficacy of regulatory and non-regulatory methods to achieve sustainable freshwater use in vineyards. Regulatory methods tell the public what ought to be happening whereas non-regulatory techniques inform the public of 'best practice' protocols.

## 2.3 Interview/Survey

Investigating the elements of sustainable vineyards and freshwater use as they relate to the non-regulatory organisation SWNZ involved the design of a questionnaire targeting Marlborough vineyards (Appendix 2). Use of a questionnaire was to distinguish between awareness and requirements in order to identify the range of perceptions held by various people regarding the issue of sustainable freshwater use in vineyards. The aim of the questionnaire was to form an elicit identification of the commonalities and differences in considerations held regarding regulatory and non-regulatory methods of achieving sustainable freshwater use. The design of the questionnaire aimed to extract a number of interrelated attitudes and practices held by a range of stakeholders involved in viticulture. A questionnaire was used in preference to straight policy analysis to gain a more representative insight into actual methods of sustainable freshwater use, as opposed to intended or planned methods of implementation.

One semi-structured interview was conducted with a vineyard manager who was considered to be knowledgeable about the topic. The aim was partly to clarify the draft survey questions that had been incorporated into the questionnaire. Feedback expressed on the terminology used or any misunderstandings or points of clarification were acknowledged so that any deletions, additions or other modifications could be made before the finalised questionnaire was sent out. Also discussed were thoughts concerning freshwater management and the elusive sustainability term.

The questionnaire was implemented through an email survey. There are advantages and disadvantages in the use of email surveys as a research technique, which must be acknowledged. Massey University Institute for Executive Development (MUIED, 1994) lists some of these advantages and disadvantages. These are shown in Table 2.1, with comments relevant to the questionnaire carried out in this research.

Considering the advantages and disadvantages outlined in Table 2.1 regarding the use of email surveys, an email survey was concluded to be the best technique in this instance.

This is due to the cost involved in such a large and geographically scattered sample and covering a contentious issue such as freshwater use.

**Table 2.1** Advantages and disadvantages of email questionnaires (adapted from MUIED, 1994)

| | **ADVANTAGES** |
|---|---|
| **1.** | **"Relatively cheap"**<br>The questionnaire enabled a range of people to be included in the sample for relatively low cost. The use of free emails meant that only the costs incurred were the charges required by the internet provider. |
| **2.** | **"Good for widely dispersed samples"**<br>The wide geographic distribution of the participants surveyed meant that an email questionnaire was an effective approach. |
| **3.** | **"Allows respondents to reflect on their answers"**<br>The respondents are able to ponder their answers to the questions, as they can take the questionnaire at their own time and pace. |
| **4.** | **"No interviewer bias"**<br>The questions in the questionnaire were asked in a consistent form for all participants. No prompts or tone of voice from an interviewer to offer any bias in the manner that respondents answer the questions. |
| **5.** | **"Allow for presentation of visual concepts"**<br>No photographs or diagrams were used in this particular questionnaire, which is what the comment refers to. However, the depiction of the five point scale (Table 2.2) as a continuum between strong agreement to strong disagreement made answering questions easier. |
| **6.** | **"Good response for a sensitive subject"**<br>The email questionnaire was useful in the case of the topic of freshwater use, as the anonymity of the responses by viticulturalists to a topical subject helped to ensure a good response. |
| | **DISADVANTAGES** |
| **1.** | **"Slow – 3 weeks for fieldwork"** |

| | |
|---|---|
| | Waiting for replies and collating data was time consuming. |
| **2.** | **"Assume literate respondents"**<br>The questions in the questionnaire had to be worded carefully to ensure a wide range of respondents (with all levels of formal education) are able to respond to the questionnaire. |
| **3.** | **"Response bias in favour of better educated respondents"**<br>The lack of interviewer prompts and technical nature of the questionnaire means that a bias develops in the responses, towards the better educated members of the sample. The potential respondents in this sample with higher formal education are more likely to respond, than then lesser educated counterparts. |
| **4.** | **"No interviewer to probe or clarify answers"**<br>The result of this is that some answers are given with comments by respondents that are not entirely clear. Suggesting explanations for these unclear statements is made more difficult, due to this lack of clarity. |
| **5.** | **"No guarantee of identity of respondents"**<br>Even though the questionnaires were emailed to those involved with the viticulture industry, there is no guarantee that the person responding, is the person that was identified as part of the sample. The inclusion of an 'occupation' question in the survey helps address this a little. |
| **6.** | **"Sampling frames sometimes unavailable or inadequate"**<br>The lack of an exact sample frame will introduce some bias, due to the geographically diverse sample in this questionnaire, it would be difficult to identify the sample frame by any method, including telephone surveys or face-to-face, as achieving a constant diversity of respondents would be difficult, if not impossible. |

### 2.3.1 Questionnaire Design and Piloting

The flowchart in Figure 2 briefly outlines each step in the questionnaire process, from initial design, through to the explanation of the results and of the analysis. The design of

the questionnaire aimed to elicit a number of interrelated attitudes and practices held by viticulturalists.

Renzetti and Lee (1993, p5) defined a sensitive topic as “one that potentially poses for those involved a substantial threat, the emergence of which renders problematic for the researcher and/or the researched collection, holding and/or dissemination of research data”. The topic of freshwater use to viticulturalists could be potentially a sensitive topic, as they may feel that if viticulture is to become more sustainable then it was unsustainable in the past, which is wrong.

**Questionnaire Design and Piloting**

The aim of the questionnaire is to answer objectives 2 and 3 of this research, as outlined in Chapter 1, Section 1.4.

↓

**Sample Selection**

Participants who formed the sample frame were generated from being members of Marlborough Winegrowers i.e. grape growers who pay levies to New Zealand Winegrowers. The sample frame was selected to obtain a representative cross-section of viticulturalists in the Marlborough area.

↓

**Email of Questionnaire**

The questionnaire was emailed out on 29 July 2009 via Wine Marlborough Ltd to approximately 600 recipients with a follow up email sent on September 4 2009 to recipients who did not reply to reinforce the importance of their views.

↓

**Collation of Responses**

The collation and coding of the responses to the questionnaire was undertaken over a few weeks.

↓

**Statistical Analysis of Results**

Bar and Pie graphs in Microsoft Excel along with tables were used to analyse the results entered into a spreadsheet in the previous collation step.

↓

**Explanation of Analysis Results**

The explanation of possible theories for the results to the questions are given in the following chapters

**Figure 2** Questionnaire methodology

### 2.3.2 Attitudes and Ideal Practices

Respondents were asked to indicate their preferences using a Likert scale questions. They are distinguished in having five relative orders of rating (Table 2.2). Five-order Likert questions have been used because there was no reason in this research to use greater than five, and using less than five does no always provide an adequate degree of separation for interpreting meaning from the responses. Boote (1981, p58) claims that fully labelled

scales tended to have less skewed responses therefore do a better job of discriminating. The respondents have a greater idea as what each point in the scale represents, and are less likely to answer with an extreme response. The use of a Likert scale Babbie (1975, p18) states is to provide analysis between relative replies to a statement by the respondents to the questionnaire.

Along with strengths and weaknesses of other types of closed questions, those based on the Likert scale carry the additional advantage of consistent and uniform responses (for easy collation), but also the additional disadvantage of monotony and repetition that may lead to boredom. Youngman (1986, p16) claims that "the use of open type questions are valuable as it puts the respondent at ease where as excessive structure can progressively generate a feeling of repression or even resentment, simply because the respondent feels he or she is not doing justice to his opinions". The aim of the questions was to identify the commonalities and variation in responses to issues which arose from regulatory and non-regulatory literature on sustainable freshwater use. The questions reflect just some of the reoccurring themes that run through the literature on sustainable freshwater use. There is no intention to suggest that the survey was comprehensive in its coverage, as this would have been beyond the scope of the research.

The questions could have been more detailed, and included for example definitions of water allocation rates pertaining to each river, however this adds extra problems. This could add to the length, or technicality of the survey, both of which could hinder responses. The questions were designed to vary the response given for the different questions. For example, the respondent with a strong environmental ethic may respond with 'strongly agree' with a question regarding the importance of the preservation of freshwater quality and quantity, but then in the next question disagree with a question asking if accelerated freshwater use was acceptable. These two responses illustrate the consistency held in opinions from this theoretical respondent. Overall the questionnaire was designed to be relatively easy to answer to ensure a good response rate.

**Table 2.2** Likert Scale - Question response and response value assigned

| QUESTION RESPONSE | RESPONSE VALUE |
|---|---|
| Strongly Disagree | 1 |
| Disagree | 2 |
| Undecided | 3 |
| Agree | 4 |
| Strongly Agree | 5 |

### 2.3.3 Questionnaire Response Analysis

In this study a response rate of 11% resulted with 67 responses from the 600 questionnaires dispatched. Youngman (1986, p27) points to the fact that a response rate under 50% must be considered of dubious validity unless representativeness can be established. A check on the representativeness of the residual sample examined the demographical characteristics of respondents. It was determined that the important criterion in this study was not the response rate, rather response representativeness.

## 2.4 Supplementary Research

After gaining an 11% response rate on the email questionnaire, it was determined that supplementary research in a series of semi-structured interviews would be undertaken. It was also decided interviews would help provide further credence and insights to the data already obtained and to get first-hand opinions about the role of regulatory and non-regulatory methods in managing freshwater in Marlborough. Participants interviewed included two vineyard managers, MDC staff (Groundwater Scientist; Surface Water Hydrologist; MDC's Resource Policy Manager) and a resource management consultant specialising in water permits. Semi-structured interviews were chosen to get a more localised, personal impression of the industry with an outline of questions asked contained in Appendix 3. The goal of these interviews was to clarify why there might be inconsistencies between reality and perception in regards to freshwater use. These conversations were generally successful, in that all six people interviewed had different things to say about the direction the industry is heading in terms of environmental sustainability and current management techniques used in freshwater allocation and use.

## 2.5 Qualitative Data Analysis

Qualitative data analysis was used as it examines the range of processes and procedures where the collected qualitative data is moved into some form of explanation, understanding or interpretation of the views held by the participating stakeholders. “Qualitative analysis aims to provide detailed understanding of socio-economic processes and the complexities of everyday life by exploring meanings, understandings, knowledge, experiences, feelings or opinions” (Dwyer and Limb, 2001, p23). In addition, qualitative research is intersubjective and knowledge is constructed through the process of research and the interactions between the researcher and participants.

Results are presented primarily as bar or pie graphs or tables with a brief discussion. Emphasis is given to broad interpretation because of the complex and intertwined nature of regulatory and non-regulatory instruments in dealing with freshwater use.

In this study, qualitative data analysis was in the form of data summary, though this did contain some analytic ideas. This method of analysis is based on an interpretative philosophy and the idea is to examine the meaningful and symbolic content of the qualitative data. In order to categorise the collected data, discourse analysis was used for the questions that do not have mean responses to be analysed statistically. Discourse analysis, the study of how various discourses circulate, works to produce meanings and practices and the extent to which individuals take up the forms of subjectivity offered by particular discourses. This can illustrate the variation in views held by the different respondents, and also address the relevance of the characteristics and barriers mentioned in the responses.

## 2.6 Ethical Considerations

No special ethical considerations were identified for the study. Massey University ethical and instructional requirements have been adhered to, and were explained in the introductory phase of each questionnaire. Consistent with the code of ethical conduct,

interviewee participants were also provided with information about the research and it being of low risk before the interviews were conducted (Appendix 4). The project was evaluated by, peer review and judged to be low risk. Consequently it was not reviewed by one of Massey University's Human Ethics Committees with no formal ethics approval required. Confirmation of this is included in Appendix 1.

# 3.0 APPRAISAL OF WRITTEN WORKS

## 3.1 Setting the Scene

To provide a context to place the aim and objectives of this research in determining how regulatory and non-regulatory methods work towards achieving sustainable freshwater use in vineyards, the following literature review was undertaken.

The first part of this chapter addresses the concept of sustainability and its rise to popularity, and why its elusive definition continues to create confusion and disagreement between different sectors of society. Following on from this is a review of sustainability from ecological, economic and social perspectives. System theory is used to identify criteria useful for clarifying specific application of the sustainability concept. Subsequently, literature on freshwater as an essential natural resource is reviewed emphasising the fact that sustainable freshwater use can only be achieved through the realisation of two aspects considered together: ecological and economic. Regulatory and non-regulatory methods are explored with the idea that coercive and voluntary societal actions are required in order to resolve community goals, including co-ordinating environmental outcomes surrounding sustainable freshwater use.

## 3.2 Sustainability Views

Sustainability is a broad topic that means many things to many people. Sustainability is an established concept that is socially determined rather than something that exists as a self-evident given with the term gaining recognition since the 1980's. Civilisations have always relied on and altered their physical environment and in pre-industrial times populations were able to use space and then move away from environmental problems. The growth in the world's population and modern industrial revolutions no longer allows this and people are more aware of and must take responsibility for environmental degradation for not only themselves but for future generations.

Sustainability is now widely accepted as a general principle that, in its broadest sense, seeks to describe the relationship between human development and the integrity of ecological and socio-ecological systems. “Sustainability is about humankind’s evolving relation with our socio-ecological environment” (Gallopin and Raskin, 2002, p83). This relation has been ongoing since time immemorial, with many of the themes and principles associated with sustainability being evident throughout history (Pepper, 1984; Reid, 1995; Harding, 1998; Bell and Morse, 1999; Oskamp, 2002).

Sustainability is a noun constructed upon two adjectives sustain and ability, which when taken together literally mean the ‘ability to sustain’. To sustain means to support or nourish which implies a dependent relation. Generally, physical objects are supported, while biological objects are nourished. The term ability implies a capacity or function that can fulfil something’s requirement or need. Hence, the ability to sustain can refer to both a state and a process. In the context of a vineyard, being a biological object, it is sustained through multiple relations and the continual input of resources from multiple sources, directly and indirectly.

The term sustainability has been subject to a number of examinations and interpretations (Redclift, 1987; Toman, 1992; Lele, 1991 to name a few). Nonetheless, the World Commission on Environment and Development (known popularly as the Bruntland Commission) has the most widely quoted definition. In its 1987 report, *Our Common Future*, it defined the sustainability concept as ‘development that meets the needs of the present without compromising the ability of future generations to meet their own needs’ (WCED, 1987, p43). The sustainability concept ‘politically came of age’, and was distilled into a conceptual framework that guided the content and structure of the human development debate through the 1990s (Kirkby *et al*., 1995; Mebratu, 1998).

Today, sustainability has become the catch-all term for the study of environmental issues (Schmuck and Schultz, 2002, p113). Such levels of popularity have been credited to the concept’s vagueness (Daly, 1992; Reid, 1995; Bell and Morse, 1999), which has allowed widely divergent theoretical and ideological perspectives to come together in a single

conceptual framework (Estes, 1993). As noted by Reid (1995), people are generally in favour of such a concept, however retain their individual definitions as to what it means. The ambiguity of the use of the term hinders possible implementation, as various stakeholders perceive a different end-state when they refer to and discuss the same term.

Newton and Freyfogle (2005) conceive that the environmental movement should discard the sustainability term in favour of a more alluring goal, attentive to nature and its ecological function. Newton and Freyfogle (2005) further suggest that environmental planning should be understood via the term 'land health' rather than sustainability, thus providing a framework within which societal aspirations and development can be acted upon. However, the concept 'land health' is, in comparison to Newton and Freyfogle's (2005) suggestions, no more ambiguous than the term 'sustainability'.

It is therefore crucial to obtain a clear picture of the sustainability concept if it is to have policy relevance. To achieve this, it is necessary to delve into the various dimensions of sustainability. So far, the literature is composed of three complementary views: ecological, economic and social perspectives.

### 3.3 The Ecological Concept of Sustainability

In the past rapid economic growth was the most basic goal for planners and decision makers, with other related factors such as environment and natural resources not accounted for. According to Horsley (1989) "basic economic concepts became narrowly defined and are used without consideration of their wider social and ecological context". The resulting environmental repercussions of these narrowly focused economic growth agendas were gradually causing environmental destruction due to such things as pollution and resource exploitation.

It was on this premise that the World Conservation Strategy (WCS, 1980) was prepared by the International Union for Conservation of Nature and Natural Resources (IUCN). This publication describes development as the modification of the biosphere for anthropocentric purposes (Section 1.3), and recognises such modifications are a threat

unless guided by the principle of conservation. The Strategy closes with a section entitled Towards Sustainable Development, in which conservation and development are seen to be mutually dependent.

Ecological sustainability requires the establishment of resource use limits. Accordingly, economic development cannot be pursued through increased material and resource exploitation alone. It requires a balance between economic development and environmental conservation. The natural environment is needed for other services that can not be provided by economic growth and technological progress, and implies that the economic system is only a part of a bigger ecosystem. In the end, ecological sustainability means a way of life within the laws of nature.

Newton and Freyfogle (2005) proclaim that "as long as resource flows are bountiful, it is hard to convince the public that a problem exists". A landscape of mixed uses is a reality as humans will always alter nature. However the issue from an ecological perspective lies with the questions of how far should we go, and with what aim. Alternatively should we simply understand that nature has no set form, rather, is created through a network of processes?

### 3.4 The Economic Concept of Sustainability

Sustainability means many things to economists. For some, it means "to increase in social welfare" (Lele, 1991), or "sustainable utility" (Pearce *et al.*, 1989), or for others it is simply to increase material consumption and production. The concept of economic sustainability is also subject, on all levels, to different inputs and outputs. The economic sustainability of a vineyard is subject to the viability of, and markets for, an end product i.e. the wine. All these factors mainly rely on the requirement that the stock of capital that one generation passes on to the next be maintained or enhanced. Furthermore, this stock of capital is seen by some to comprise two elements: manufactured capital and natural capital. The extent to which these are believed to be substitutes or complements is subject to debate. As it is considered to be of relevance to this study, a brief examination of these views is considered further.

### 3.4.1 Neoclassical Economic Ideologies of Sustainability

The neoclassical economic paradigm of sustainability is optimistic. According to this concept, "sustainability can be achieved even if production and consumption deplete a natural resource faster than it regenerates if:

- The resource can be continuously substituted for capital; or
- If there is resource-saving technological progress" (Klaassen and Opschoor, 1991).

Therefore, it is assumed that sustainability can be achieved through capital substitution and technological progress. This assumption appears to be unrealistic as, firstly all natural resources cannot be substituted in all of their capital functions. Secondly, there are well known physical thermodynamic limits to technological progress. Technology can only minimise loss, not completely eliminate it.

### 3.4.2 Ecological Economic Ideologies of Sustainability

The ecological economic perspective can be classified as restrained. This theory is more cautions in dealing with the natural resource and environment to the point that the rate of its exploitation and use should be maintained or even minimised as suggested by Daly (1973) in his steady state economics. The importance of the maintenance of environmental and natural resources is due to the significance of their role in the economic process. Sustainability is viewed as an evolutionary process in the dynamic interaction between the environment and the economy.

Furthermore, "the role of the natural environment to economic activity and the effects of economic activity on the environment are still uncertain. Compounding this is the fact that "the repercussions of human activity on the environment are irreversible and cannot be matched by manufactured capital" (Victor, 1991).

### 3.5 The Social Concept of Sustainability

The social concept of sustainability is relatively qualitative, which, if viewed from the objective of this study, is difficult to relate. However without it the whole picture of sustainability would not be complete.

Redclift (1987) defines social sustainability as the ability to maintain desired social values, traditions, institutions, cultures and other characteristics. Similarly, it is recognised by Pearce *et al.*, (1989, p24) as being the survival goal of the human species, and the realisation of an acceptable quality of life for each individual in present and future generations. Moreover, according to O'Riordan (1988, p155) "this implies a much broader phenomenon, embracing the ethical norms to institutions responsible for ensuring that such rights are fully taken into account in policies and actions". In other words, social sustainability pertains to intergenerational equity. The IUCN (1980) categorises social sustainability as an equitable distribution of 'goods' and 'bads' of resource use along with environmental management by present and future generations within and between countries.

For human survival to be long-term, it must make reference to the means and limits of its environment. This implies the stabilisation of human population to maintain a standard of living, minimise resource consumption and pollution, to improve welfare and minimise environmental degradation. There is great difficulty in achieving these goals. However, according to the WCED (1987), this can be attained through the political will to formulate policies for decentralisation and for a new era of economic growth, one that must be based on policies that sustain and expand an environmental resource base at the national level, and community empowerment in decision making and resource use at the local level.

### 3.6 A Systems Perspective of Sustainability

System theory is the transdisciplinary study of the abstract organisation of phenomena, independent of their substance, type, or spatial and temporal scales (Dale, 2001, p90). As

such, systems can be used to represent the complex organisation of virtually any real-world entities into some form of ordered model with a set of components that interact with each other in which we can better understand. Sustainability from a systems perspective is remarkably dynamic and complex, so there is good reason why such a large degree of confusion exists between users of resource, interest groups, policy and decision makers. A system has at least seven characteristics as defined by Clayton and Radcliffe, (1996, p63):

1. ***Components*** or ***subsystems*** as the fundamental internal units of a system.
2. ***Resources*** and ***resource flow***. System resources can be simplified down to energy, material or matter, and information. Resource flow is described as the input, throughput, and output of resources.
3. ***Relations*** as system internal intra-relations and external inter-relations. Relations represent resource flow pathways.
4. ***Control and regulation mechanisms*** that add order and coherence to a system. These can be subsystems unto themselves, becoming more distinguishable and important with increasing system complexity.
5. ***System boundaries*** that encompass components and internal relations. Boundaries can be difficult to distinguish in reality because external relations often have the effect of blurring where one system stops and another starts.
6. Internal ***hierarchy*** representing levels of relative system complexity. Lowest tiers represent basic system components that interact to build successively higher and more complex tiers.
7. ***Emergent properties*** representing 'something extra', as they cannot be explained solely through examining the sum of a system's parts.

### 3.6.1 The How, What and Why of Sustainability

We are not only interested in 'what' is being sustained due to sustainability often implying purpose and continuity, we are also interested in 'why' and 'how' a system is being sustained (Figure 3). Using a vineyard system, for example, (the 'what'), we may be interested in its ability to sustain vineyard productivity (the 'why'). We may also be interested in 'how' the system's vineyard sustaining abilities are being sustained. In

doing so, we can gauge the all important ‘for how long’ temporal dimension, and as a managed system, we can intervene to maintain or enhance vineyard sustainability through such measures as irrigation use.

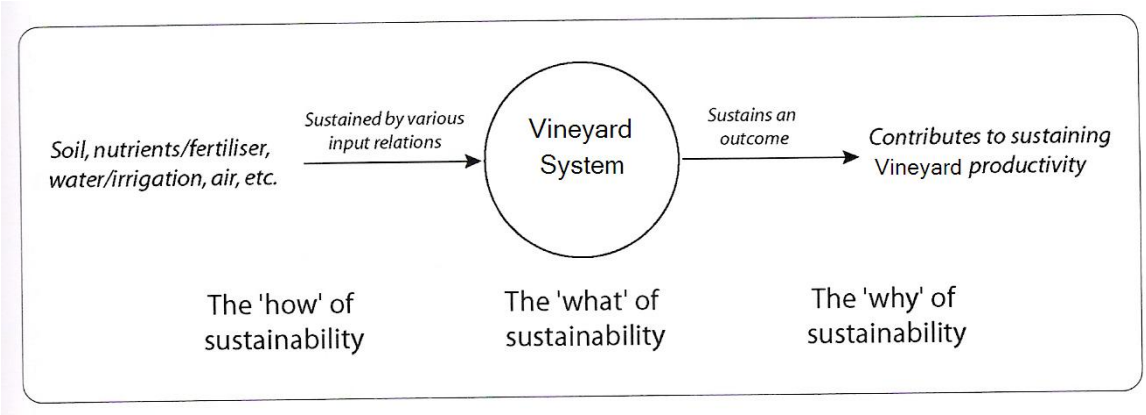


**Figure 3** The how, what and why of sustainability for a vineyard system (Adapted from Ikerd, 1990)

Vineyard systems are an example of internal and external relations which are not always sustainable. Externally, a vineyard requires a constant influx of resources – water from weather or irrigation systems, information from communication systems, nutrients from fertiliser and soil systems, machinery from manufacturing systems, and so on. Reciprocally, a vineyard directly contributes to sustaining rural economies and societies social requirements in the form of income generation and wine consumption. Internally, a vineyard boundary encompasses social, economic, production and biophysical systems, all interacting through various network relations as regulated by management. Figure 3.1 illustrates the principle subsystems conceptually encompassed by a boundary.

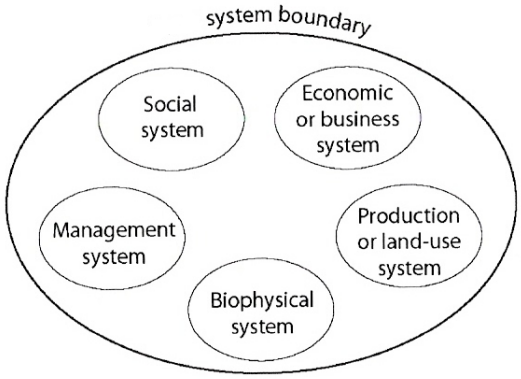


**Figure 3.1** Principle subsystems of a vineyard (adapted from Manderson, 2003)

All of a vineyard's internal and external relations, no matter how small or brief, will in someway contribute to whole-vineyard sustainability. As such they are all important in their own way. However, the sustainability of some systems is more directly important than others, and can be singled out as primary factors determining vineyard sustainability. These are considered as biophysical, environmental, and the ability of management to sustain vineyard function through design and control (Figure 3.2).

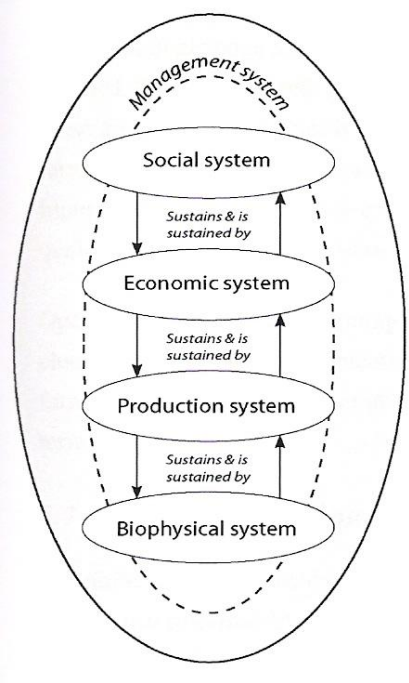


**Figure 3.2** Linear sustaining relations within a vineyard system from an anthropocentric perspective (adapted from Manderson, 2003)

### 3.6.2 Hierarchies of Sustainability

Hierarchy within the sustainability debate is characterised as various tiers of interpretation (Figure 3.3). Hence, we can begin with vineyard sustainability as viticulture's smallest decision making unit, which is a part of, or contributes to sustainable viticulture. That is, the collective sustainability of individual vineyards contribute to sustaining the viticulture industry. Viticulture is one of many potential land uses, so in turn contributes to sustainable land use or land management. Land is one of

many resources contributing to sustainable resource management, all of which eventually come together as sustainable development.


**Figure 3.3** Hierarchy in Sustainability from a vineyard perspective (adapted from Dumanski, 1997, p219)

Unfortunately the distinction of hierarchy can be overlooked in the application of sustainability. Whereas a generalised interpretation may be necessary for policy formation at national and international levels, its lack of specifics and detail will have little value at the field-level. Hence, the dictum 'think globally but act locally' is recognition that sustainability cannot be imposed top-down from upper tiers (Reid, 1995, p8). Conversely, as there can be many possible sustaining relations involved, upper tier interpretations may become bogged down by seeking to include too many specifics.

### 3.7 How to Achieve Sustainability using Legislative and Voluntary Methods

The imperative to use and manage resources sustainably was recognised by New Zealand as a nation over eighteen years ago, and captured as legislation known as the Resource Management Act 1991 (RMA). The purpose of this Act is to promote the sustainable management of natural and physical resources (Part 2, Section 5, RMA, 1991). "Considerable responsibility for implementing the Act is devolved to regional and district authorities who are required to interpret and apply the RMA's sustainability principles within their own regional jurisdictions" (Memon, 1991). This is largely an autonomous process, which has resulted in the formation of regionally-unique policy, plans, and approaches for promoting sustainable resource management. In this sense, policy instruments represent the interface between desired and actual RMA outcomes (the 'coalface') and can therefore have a large determining influence on the effectiveness of achieving sustainability.

Conversely, regulation is not necessary the best means of inducing widespread change in the ways resources are managed (McShane, 1998; Morriss, 1998). Central and local government also support and encourage independent sustainable resource management related initiatives. These may be fostered by communities, industry, or other non-government organisations (NGOs), including recreation and environmental groups.

There exists a very broad array of voluntary initiatives, which are tailored to local circumstances, the industry concerned, other societal partners which may be involved and the environmental challenge at hand. There are instances of successful voluntary methods in all areas of environmental policy. One example is the Australian Greenhouse Challenge, a voluntary initiative underway to respond to climate change issues, which has become a cornerstone of national climate change policy in Australia. Voluntary initiatives comprise many elements, which can include setting objectives and/or defining principles, implementation, assessment and reporting. They are not only 'stand alone' measures, but can be used as a supplement to laws and regulations and can serve as an efficient tool to implement politically defined objectives. Due to their voluntary nature and flexibility, they can offer innovative solutions and reduce regulation. For voluntary actions to be

most successful, BIAC (1998) note it is essential that government, business and the public co-operate and that policies be designed to promote cost-effective voluntary action.

Voluntary approaches in achieving sustainability help reduce both compliance and enforcement costs and can provide businesses with additional flexibility and motivation to tailor approaches to their specific needs. Voluntary methods are a flexible instrument of environmental policy, which can stimulate the development of cost-effective and clean production methods and encourage responses to environmental demands.

> "They can help promote partnerships with public authorities, allow for a quicker and smoother achievement of environmental objectives and reduce the administrative burden. Implemented wisely, they have the important feature of achieving change without forcing the early retirement of capital stock and the commensurate loss in economy and jobs" (BIAC, 1998).

### 3.8 The Ability of Management to Sustain Vineyard Function

The ability of management to sustain vineyard function has the greatest direct influence on whole-vineyard sustainability. It is also the most important as management is responsible for designing and operating a production system that fulfils socio-economic needs. In short, a vineyard manager must design, continually refine, and manage the vineyard system if it is to be socio-economically sustainable (the exception being a catastrophic event that management cannot accommodate such as a severe frost).

The importance of management is often captured when sustainability is defined in terms of objectives to work towards. Objectives include:

- Be economically viable;
- Be socially acceptable;
- Maintain and enhance yield quality and quantity;
- Decrease risks to the vineyard; and

- Protect the potential of natural resources and prevent the degradation of soil and water quality.

It is the responsibility of the vineyard manager to decide how these objectives are to be specifically met as they apply to individual vineyards. However, it is the ability of the manager that largely determines whether or not they can be achieved through the appropriate design and management of a vineyard's production and business systems.

### 3.9 Freshwater

Eternally fundamental but for so long taken for granted, freshwater today is a commodity of which effective and sustainable management is becoming increasingly important. Management of water resources is a critically important human activity, with the quality and availability of water determining levels of public health, food production, the productivity of industry, and production of energy (Grigg, 1985, p31). Freshwater is essential to virtually every human endeavour (IUCN, 1980; Postel, 1984, p29).

The scarcity of anything so fundamental has the potential to create conflict and unrest comparable to the energy 'crisis' of the seventies, and in fact many people believe the next crisis might be in water (Postel, 1984, p50). Many countries, especially those on uneasy borders, could easily go to war over conflicts arising from disagreements regarding water, more specifically its use and allocation (Young, 1991, p21). The world is entering a period of intense competition over limited supplies of water for the multitude of uses and users which depend on it.

Thankfully in New Zealand this extreme situation is not a factor. However, the increasing demand on the water supply is in places creating pressures on the available resource, which is characteristically disproportionately distributed. This creates the necessity of management intervention to ensure the sustainable management of the dynamic water resource. A prime example is the Auckland water supply problem of 1994, where the expanding population of Auckland City came close to consuming the water available in the public water supply system. Another example is the lowering of Lake Pukaki to

maintain power supply in 1992, when the hydro lakes got low during an extended dry period.

The uneven distribution of the water resource and changes in the demand for water caused by continuing population growth or increases in the use of water in agriculture, often result in localised scarcity. Excess demand relative to supply is already beginning to cause problems in Marlborough where increasing demand for water is occurring due to expanding viticulture, along with increasing consideration for the natural processes and functions of ecosystems.

Freshwater is a driver of the New Zealand economy and of vital importance to the identity of New Zealanders. The key issues relating to New Zealand's freshwater resource include increasing demands, reduced or declining quality, and uncertainties regarding possible impacts of climate change. All New Zealanders have a common interest in ensuring that the country's freshwater resources are managed wisely, in order to provide for the present and future environmental, social, cultural and economic well being of New Zealand.

The technical paper written by Ward and Pyle (1997) for the Ministry for the Environment (MfE) suggests an approach to and some examples of indicators for the sustainable management of freshwater. Ward and Pyle's (1997) paper details that freshwater indicators will help to monitor the effectiveness and suitability of regional policies and resource management methods for dealing with freshwater use. As an official government document it is structured into four main sections: the first outlining its purpose, relevant policies and legislation; the second a moderately detailed overview of monitoring of freshwater resources in New Zealand; third, the proposed freshwater indicator strategies (this is the largest section); and fourth, how freshwater indicators will be implemented and reviewed. This document is very relevant to the topic, as there is an overarching desire to reach a management strategy that will maintain the health of New Zealand's freshwater resources and promote sustainable management for future generations. The script is clear and well structured. It is politically correct and by its

nature strives for a synthesis of regulatory and non-regulatory goals. While the document is to serve the objectives of recommending indicators for specific freshwater resources according to MfE, it will be difficult to implement if the indicators cannot be flexible to work within a more community based context.

The MfE (2003) Sustainable Water Programme of Action was established to ensure freshwater resources in New Zealand are managed and used in ways that support New Zealand's long-term sustainable development. In brief, the national outcomes the Water Programme of Action has developed which are of relevance to this research are:

- Improving the quality and efficient use of freshwater by building and enhancing partnerships with local government and industry;
- Working with local government to identify options for supporting and enhancing local decision making, and developing best practice;
- Maintaining primary responsibility for managing freshwater use with regional councils;
- Allowing freshwater resource users to take responsibility for their actions and will be given the flexibility to develop appropriate solutions; and
- Providing for community involvement in decision-making.

Overall, the MfE (2003) Sustainable Water Programme of Action has an emphasis on and largely based upon regulatory components in meeting its objectives. However it does have extensive education components to allow industries/communities to develop into self-regulatory modes in the future.

### 3.10 Regulative vs. Non-Regulative Methods

A natural resource as fundamental to humans as freshwater inevitably faces the quandary of localised scarcity as demand from a continually expanding population place increasing pressures on what is essentially a limited resource. This localised deficit necessitates intervention by management authorities to ensure the use of the water remains sustainable, as required by the RMA.

### 3.10.1 The Case for Regulation

There are two principle circumstances Bell (2008, p18) denotes as justifying why regulation is warranted:

- **Public resources** – The management of 'public resources' such as water automatically requires some form of regulation, owing to the fact that the market place cannot adequately manage these types of resources. For example, without some form of regulatory framework, it would be very difficult to stop people taking large quantities of water from surface water bodies for irrigation or discharging an unacceptable level of contaminants into air or water. Regulation is therefore required, as a minimum, to set environmental standards.
- **Private resources** – By contrast, regulation of 'private resources' including land or buildings is justified if it can be argued that individuals are not the best judge of their own interest. In particular, it might be in the public interest to regulate an individuals actions e.g. in relation to building height. Alternatively, there may be a need for collective action, which individuals cannot bring about, but a regulatory agency can (e.g. management of urban growth).

The fundamental difference between regulation of public and private resources is that the presumption is in favour of regulation of public resources, but non-regulation of private resources. Regulation of private resources should only be introduced if the regulatory agency can clearly demonstrate that regulation is needed, and the benefits outweigh the costs.

### 3.10.2 The Degree of Regulation

Paehlke (1990) ascertains the policies which followed in the wake of environmental concern of the late 1960s and 1970s have been predominately regulatory in character, see, for example, Lave, L (1981). The current management of New Zealand's freshwater resources is primarily through statutory controls, principally under the RMA. The RMA contains a detailed hierarchy of activity classifications, ranging from permitted activities

to prohibited activities. “Many local authorities appear to still be developing their ideas on how to best utilise activity classifications under their district and regional plans, and there are significant differences from one local authority to the next” (Bell, 2008, p33). This is not surprising, given the fact that there are 86 local authorities, each making their own decisions in the absence of any significant national guidance, especially in relation to the issue of freshwater. Overall, the principle for deciding the degree of regulation should be to use the least restrictive option. A more specific requirement under the RMA for local authorities to assess, and be accountable for, the cost and benefits of any proposed regulation might aid this.

### 3.10.3 Regulatory Framework

The RMA sets the framework for freshwater management and is administered by the MfE. Freshwater management is subject to the general planning provisions of the RMA through a hierarchy of documents. These documents must reflect the purpose and principles outlined in Part 2 of the RMA which lists a range of matters to be considered in resource management processes. Current freshwater management in New Zealand occurs predominately at a regional level. A proposed National Policy Statement for Freshwater Management (NPS) under the RMA will provide a consistent national policy framework for decision makers to enable improved freshwater management.

### 3.10.4 Environmental Decision Making

When making decisions concerning the environment, it is often difficult to determine whether a particular decision is good or bad. Taking an integrative approach and incorporating the needs of multiple stakeholders through regulatory and non-regulatory methods can often lead to decisions being judged as successful. However, the outcome of this process may take considerable time to eventuate, making ‘good’ decisions liable to uncertainty. Lake Ellesmere was investigated in the article by Gough and Ward (1996) to assess the process of decision making. Many stakeholders have interest in the Lake and its catchment which makes making good decisions a difficult task. ‘Soft’ systems that place greater importance on the decision making process rather than future outcomes

have been implemented to address issues of water management regarding the Lake, although the results of these decisions are not yet known. Light has been shed on the decision making process and the importance of using a system that best suits the interested parties, however the lack of results does little to confirm the validity of the approaches outlined by Gough and Ward (1996).

There is widespread acknowledgement that the greatest environmental results stem from management solutions that incorporate interested parties at all levels. Literature widely accepts that greater numbers of participants leads to greater outcomes. However this may not always be the case. There may be a limit to which the addition of resources, time and energy starts to become counter productive. Watershed groups in Ohio, America were studied by Koontz and Johnson (2004) to identify what levels of involvement led to the greatest environmental decision making. Groups consisting of a wider range of stakeholders were found to be more successful than others in plan creation, issue identification, and group development. Conversely, groups consisting of a narrower range of stakeholders were more successful in applying pressure on government and policy. These findings successfully emphasise the importance of identifying management objectives to control levels of involvement before participation is requested.

### 3.10.5 Non-Statutory Measures

While regulation seems ordinarily to have been the instrument of choice, there are numerous programmes and activities carried out by Central Government, regional and district councils, community organisations, industry groups and NGOs that aim to improve freshwater management, and the interface with land management. Pearce (1992) presents the viewpoint that non-regulatory methods, especially in perceptions, sensitivity and solutions to water quality issues, establish a series of reasonable and innovative solutions that could be carried out so as to improve the quality of surface water on lands dedicated to agriculture. Pearce (1992) commented on solutions related to such categories as education, research and monitoring with long-term management of freshwater the goal to any non-regulatory methods of sustainable freshwater use. Self-regulation is another

solution industries are setting themselves as “non-regulatory standards and guidelines can ensure an agreed level of environmental performance” (Renton *et al.*, 2002).

The Quality Planning website (2009) puts the case forward that “strategic, non-regulatory planning approaches can overcome many difficulties associated with the use of regulatory methods for dealing with freshwater management under regional plans”. While these approaches lie outside the regional plan, they can be integrated with regional plans and can add detail into the generality required for regional freshwater management. Furthermore, given the requirement under the Local Government Act 2002 for local authorities to take a sustainable development approach, the role of non-RMA plans and programmes in addressing environmental and resource development issues are likely to become increasingly important

An example of a non-regulatory method is the Fonterra Dairying and Clean Steams Accord (2003). The purpose of the Accord is to promote sustainable dairy farming in New Zealand and focuses on reducing the impacts of dairying on the quality of waterbodies. While the Accord is not legally binding on Fonterra, it is anticipated that an industry self-management approach will more effectively achieve positive environmental outcomes than sole reliance on regulation. It is anticipated however that the policies and targets of the Accord will be incorporated into Fonterra supply contracts in the future. While the Accord does not satisfy the desired outcomes of all environmental groups, with disquiet of this document felt by Forest and Bird New Zealand and Fish and Game New Zealand, its purpose is clear and it is a step towards the dairying industry acknowledging that an adaptive management approach is needed if it is to promote environmentally sound and sustainable practices.

In Australia a national environment strategy for Australia's wine industry has been released (Sustaining Success). This document warns winemakers and grape growers they risk losing their growing share of export markets, unless they treat environmental issues including freshwater use as seriously as economic ones. The industry hopes that by 2025, it will be selling $4.5 billion worth of wine every year. The "Sustaining Success"

strategy, says that target will not be reached, unless the industry manages its natural resources sustainably. It also says consumers will increasingly demand the industry proves its environmental friendliness. (Renton, Manktelow and Kingston, 2002).

### 3.11 Précis

Principles and themes underlying the sustainability concept have been evident throughout history firstly as an incidental term and then as a guiding principle for international development by the United Nations. Despite it being somewhat vague, the sustainability concept is unlikely to go away as it is a guiding principle embedded in development policy, legislation and non-regulating documents. From a systems perspective, one or many systems can have an ability to sustain one or many systems over time. Vineyard sustainability is complex and dynamic due to environmental and market fluctuations.

The localised scarcity of freshwater resources has inevitably resulted in a situation where regulatory intervention is required to ensure that the resource remains in a state where it can be utilised by a variety of users, in a variety of ways, to prevent societal breakdown. It may not always be sufficient to accept a single regulatory regime when a number of comprehensive self-regulating approaches may better represent the industry involved. What is clear however is that management in what ever shape or form has strengths and weaknesses but is a fundamental component in the freshwater planning process.

# 4.0 OPERATING CLIMATE OF MARLBOROUGH'S VINEYARDS

In order to put the following chapter which explores environmental policy considerations in perspective, it is necessary to have some background knowledge of the importance of the grape industry. As vineyards are users of freshwater through irrigation and frost protection practices, vineyard system components and processes are firstly explored in this chapter with the aim of delineating the relationship between the environment and vineyard. Following this is an outline of New Zealand viticulture and then more specifically Marlborough, the case study area. Marlborough is a grape district facing water shortages due to its distinctive climate and intensified viticultural activities putting pressure on water bodies in the region.

## 4.1 Defining the Relationship between Environment and Vineyard

It is the aim of viticulturalists to achieve a harvest of fruit that can produce a wine that meets a desired quality. Wine quality, in itself, can take on different meanings to different people. For the viticulturist, it depends on achieving optimal berry composition given the limiting environmental and management conditions. For the winemaker, a quality wine means reaching a desired style that will sell within the commercial wine market. For the consumer, quality is reflected in the way a wine looks, smells and tastes relative to their personal preferences. It is therefore the role of the viticulturalists to manage the grapevine to produce fruit of appropriate composition and quality, while the winemaker relies on the resulting grapes to produce a desired wine style.

Knowledge of a vineyard environment draws on several natural sciences, among them biology, ecology, hydrology, pedology, geology, chemistry and climatology. The interaction of these disciplines within the surrounding vine-plant environment is called oenology (Daubenmire, 1974, p12) and each discipline can be recognised as belonging to a system. The environmental system within the vineyard contains certain characteristics such as inputs and outputs, linkages and flows with interaction between each part continuously readjusting in time and space (Figure 4).

Due to the complexity of the environment within the vineyard, it is difficult to treat the role of each part as a single factor. There have been numerous papers that have described the interrelation between natural environmental sub-systems and viticulture (Coombe, 1987; Jackson and Lombard, 1993; Jackson, 2001; Rankine *et al*., 1971). How each sub-system directly or indirectly interrelates with each other differs between each author, however all agree with the conclusion that location, climate and management are the three most important sub-systems within the whole vineyard environment.

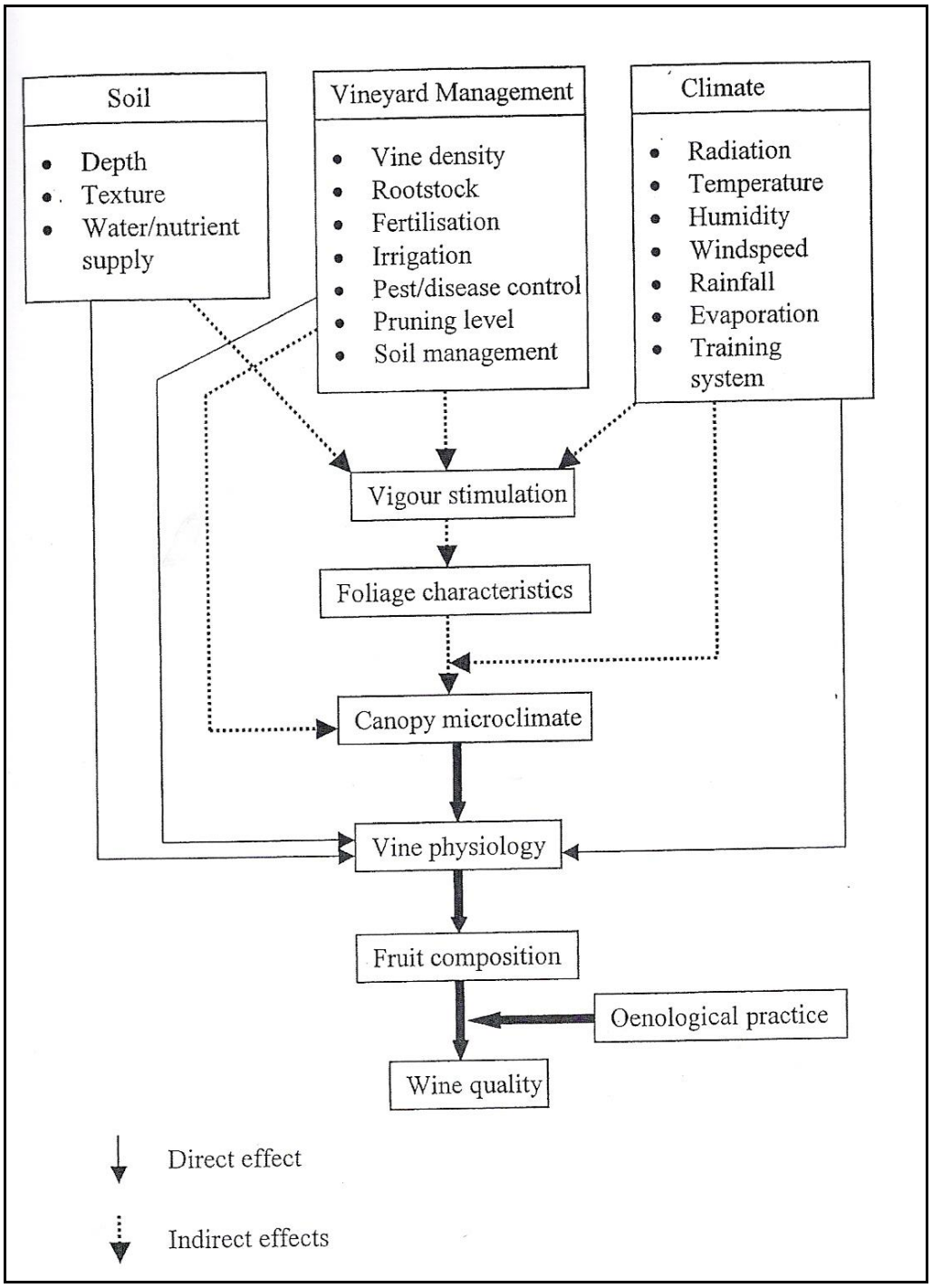


**Figure 4** Conceptual model to show how soil, climate and vineyard management can affect fruit composition directly or indirectly (adapted from Smart *et al.*, 1980).

There are many environmental factors e.g. light, temperature, humidity, wind speed, soil, water and management factors e.g. vineyard planting, canopy management, irrigation, fertilisation that influence plant water use. Rainfall is also a key factor determining irrigation need. Marlborough's rainfall fluctuates month to month and year to year (Figure 4.1).

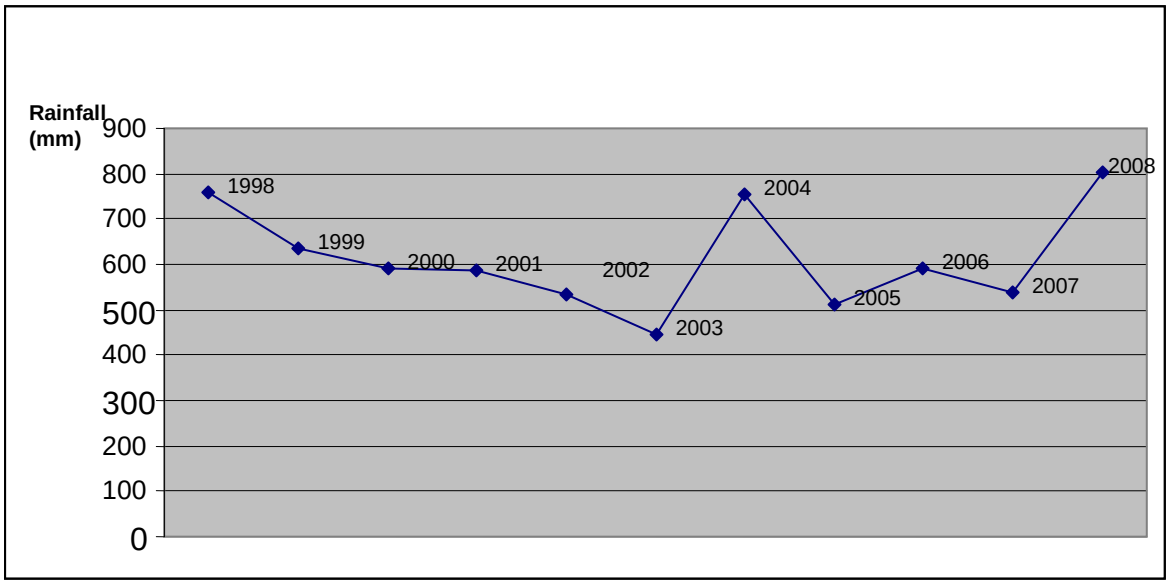


**Figure 4.1** Marlborough's Total Monthly Rainfall data 1998-2008 (Source: Marlborough Wine Research Centre)

According to Green *et al.* (2005) it is more difficult to be precise about environmental and management effects on irrigation requirements and, more importantly, what influences water use may have on the yield and juice quality of the grapes. This is because environmental and management factors are often linked, so that changing one factor can result in both a direct and an indirect response by the vine and the vineyard manager. An example of this is given by Green *et al.* (2005) as wet spring = increased vigour = greater leaf area = greater vine water use = more thinning and leaf plucking = reduced transpiration = less irrigation need. Furthermore, reducing leaf area = greater light exposure to fruit = changes in flavour and aroma profiles of the grape juice at harvest. Efficient irrigation management could account for some, or all, of these factors,

yet Green *et al.* (2005) points out that understanding is so far incomplete because quantitative measurements are seldom made.

The key to determining the irrigation requirements of grapevines are to determine the amount of available moisture in the soil and to determine the likely crop water use rates of the grapevine at various row spacings, different seasonal demands and the effects of vine growth stage (Dryden *et al*., 2006). The soils present (Marlborough soil maps in Rae, 1987) in the rootzone (top 60cm) and the readily available water content combine to determine moisture holding capacity thereby influencing irrigation requirements in grape vines. Dryden *et al*. (2006) also noted that during mid season (at a stage when the grape berries begin to soften) the vines experience a short-term elevated water requirement which needs to be matched with the provision of irrigation to avoid water stress in the vines.

The size of the yield dramatically affects the water requirements of vines. In years with high crop the water use will be higher than in years with low crops. Vine row spacing is also a very important consideration. HortResearch completed a desktop modelling exercise investigating vineyard water requirements when vine density is increased by decreasing vineyard row spacing (Green *et al*., 2004). The HortResearch study concluded that increasing plant density by decreasing row spacing produces a directly proportional increase in vineyard irrigation requirement. A 33% decrease in row spacing leads to a 33% increase in vineyard water use. Figure 4.2 shows this relationship.

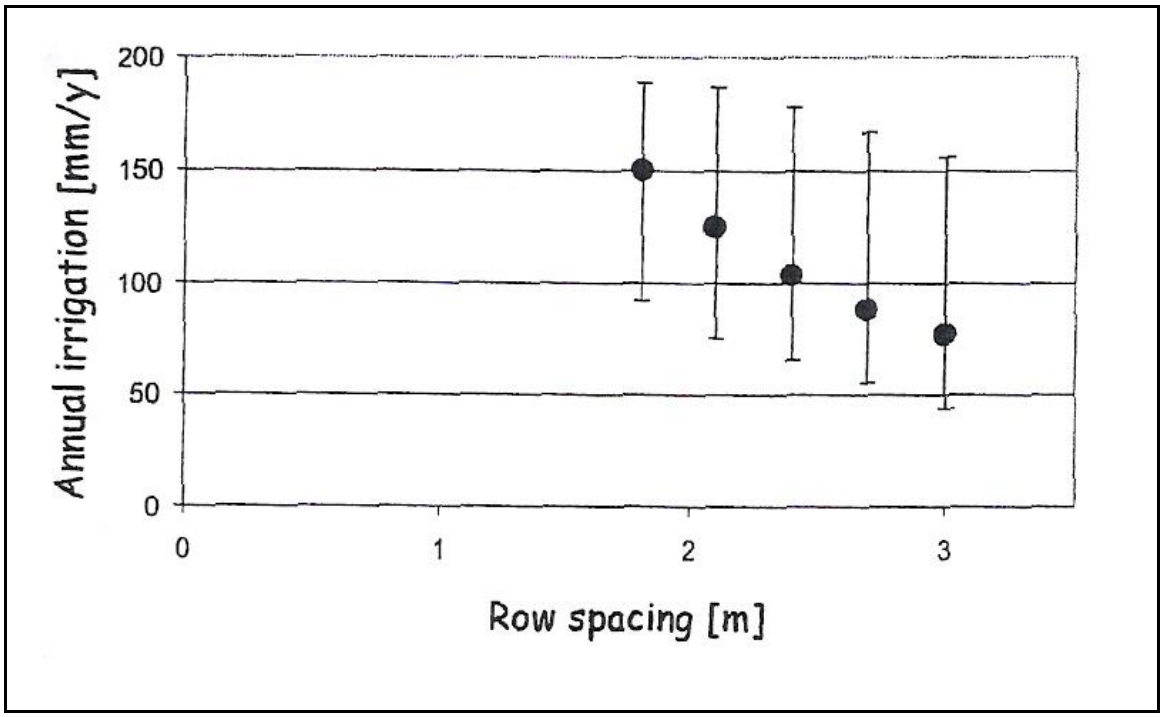


**Figure 4.2** The influence of row spacing on the annual irrigation requirement of Sav Blanc grapevines on a Wairau silt loam soil (Source: Green *et al.*, 2004)

Green *et al.* (2005) further suggest that water stress around flowering (Figure 4.3) has a greater effect on final yields. In addition, there are few data sets to quantify how much the vine's water needs change because of differences in soil type, soil depth, root depth, water and nutrient stresses, pest and disease pressures, and crop load. There is likely to be no single answer to the question 'how much water does a grapevine need?' because the need depends on the environmental and management factors discussed above. Therefore, greater understanding of the relationship between the environment and vineyard and the various stresses such as water shortages, may unravel some of the connections between water demand and irrigation needs which ultimately affect final juice quality, flavour and aroma profiles of the grape.

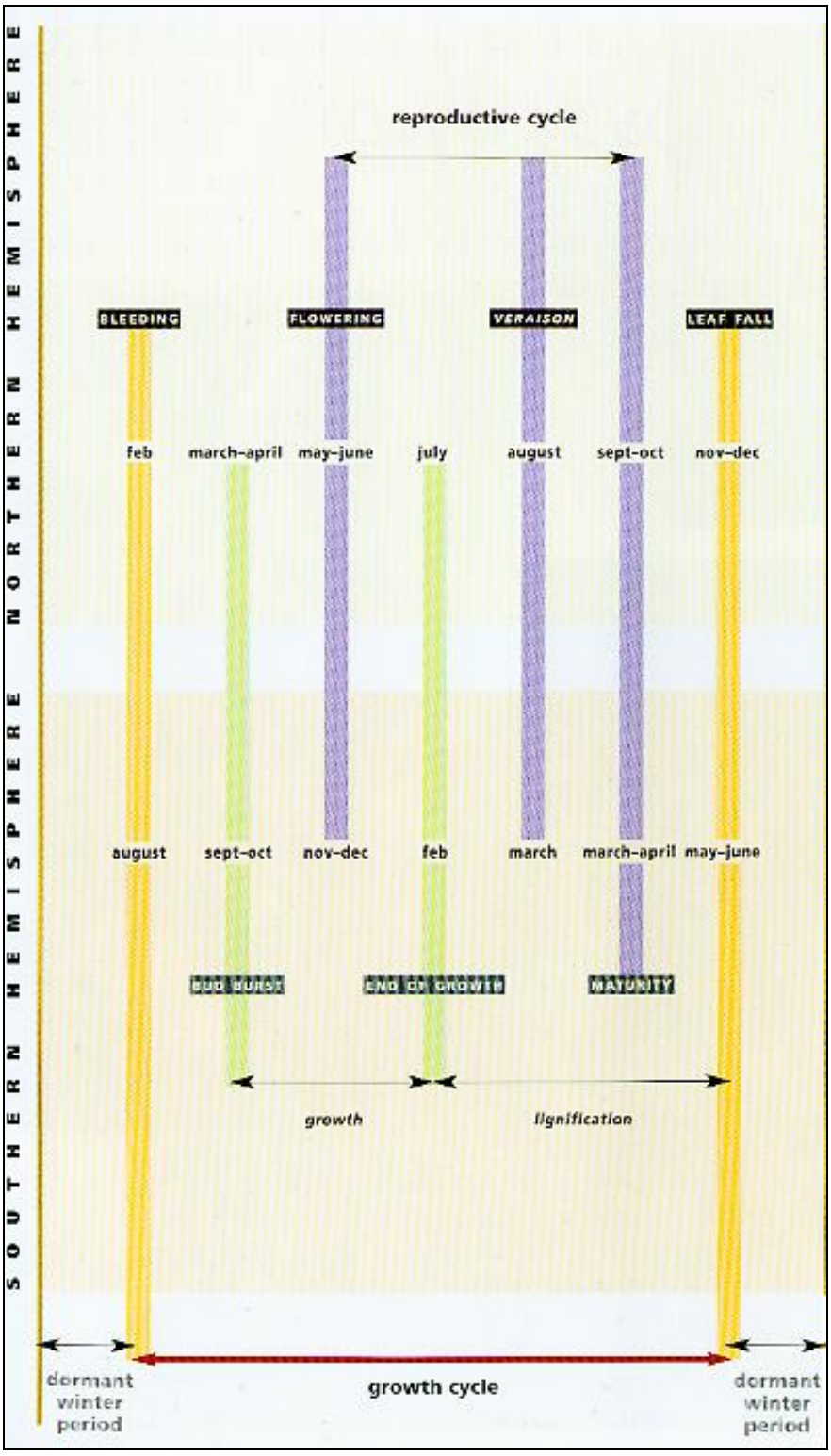


**Figure 4.3** Grape vine growth cycle (Source: Galet, 2002, p14)

## 4.2 New Zealand and Marlborough Viticulture

"The pleasures of wine have been known for over seven thousand years, ever since the people of western Asia first converted the juice of *Vitis vinifera* berries into a beverage" (Cooper, 1996, p8). "*Vitis vinifera* includes all winemaking and table grapes and is one of 60 varieties in the Vitis genus. Of these, many are infertile and others have characteristics that are unpopular with consumers" (Galet, 2002, p7). "Grapes for winemaking were first planted in New Zealand in the early nineteenth century by French settlers" (Jackson and Schuster, 1997, p41). Since the 1970's there has been rapid progress of viticulture spreading throughout many parts of New Zealand. This development can be attributed to improvements in growing techniques, knowledge of local climates and the economic advantages of grape growing aimed for the export market. New Zealand's wine growing regions are located from Northland at the tip of the North Island (latitude 35° south) down to the wineries of Central Otago, at the bottom of the South Island (latitude 45° south) (Figure 4.4).


**Figure 4.4** Map of New Zealand's wine growing regions at various latitudinal differences (Source: Jackson and Schuster, 1997, p41)

New Zealand is isolated from adjoining continents which removes the influence of continental hot air masses. New Zealand also escapes the summer heat waves which descend on wine regions at similar latitudes in the Northern Hemisphere.

> New Zealand is a cool climate viticulture region. Temperatures during the fruit-ripening phase are moderate and consistent. Wines from cooler climates are characteristically higher in acids and highly aromatic. These high acids result in wines, particularly white wines, with longer natural aging potential. Winemakers believe that cool climates produce lighter, fruitier wines whereas hotter regions produce less fruity, heavier wines (New Zealand Winegrowers, 2009).

> The Marlborough region covers an area of 1,248,400ha and is located in the top north-eastern corner of the South Island of New Zealand (Figure 4.5). The profile of Marlborough consists of three distinct areas - the Marlborough Sounds, the fertile Wairau Plains and the extensive tussock covered back country. Most (68%) of the population live in the Blenheim urban area (MfE, 2008).

Before human settlement, the entire lengths of Marlborough's river networks were surrounded by forest and natural vegetation. However, people have subsequently significantly modified Marlborough's river systems by changing vegetation cover and through water abstractions.

> Much of Marlborough's forest and tussock lands have been converted to pastoral farms with an impact on water retention, while water abstraction for agriculture, horticulture and viticulture has affected water quality and quantity (MDC, 2004).

The Government has economic growth objectives and policies for the New Zealand economy (e.g. the Growth and Innovation Framework). As agriculture, horticulture and viticulture contribute around half of New Zealand's export earnings, they will inevitably be major sectors in achieving any growth objectives (MfE, 2004). As a consequence, ongoing pressure for the intensification and changing rural land use is likely in Marlborough and throughout the country.

Marlborough's high annual sunshine hours makes it one of the sunniest regions in New Zealand, where the lee effects of the Southern Alps and Kaikoura Mountains are important in generating subsiding air and frequent occurrence of clear skies. However, the region is regarded as cool, "with an average temperature of just 18ºC during the hottest months" (NIWA Science, 2009). Rainfall is limited by the surrounding mountain ranges that shelter the valleys from rain coming from the west. Most of the rain falls in winter, rather than in the grape growing season.

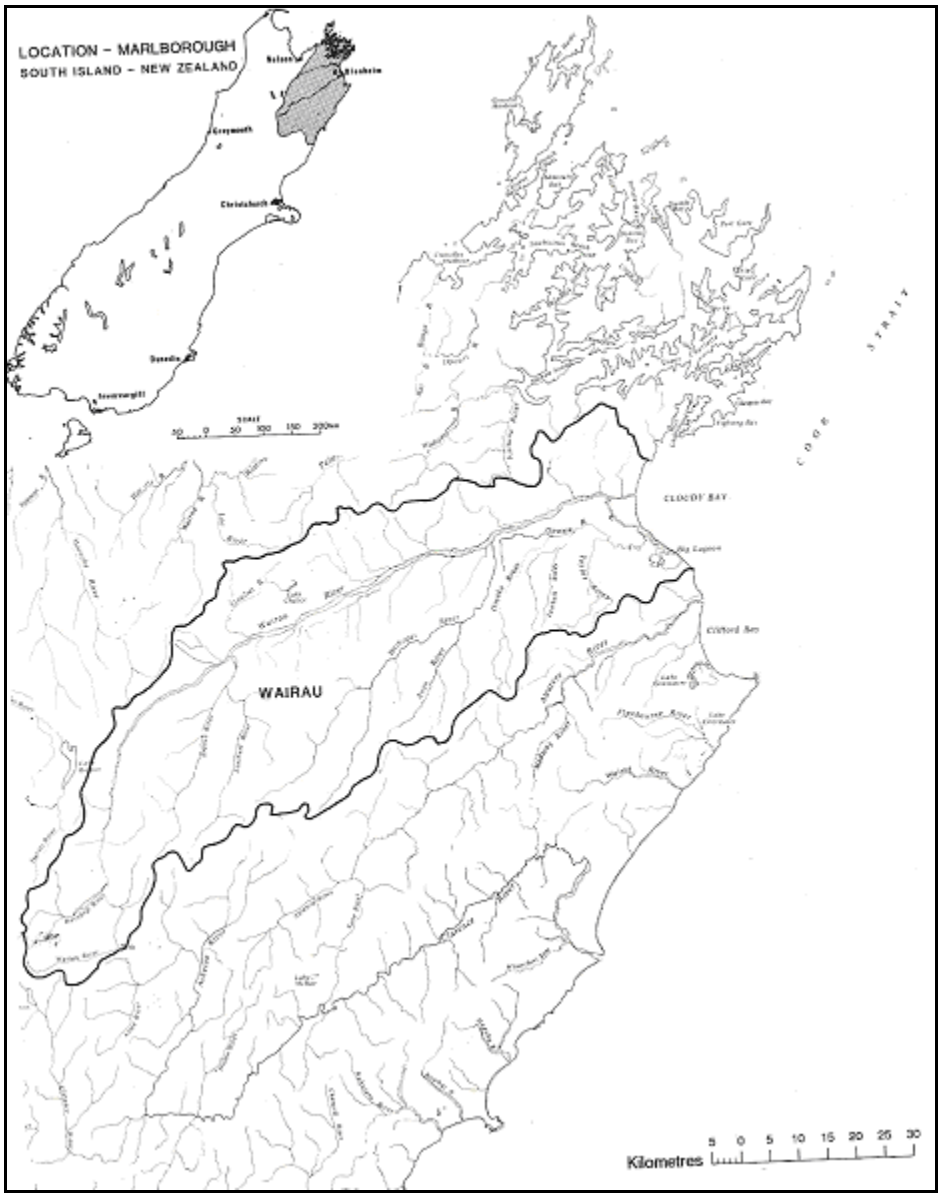


**Figure 4.5** Location Map of Marlborough, New Zealand (Source: Rae, 1987, p4)

### 4.2.1 Status Quo and Problem

As more and more Marlborough land succumbs to the lure of grape vines, growers have to look at ways of providing the plants with the elixir of life – water. That in turn has led to an upsurge in the number of water permits, irrigation schemes and dams being built throughout the province, to stave off the woes of recurring east coast droughts. Three major rivers ply their way through the grape growing areas of Marlborough. The Waihopai, the Wairau and the Awatere. Minor rivers feed all three, with the overall base being fed by catchments further inland.

> "Being on the east coast, Marlborough has been subjected to some of the most severe droughts to hit the country. Ironically, it is the very climate that allows Marlborough to produce such iconic wines. As more and more vines have been planted, the drain on the regions natural water resources has become stretched" (Nicholson, 2006).

Freshwater is one of life's essential ingredients and maintaining the quality and quantity of this resource is critical for the well being of the Marlborough community.

### 4.2.2 Viticulture in Marlborough

The Marlborough economy is based on a buoyant primary sector and is the largest and fastest growing grape producing area in the country with "23,600 hectares planted in grapes, and another 690ha in survey or being cleared for planting as of June 2009" (MDC, 2009) (Figure 4.6). The free-draining, alluvial loams over gravelly sub-soils in the Wairau and Awatere River Valleys provide ideal growing conditions. Abundant sunshine with cool nights and a long growing season helps to build and maintain the vibrant fruit flavours for which Marlborough's wine is now renowned. "Sauvignon Blanc is the most planted grape variety, with Chardonnay in second place, followed by Pinot Noir and Riesling" (New Zealand Winegrowers, 2009). It is important to realise that these viticultural plantings and the associated industry has grown from nothing in 1973 to represent the single most important lowland crop-type in Marlborough today (Figure 4.7).

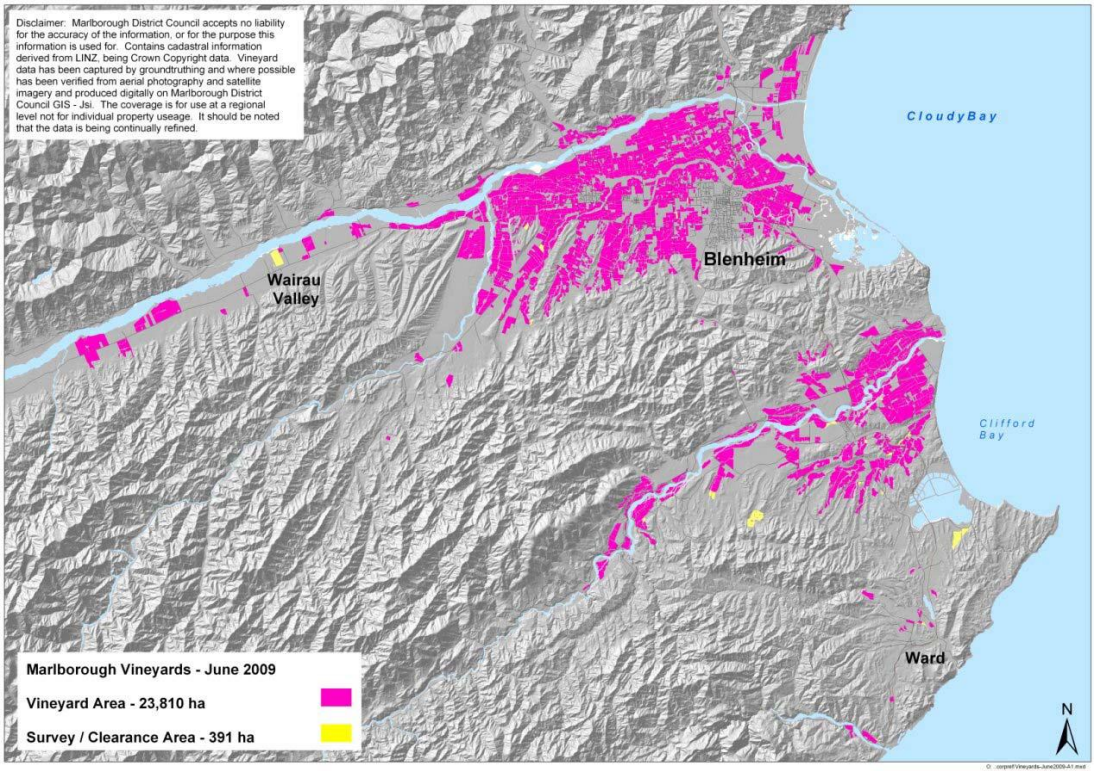


**Figure 4.6** Map showing the location of Marlborough vineyards as at June 2009 (MDC, 2009)

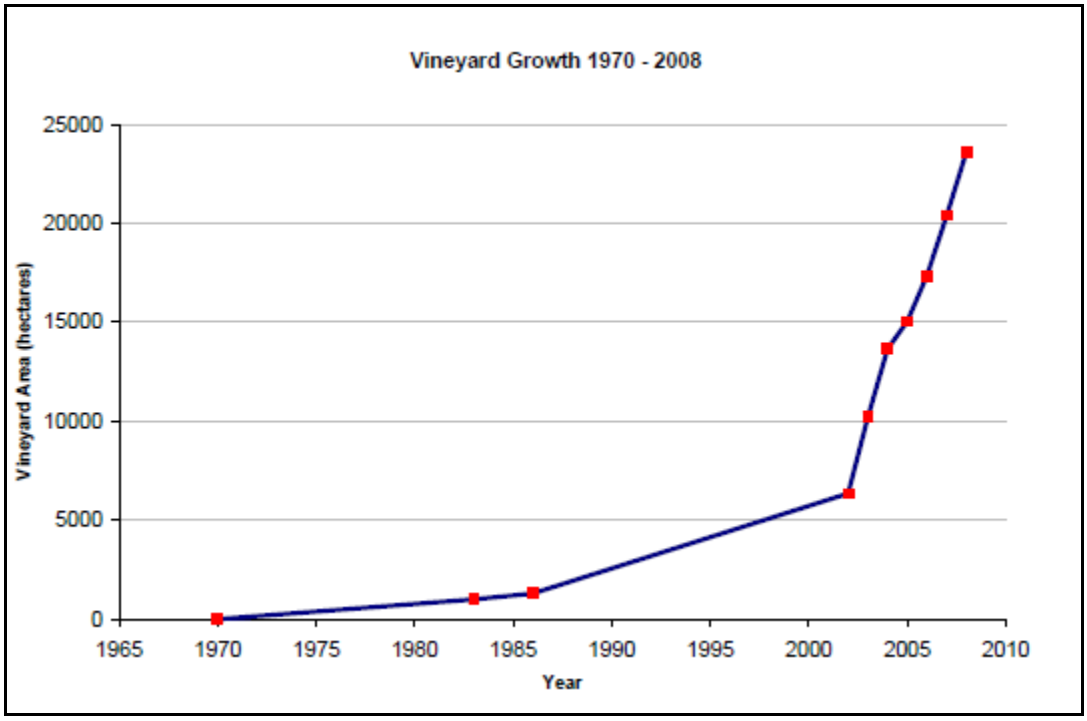


**Figure 4.7** Vineyard growth in Marlborough 1970-2008 (Source: Wine Research Centre, 2009)

Water demand patterns in the Marlborough district have changed dramatically since the early 1970s. Actual volumes abstracted are not known, but are estimated to vary between 20-80% of stream volumes. Traditional dry-land pastoral farming has been replaced by viticulture, which is reliant upon irrigation through the dry summer months. This changing pattern of land use is set to continue, as new vineyard developments expand into the drier parts of the region. A major limitation to this expansion process is likely to be the provision of sufficient water for irrigation. "Current guidelines for grape irrigation have been shown, through research and water-meter readings, to be very conservative. Some growers are often using much less water than they have been allocated. There is scope for reducing irrigation allocations for grapes" (Green *et al*., 2005). This would help to free up more of the region's scarce water resources to make sure that enough water is available for those viticulturalists, and other users, who want to use it.

## 4.3 Summary

The environment significantly influences the characteristics of grape berries during the growing season. The understanding of climate and irrigation requirements is therefore valuable knowledge, especially to viticulturalists. Rainfall in Marlborough is limited which creates challenges for the viticultural industry. This chapter sets the scene for why certain water management criterion have been set, as explored in the following chapter, to make sure there is enough water available for all users. Management plays a very important role in maximising yield and quality from a limited water resource.

# 5.0 INSTITUTIONAL ARRANGEMENTS AND THE ENVIRONMENT IN NEW ZEALAND

The management, protection and use of freshwater occurs in New Zealand, as elsewhere, within a particular set of institutional arrangements. These arrangements have been progressively modified over the last century. The scope of this chapter therefore addresses past institutional arrangements to provide context of how regulations have changed in comparison to current institutional arrangements to deal with the long standing problem of water allocation. This chapter also provides an overview of non-regulatory viticulture initiatives that collectively address freshwater resource management matters in Marlborough and shape the institutional framework within which viticulturalists must operate.

## 5.1 The Power to Manage

Historically a range of mechanisms to deal with freshwater use and allocation in New Zealand have developed over the preceding century due to long standing water allocation problems. Before local government reform and the RMA in the early nineties, they had become highly complex with a multiplicity of relevant agencies and legislation. In this chapter historic water resource management legislation is described, before examining the current regime for managing water quality, quantity, and allocation. The relevance of such information for this study is that water use is a vital element in grape growing in order to achieve commercial and wine quality goals. Given the expansion of grape growing areas in Marlborough (Figure 4.6, Chapter 4) it is important to realise that freshwater resources are managed today in such a way that existing user demands on the resource can continue to be met without adversely affecting other users or the life supporting capacity of the resource.

### 5.1.1 Past Institutional Arrangements

The imperative to use and manage water resources sustainably was recognised by New Zealand as a nation over 60 years ago and explained in detail by Roche (1994). Water

management in New Zealand has been subjected to a detailed evolution, rationally developing through to the present comprehensive framework. Knowing how New Zealand endeavoured to promote water resource management in the past has important implications towards the structure and implementation of current water legislation and the legacy issues impacting on current water use and allocation.

According to English common law water allocation rights were apportioned on a first-come-first served basis, and were applied in colonial New Zealand. Eventually legislation was introduced to regulate and control water use and allocation. Institutional arrangements connecting catchment land-use planning and water management issues were first established under the Soil Conservation and Rivers Control Act 1941 (SCRCA). This legislation was largely a response to the problems such as flooding and erosion resulting from the significant clearance of forest along with agriculture and mining development. The SCRCA recognised the link between land-use and associated watercourse degradation. Catchment boards were established who were given the power to make By-laws and land-use controls to, for instance, control works likely to cause deposition in streams. In such circumstances property owners had to gain consent and make appropriate measures to mitigate sedimentation in watercourses.

“Water allocation and water quality emerged as new issues in the 1960’s. By the post war period early legislative mechanisms for controlling water allocation and use had become ineffective” (Roche, 1994). Strong economic growth and intensification of agricultural practices were putting pressure on access to water resources for irrigation as an example. The official response took the form of the Water and Soil Conservation Act 1967 (WSCA). This piece of legislation was a comprehensive framework to plan and administer water allocation, water pollution, flood control and soil and water conservation. The WSCA set up new authorities to oversee the various new responsibilities embodied in the legislation. At the national level, the National Water and Soil Conservation Authority (NWASCA) was established to co-ordinate issues, while Regional Water Boards were set up to administer at the regional level.

Water managers were given a variety of mechanisms under the WSCA to carry out the functions of the WSCA. These included an ability to authorise activities in or near rivers through a permit system, an ability to fix the acceptable flow and standard of quality for any river and "General Authorisations" (s22 WSCA) to permit a range of environmentally insignificant activities such as the discharge of stormwater into receiving environments. However, in terms of water allocation "the WSCA created difficulties, primarily as a result of the lack of specific criteria for allocation decisions" (Grigg, 1985). Water was allocated solely on the basis of water rights without the provision of other management tools such as legislatively grounded water management plans and the setting of minimum acceptable low flows as is the case for current water abstractions from Marlborough's major rivers. The plethora of environmental laws and regulation that had emerged in an incremental and ad hoc fashion over about 80 years had created an enormously complicated system. Water management was controlled by a wide number of statues creating a legal content that was considered "unnecessary and inefficient" (Roche, 1994).

### 5.1.2 Local Government Reform

The legislation outlined so far came out of a period that was characterised by a strong development ethos and bureaucratic, coercive government control. This lasted until 1984 when a new political and economic environment was created by the incoming Labour government. This according to Palmer (1993) ensured a period (1985-1991) of fundamental restructuring to the whole state sector including that of environmental management in New Zealand. The key themes of the time were to:

- 'Downsize' the state through shifting business activities into the private sector;
- Promote economic liberalism in which the market place was considered the most efficient and most effective means of realising individual and community preferences; and
- Promote individual community responsibility i.e. 'user pays' and devolution of power.

At the national level the Ministry of the Environment was formed to replace the former government agencies involved in environmental issues. Its role was to overview and monitor local authorities. An emphasis was placed on separating regulatory and policy functions from service delivery. Councils were expected to be highly accountable to their ratepayers in terms of their performance and were expected to become more 'business-like' to improve efficiency and the quality of work they carried out. There were also limitations placed on the size and functions of government. In particular, there was a substational reduction in the number of local authorities. Before the reform there were 625 units of local government. There are now just 12 regional councils and 74 territorial authorise (including 4 unitary authorities which have both district and regional functions of which MDC is one). The decrease in the number of local authorities was designed to improve the delivery of their services and policy.

### 5.1.3 Current Institutional Arrangements

Current institutional arrangements provide the backdrop for subsequent analysis of how MDC in the case study area have responded to the current legislation to manage freshwater use driven by the buoyant viticulture industry the region is renowned for. Prior to the 1990's, laws relating to resource management in New Zealand were, according to MfE (1997), numerous, cumbersome, and poorly interrelated.

> New Zealand's environmental regime to manage freshwater is today a top down model driven by state-derived goals of economic growth, to a policy process devolving responsibility from central government through to regional decision-makers guided by the overarching objective of sustainable management (Fenemor and Markham, 1994).

The long awaited overhaul of environmental legislation was realised in 1991 with the passing of the Resource Management Act (RMA). This single piece of legislation integrated the administration of land, air, water, the coastal zone and pollution with the goal of sustainable management. The vision of sustainable management was that future generations were to have adequate resources to meet all foreseeable needs and to protect

the life supporting capacity of the environment. Through Section 5 of the RMA, New Zealand put its own modified definition of sustainability into its legislation framework. The RMA has put into legislation many new duties and explicit principles and requirements. The values of the RMA are embodied in Part 2 which sets out a hierarchical set of principles and considerations to guide the management of natural and physical resources. These principles affect the consideration of all policy, planning and resource consent applications.

Under the RMA both regional councils and territorial authorities have a role in environmental management. Regional councils have most of the responsibility for water management. They effectively took over the functions of the NWASCA, water boards and catchment authorities. Regional council's have the responsibility for controlling catchment land-use activities for the "maintenance and enhancement of the quality of water in water bodies" (s30c RMA). In the allocation of water, the RMA provides for the requirements of commercial and community interests, but also takes into consideration the protection and enhancement of ecological, scientific and intrinsic values. The RMA, as expressed in Part 2, stresses the need to maintain a 'bottom line' through safeguarding the life-supporting capacity of air, water, soil and ecosystems (s5b).

Part 2 of the RMA places a high priority on protecting water bodies. For instance Section 6(a) makes "the preservation of the natural character of ...lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use and development" a matter of national importance.

The provisions contained in Section 7 of the RMA are perhaps more important to water managers in that they require particular regard to be made for such aspects as:

- "the efficient use and development of natural and physical resources" (s7b)
- "the maintenance and enhancement of amenity values" (s7c)
- "intrinsic values of ecosystems" (s7d)
- "maintaining and enhancing the quality of the environment" (s7f)
- "any finite characteristics of natural and physical resource" (s7g)

While the RMA has an ecological focus it is neutral with respect to reconciling competition between economic and environmental goals. It is up to private developers to utilise natural resources, as opposed to the state. This represents a change from the Town and Country Planning Act 1977 where land-use planning was an essential tool for promoting development and regulating its adverse effects. The notion of social equity has also been avoided.

Compared with previous legislation, the RMA focuses on controlling adverse environmental effects rather than specific activities. For instance:

> The Section 17 term "avoid" suggests the prevention of damage, the term "remedy" suggests either curing or controlling the symptoms. The term "mitigate" implies reducing adverse effects. Local authorities have to choose which of these options to pursue (Harris, 2004, p99).

### 5.1.4 Implementation of Policy

A major tool for resource management under the RMA is regional and district plans. The RMA framework establishes that issues must link into objectives, policies and rules. Rules present one of the principal regulatory means for resource management allowing activities to be "prohibited, regulated or allowed" (Table 5.1).

Planning can occur at national, regional and local levels. Planning at the regional level employs two types of policy instruments; Regional Policy Statements and Regional Plans. It is compulsory for regional councils to prepare a Regional Policy Statement (s60 RMA). These provide an overview of resource management issues in the region and the policies and methods necessary to achieve the integrated management of the natural and physical resources. Regional plans specifically relate to resource management issues. They have given regional councils a statutory basis for water resource planning although there is no general obligation to prepare them. Regional plans may be used to set minimum flows, river levels and standards of water quality or permit minor activities.

They can also be used to control land-use activities that may impact on water quality. Section 5.2.6 of this chapter specifically discusses the statutory requirements set by the MDC pertaining to water resource planning.

The RMA planning process for policy statements and plans is based on adaptive management. This provides greater potential for an effective ecosystem approach to environmental management. Under the RMA framework issues are planned for by setting objectives, policies and methods to promote desired changes which can be monitored. The RMA requires local authorities to monitor the operation of their plan with the intention of providing feedback on the efficiency and effectiveness of methods that are being implemented.

There is also a new obligation to consider alternative methods, the reasons for and against adopting particular courses of action, and the extent to which particular courses of action are necessary before adopting any objective policy, rule or method. There is the option of local authorities not intervening in a situation if the costs of doing so would outweigh the benefits.

### 5.1.5 Resource Consents

For the public the part of the RMA they are likely to come in contact with is the resource consent process either as an applicant or a submitter. Water rights as provided for under the WSCA, have been replaced by the RMA with resource consents. The RMA recognises five main types of resource consents contained within Part 6 of the Act, as shown in Table 5.1 below. Water management under the RMA is very restrictive given the definitions in Table 5.1. This was the same with the WSCA. Any type of activity involving the disturbance of a riverbed or taking, damming, diverting water or discharging contaminants into water is restricted by the need to gain a resource consent.

**Table 5.1** Restrictions on Activities as set up by the RMA

| | |
|---|---|
| Land-use Consent (s9 RMA) | No person may use any land in any manner that contravenes a rule in a district plan or proposed district plan unless allowed by a resource consent or is an existing use allowed by s10 or s10A RMA |
| Subdivision Consent (s11 RMA) | No person may subdivide land unless allowed by a rule in a district plan or a resource consent |
| Coastal Permit (s12 RMA) | Restrictions on the use of the coastal marine area without a resource consent |
| Land-use Consent (s13 RMA) | Restriction on certain uses of beds of lakes and rivers |
| Water Permit (s14 RMA) | No person may take, use, dam or divert any water and other matters listed under s14 unless allowed by a rule in a regional plan or have a resource consent |
| Discharge Permit (s15 RMA) | No person may discharge any contaminant or water into water or contaminant onto or into land in circumstances which may result in the contaminant entering water etc unless allowed by a rule in a district plan or a resource consent |

The system of granting permits or resource consents has changed compared with previous legislation. All applications are dealt with in exactly the same way as other activities having a similar effect on the environment. Any type of activity requiring a resource consent may, according to definitions and provisions contained in the regional or district plan and rules, fall under the specific categories (Table 5.2).

Water management issues in Marlborough are not new. Concern over environmental impacts of water abstractions driven by viticultural intensification in Marlborough has increased especially over the last decade (Pers. Comm Peter Davidson Hydrologist MDC 17 September 2009). Bramley and McNeill (2009) state that while good data is not

available to show the full impact of water allocation nationally, some general observations are possible. In a report written by MfE (2006) it is quoted that approximately 20,000 resource consents have been grated for water takes, of which a third are from surface water, with the remainder being groundwater takes. Furthermore, three quarters of New Zealand's allocated water is for irrigation purposes with a 50% rise in total water allocation between 1999 and 2006, primarily for irrigation.

Decisions on resource consent applications are subject to criteria such as the resource management objectives (Part 2 of the RMA), written approval of persons affected and the assessment of the effects of activities on the environment (Fourth Schedule RMA). The assessment of environmental effects is of primary importance in considering resource consent applications such as surface water abstractions. This contrasts with 'water rights' under the previous regime in that the conditions that must be considered are now made explicit. The primary focus is on outcomes or environmental bio-physical effects. The meaning of the term 'effects' is however wide ranging and includes cumulative effects. In the opening speech of the 6th National Water Conference in Hamilton in 1994, then Minister for the Environment, the Hon. Simon Upton, stated that the RMA provides more alternatives for the allocation of water. It is presumed by this it was meant the specific opportunities for the tradability of water permits and the increasing place of the market in the allocation and management of water in New Zealand.

**Table 5.2** Restrictions on Classes of Activities as set up through plans (s2 RMA)

| | |
|---|---|
| Permitted Activities | Allowed by a regional or district plan; no consent is required. |
| Controlled Activities | Specified in a plan as such, a consent is required, some conditions may be imposed. |
| Discretionary Activities | Specified in a plan as such, a consent is required. Consent can be granted or refused, if it is granted conditions may be imposed. |
| Non-Complying Activities | These are not allowed by a rule in a plan but are not prohibited activities. A resource consent is required. A |

| | |
|---|---|
| | consent authority should be satisfied that the environmental effects are minor or that the activity will not be contrary to the objectives and policies of the plan. A resource consent can be granted or refused, if it is granted conditions may be imposed. |
| Prohibited Activities | If these are specified in a plan the activity is not permitted and a resource consent cannot be granted. |

### 5.1.6 Marlborough District Council (MDC)

As a Unitary Authority, the MDC has the powers, functions and responsibilities of both a regional and district council. A Regional Policy Statement (RPS) has been prepared by the MDC to provide a community based vision and direction of the management of the natural and physical resources of Marlborough. The land it administers is divided into two parts for management under two respective Regional Plans, the Marlborough Sounds and Wairau/Awatere Resource Management Plans (WARMP). The methods in which policies concerning the regulation of freshwater water are mainly through rules and education (as targeted education programmes to provide information along with promotion/advocacy and support/assistance). The protection of freshwater water is a regionally significant issue with "the freshwater resources of the Wairau/Awatere plan area among the region's most important natural assets" (MDC, 2009).

A summary of MDC RPS objectives relating to surface water include:

- The water quality in Marlborough freshwater bodies be at a level which provides for the sustainable management of fish and plant life.
- To sustainably manage flows and levels in wetlands, lakes and rivers to safeguard their life supporting capacity, and to avoid, remedy and mitigate any adverse effects on the environment to ensure the adequate recharge of groundwater systems.
- The preservation of the natural character of wetlands, lakes and rivers and their margins and the maintenance and enhancement of amenity values.

- Groundwater should be maintained at levels sufficient to ensure natural recharge of surface water systems, to safeguard the life-supporting capacity of all water bodies and to avoid, remedy or mitigate any adverse effects on the environment.
- Provision for activities sets out to enable present and future generations to provide for their wellbeing by allowing use, development and protection of resources provided any adverse effect of activities are avoided, remedied or mitigated.
- Policy 7.2.3 of the RPS specifically relates to the allocation of water and states:
  *Establish mechanisms for the allocation of surface water as mechanisms are necessary to ensure that water resources are used in an efficient and equitable manner.*
  *Include the following principles into water allocation mechanisms:* the list includes *sustainable management, equitable allocation and ensure efficient and beneficial use.*

Commentary to support the objectives listed above includes that 'sustainable management of Marlborough's surface water resource is essential for the district's human and natural communities.

Human induced (e.g. irrigation and power generation) and natural factors (e.g. rainfall distribution and intensities) can affect surface water flows. MDC (1995) state that monitoring and predicting both extremes of flow, low flow and flood flows is very important so that the resource can be managed in a sustainable manner. MDC operates a regional network of hydrological monitoring stations that measure and record river levels and flows, rainfall and groundwater levels. The information collected is used for forecasting and enables MDC a more effective management tool to aid in the establishment of recommended minimum flow requirements. The information also provides MDC with an insight to see what effects abstractions have on the river system.

The WARMP set outs the issues, objectives, policies, methods and rules which enable the management of freshwater resources within the Plan area (Table 5.3). The belief underlying this approach is that the decisions relating to resource allocation and use

should be taken by the communities most affected by those decisions, taking explicit consideration of their own specific geographies.

**Table 5.3** Management of Marlborough's Surface Water (Source: WARMP, 2009)

| **Resource Issue** | **Anticipated Environmental Result** | **Management Method** |
|---|---|---|
| Surface water | Protection | Water quality<br>Contaminants<br>Flow<br>Level |
| | Provision for use options | Abstraction<br>Consents |
| | Provision for food gathering<br>Provision for recreation | Discharge use<br>Water quality<br>Complaints |
| | Ecological value maintained or enhanced<br>Clarity maintained or enhanced | Habitat changes defined<br>Values<br>Turbidity<br>Complaints<br>Valued species |

The WARMP uses a water allocation regime to determine the quantity of water which should be set aside for the environment and how the remaining water should be assigned to the public.

Council has developed a surface water allocation system applicable to the area under the jurisdiction of the WARMP which incorporates three classes of water takes – Class A, B and C, each tied to summer low flow assessments undertaken in the early nineties. Sustainable Flow Regimes (SFRs) have been set for only those rivers of significant potential abstraction and are set out in a table under the General Rules Chapter of the WARMP. Surface water allocation limits from the districts major rivers have been set on

the basis of Council and the community's determination of the SFR for the specific river. Particular restrictions pertaining to the triple class water take system have been developed to manage the quantity, level and flow of each river to sustain its life-supporting capacity, ensure adequate recharge of groundwater systems, preserve natural character and protect recreational and other amenity values. Surface water takes which fall outside the triple class allocation regime provided in the General Rules Chapter of the WARMP are deemed to be Non-Class takes and are therefore not anticipated by the allocation system.
Chapter 6 of the WARMP provides objectives and policies in relation to freshwater. This includes maintaining the quality and quantity of freshwater at levels required to meet ecological, cultural, recreational, social and economic needs essential for community wellbeing while safeguarding the life supporting capacity of freshwater. The relevant objectives and policies from Chapter 6 are as follows:

Objective 1 (6.2.1) provides for the taking, use, damming and diversion of freshwater in a manner which safeguards the life supporting capacity of the resource and avoids, remedies or mitigates any adverse effects on the environment. Supporting policy (1.1) aims to achieve this by *maintaining surface water flows at levels which safeguard the life supporting capacity of the resource by setting and enforcing Sustainable Flow Regimes (SFRs)*. These sustainable flows aim to (Policy 6.2.1.1.5):

- *Protect instream habitat and ecology*
- *Improve fish passage and spawning grounds*
- *Protect the natural character of freshwater resources*
- *Maintain water quality*
- *Protect cultural values*
- *Provide for aquifer recharge*

Objective 1 (6.3.1) is to achieve equitable allocation and use of surface water and groundwater resources. The triple class system of water allocation was designed to protect a safe minimum flow for the river and to provide an efficient allocation mechanism. The allocation system was set after extensive consultation with a wide range of affected parties.

Objective 1 (6.4.1) is to establish an efficient resource use regime and support sustainable management of the freshwater resource. Supporting policy 1.2 is to allocate water on the basis of guidelines. Supporting policy 1.3 seeks to encourage water storage for use during low flow and level periods, by exempting water retained in storage from any conditions on use, and when flows are high allowing water to be drawn off for storage purposes.

Objective 1 (6.5.1) is to achieve sustainable, equitable and efficient allocation of water during periods of low surface water flows or low groundwater levels.

The variability in the natural water supply results in oscillating supplies which creates some situations when supply is unable to meet demand. With surface water resources in Marlborough the cumulative impacts of numerous abstractions requires reduced pumping rates on abstractions during periods of water shortages. Bramley and McNeill (2009) state that "summer abstraction may exacerbate existing natural flow conditions when ecosystems are already stressed". Some abstractions must fully or partially cease until the minimum flows resume. Efficient allocation requires specifying minimum flows to provide to ensure certainty for both resource users and management authorities. Bramley and McNeill (2009) suggest that as over-allocation is a reality, the ability to internalise existing externalities, is through reducing total abstraction allocation.

Water in Marlborough is allocated on a 'first come, first served' basis until the total available allocation limits are reached. Allocation will be based on water allocation guidelines which have been determined for a number of activities through research. Water is managed so as the quantity, level, and flow of surface waters to sustain their life-supporting capacity, ensure the adequate recharge of groundwater systems, preserve natural character, and protect recreational and other amenity values.

## 5.2 Industry-led Self Management

Grape growers all strive for quality produce. In order to achieve quality, those involved in the viticultural business have formed industry-led self management organisations

including New Zealand Winegrowers who subsequently launched Sustainable Winegrowing New Zealand to provide a structured way to draw diverse management issues together under a common umbrella. In this way a systematic approach has been formed to identify and manage impacts the viticulture industry has on the environment. Self Management is a form of workplace decision making in which the viticultural industry themselves agree on choices for issues like environmental impacts, legal responsibilities, general production methods, scheduling, quality assurance etc and then implement and review changes and improvements.

### 5.2.1 New Zealand Winegrowers (WINZ)

WINZ is a non-regulatory organisation, established as the joint initiative of the New Zealand Grape Growers Council, representing the interests of New Zealand's independent grapegrowers, and the Wine Institute of New Zealand, representing New Zealand wineries. New Zealand Winegrowers aims to represent, promote and research the national and international interests of the New Zealand wine industry.

WINZ first initiated research into sustainability issues in 1994 following concerns within the viticulture industry that many viticultural practices did not support the catchphrase 'New Zealand wine – riches of a clean, green land' (Dunleary, 2006). Although legislation governs issues such as pesticide residue levels little else ensures the sustainability of the country's precious natural resources (Nicholson, 2005).
An example of this is given by Nicholson (2005)

> More and more land was being developed into vineyard with the continual drain of natural resources. It was not unusual for grape growers to irrigate plants continually, whether they required water or not, and wells were being tapped into on a regular basis, without any long-term thought given to how long the resource could last.

After the initial research period a programme utilised by the Swiss winegrowing industry was adapted to suit New Zealand conditions. In 1995 WINZ launched the vineyard module to the industry namely Sustainable Winegrowing New Zealand (SWNZ). WINZ

mandate is to represent, promote and research the interests of the industry. In terms of sustainability, WINZ have set a goal that has the aim of 100% of the industry operating in accordance with the SWNZ programme by vintage 2012. Those not accredited by this time will be unable to export wines.

### 5.3 Sustainable Winegrowing New Zealand (SWNZ)

SWNZ is an independently audited vineyard management programme with a holistic focus that attempts to guide vineyard operators towards sustainable management practices using a combination of education, encouragement, measurement and assessment against a background philosophy of continuous improvement. SWNZ was established in 1995 as an industry initiative directed through WINZ and was commercially introduced in 1997 and adopted by growers from all the grape growing regions in NZ. SWNZ sets guidelines which are however not binding from a legal perspective. The operation of SWNZ is overseen by the Sustainable Winery Advisory Group (SWAG). Current membership of SWNZ is 582 vineyards of which 260 are in Marlborough.

The SWNZ scheme was borne out of a concern for:

- Sustainable management of our environment;
- The well being of our staff, the consumer and the broader community; and
- Growing general awareness of environmental issues (Nicholson, 2005).

SWNZ provides vineyards with:

- A ‘best practice’ framework for viticultural practices that protect the environment while efficiently and economically producing premium winegrapes.
- A format of continual improvement to ensure companies operate with a goal of improving their operational practices.
- A guaranteed better quality assurance from the vineyard through to the bottle to address consumer concerns in matters pertaining to the environment and winegrape production.

- A vehicle for technology transfer so that companies are kept informed of new technology and application.
- An audit structure that has integrity and rigour to comply with market expectations.
- Opportunity to be a part of the positive future for New Zealand grape growers and winemakers.

### 5.3.1 Self-audit Philosophy

The basic philosophy behind SWNZ was, and still is, centered on self-audit at the whole property level. The self-audit scorecard is the core operational document which acts as a reference document for growers through the season and provides a format for recording the practices used in the vineyard. This effectively acts as a self-audit tool which is later verified with an external audit. The scorecard is made up of 5 categories; Soils and Fertilisers, Ground Cover and Irrigation Management, Diseases, Pests and Membership Criteria. The scorecard:

- Applies to the whole vineyard;
- Is flexible and able to apply to vineyards of all sizes in any region;
- Provides a range of management practices within any category; and
- Encourages continual improvement, and is a "living document" which is easily updated to include new practices.

The key aspects of the scorecard pertaining to irrigation management are:

- Meeting legislation requirements;
- Accurate irrigation scheduling;
- Knowing water requirements for each block of grapes;
- Water budgeting – throughout the season;
- Deficit irrigation; and
- Accurate record keeping.

On completion of the scorecard reports are generated for individual vineyards, allowing them to benchmark and monitor their performance over time as well as against the region and the wider industry.

### 5.3.2 Water Management Criteria

SWNZ have developed a set of standards for New Zealand integrated winegrape production. The criteria and aims are a predisposed guideline which enables grape growers to manage freshwater within the realm of their vineyard (Table 5.4).

**Table 5.4** SWNZ Water Management Standards (Source: SWNZ Member's Manual, 2009 edition)

| **Activity** | **Criteria** | **Aim** |
|---|---|---|
| Water takes (drawn from aquifers, lakes or watercourses) | Complying with the RMA | Efficient use of the water resource |
| Water use<br>- irrigation<br>- frost protection | Apply sufficient & well-targeted water<br>Avoid over and under water use | Protection of plants; ensuring balanced growth and helps to produce quality fruit |
| Water budgeting | Compare loss of water out of the defined root zone to the water input, with the soil's water storage acting as a buffer.<br>Record and monitor meteorological figures and soil conditions, actual water use and the vines themselves. | Replace the amount of water lost from the soil over a specified period of time.<br>Influence vine growth and berry quality |

| | | |
|---|---|---|
| Record keeping | Growers must record their seasonal water input, including total amount of water used | Recorded information is used to make informed decisions about how much, when and where to apply water.<br>Effective monitoring results in effective management decisions |

## 5.4 The Management Environment

The *purpose* of water resource management is to determine what measures should be employed to meet water needs as opposed to wants (Grigg, 1985). The *role* of water resource management can therefore be described as one of integration, across both ecological and institutional realms. In the management of scarce resources, some form of management system is required to ensure that the resource is used in a sustainable manner. The management option for water has a distinct technical implementation focus, with the RMA providing the framework for local authorities to implement the legislative day to day management of the resource with non-regulatory organisations providing 'best practice' mechanisms so that, in this instance, the viticulture industry continues to develop. It is necessary therefore to bring together the issues of concern regarding water resource management (Table 5.5).

Table 5.5 presents the tools for effective resource management. Initial equity issues from the onset of setting a freshwater regime that recognises priority issues to protect a multitude of water users must be confronted. Following on from this are issues surrounding levels of regulation, integrated management and effectiveness of educational instruments which on their own are unlikely to achieve environmental sustainability however when included as a collaborative approach, the overarching challenge of implementing a water resource management system to meet the needs and desires of all users can be recognised.

**Table 5.5** The key issues for the implementation of a water resource management system (Source: Fenemor and Markham, 1994)

| **Issue** | **Problem** | **Challenge** |
|---|---|---|
| **Equity** | Water rights in the form of permits under the RMA do not have an inherent value | - Unless a statutory exception applies, no legal ability to take or use water exists which can have very real impingements on the development of land;<br>- Water rights increase property value. |
| | Setting the actual amount of water available for allocation | - "The changing emphasis toward preserving instream flows has created tension between environmental groups and traditional consumptive water users" (Meister, 1977). |
| | Allocating the 'available' water for use in low flow conditions (i.e. summer) and of surplus water where supply exceeds actual core allocation plus any base level required (i.e. winter) should be clear and equitable | - Extensive information is required to enable the setting of threshold values and to achieve the desired level of |

| | | |
|---|---|---|
| | | decision making. |
| **Priority** | Prioritise users of a water resource | - Prioritisation may be based on a variety of things, for example crop yields, efficiency of use, environmental effects, and will be case specific;<br>- The political nature of water management introduces prioritisation of use |
| | Significant effect on the degree of importance based on environmental values | - "Iwi are particularly concerned that takes of water will adversely effect the *mauri* of water bodies" (MDC, 1995) |
| | Consumptive verses non-consumptive use | - Every potential user having personal views and perceptions of the water resource, and justification for that perspective viewpoint. |
| **Efficiency of Use** | Misleading nature of total allocation compared to the amount actually used | - Is efficiency judged in terms of its |

| | | |
|---|---|---|
| | | physical or economic designation?<br>- Avoiding over-allocation |
| **Issues of Control and Over-Regulation** | Greater responsibility on councils to define water resource values | - This should be completed before development pressures reach the stage where it is too late to measure and preserve the valued characteristics of the water body in question. |
| | Unnecessary imposition of strict quality controls, including biophysical base flows | - Perceptions of all involved should be considered before any controls are imposed. |
| **Integrated Management** | Land clearance and water use have the potential to reduce the base flow of rivers. Therefore, such activities reduce the ability of the land to soak up water during wetter periods, and slowly release it back into the system in extended dry periods | - Regional councils must consider the hydrological cycle, and water permit regulation<br>- District councils should also take these matters into consideration, particularly in land-use regulation |

| | | |
|---|---|---|
| | | - Non-regulatory methods should promote best practices to address integrated management |
| **Public Awareness** | Concern for the environment, in particular cumulative effects on water resources | - Increased modes of education to promote sustainable freshwater use<br>- Participation in writing of a regional plan to regulate the use of water supply.<br>- Being part of a public committee which has been delegated responsibility by council to make decisions on the use of a certain water resource.<br>- Forming non-regulatory programmes to address the issues pertaining to water management |

## 5.5 Summary

Environmental values are a primary concern in the water resource planning process. Water management is now provided for mostly at the regional government level. It has only been with the introduction of the RMA that regard for adverse environmental effects is mandatory in all water management decisions. Further, non-regulatory methods have a much larger role in water management processes in New Zealand. MDC and SWNZ in the case study area have responded to issues pertaining to sustainable freshwater management in vineyards. This chapter brings together institutional arrangements and non-regulatory viticulture initiatives that collectively address water resource management matters both in New Zealand and more specifically in Marlborough. Such arrangements shape the content in which viticulturalists must operate. This chapter sets the scene for subsequent analysis of how those involved in Marlborough's viticulture industry today respond to both legislative and industry-led approaches for the use and allocation of freshwater. The means through which this is done is explained in the third chapter on Methodology and presented in the following chapter on Findings.

# 6.0 FINDINGS

This chapter presents the findings of the questionnaire responses and the key informant interviews. The results provide information on the opinions held by various people relative to regulatory and non-regulatory practices to sustainable freshwater use in the context of a vineyard.

## 6.1 Demographics of Respondents

An electronic survey was carried out on 29 July 2009 which was sent to approximately 600 recipients and closed on 20 August 2009. An 11% response rate was received with respondents answering all questions contained in the survey. A check on the representativeness of the sample examined the demographical characteristics of respondents. Respondents indicated the descriptor that best described their position in the industry (Figure 6) which provided a general representation of the industry makeup in Marlborough. The vast majority (73%) of respondents identified themselves as vineyard owners or managers.

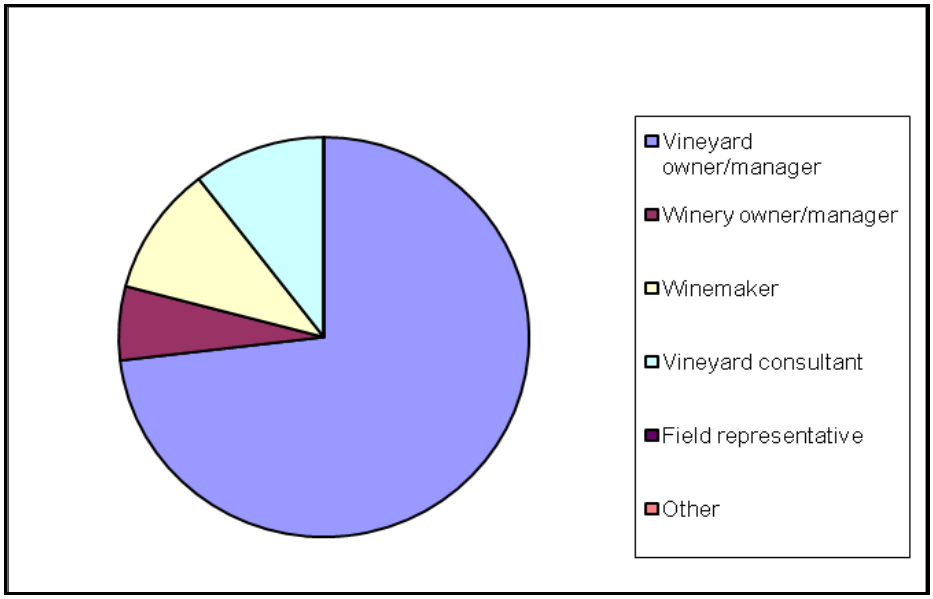


**Figure 6** Respondents position

## 6.2 Irrigation Usage and Freshwater Supply

All respondents identified that they use irrigation at some point during the year with total vineyard acreage ranging from 0.67ha – 2000ha. Whilst the average area irrigated was quite small, nearly half of respondents managed or were associated with vineyards of a size 51ha or greater (Figure 6.1).

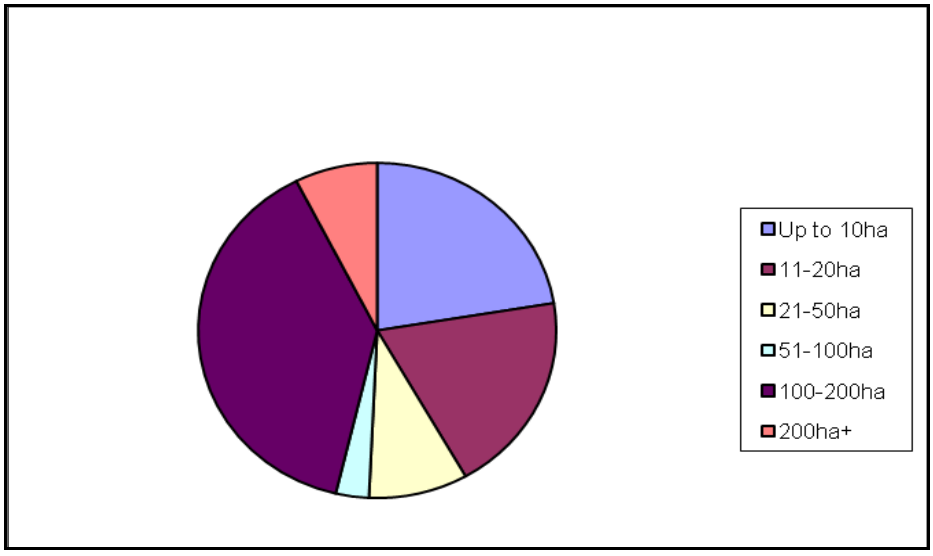


**Figure 6.1** Total Number of hectares questionnaire respondent are associated with

Marlborough's irrigation season typically runs from 1 October through to 30 April of the following year. Respondents associated with vineyard rather than winery aspects of the industry identified where they drew their irrigation water from. Most (42%) drew water from wells, followed by irrigation schemes (21%), surface water (12%) and one quarter drawing water from a combination of sources (Figure 6.2). Only one respondent acknowledged that they were not aware of their allocation requirement to take and use water for irrigating their vineyard. The remainder of participants all knew their irrigation requirements or knew that someone else was in charge of both metering and monitoring water takes and irrigation usage.

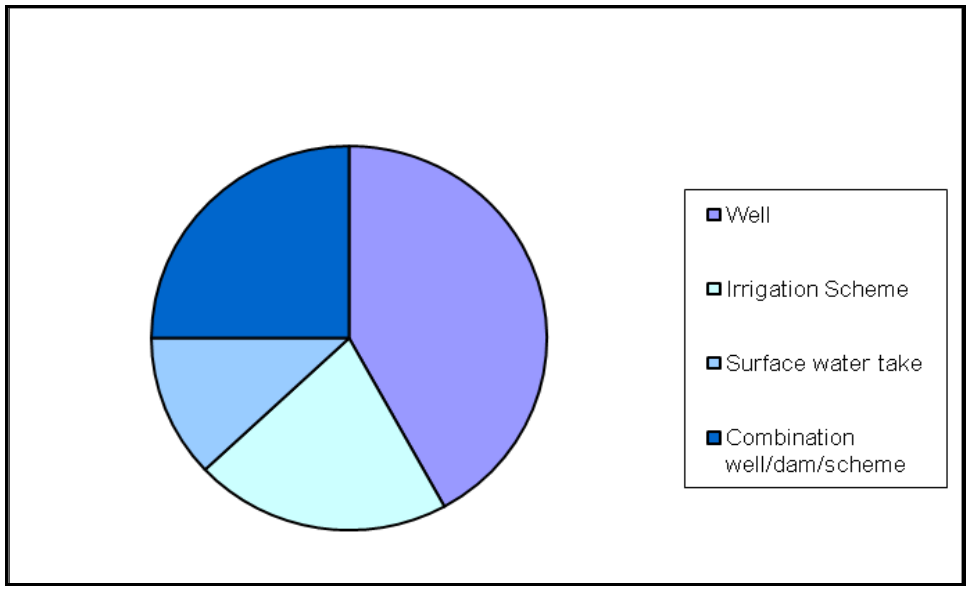


**Figure 6.2** Irrigation Source

## 6.3 Freshwater Quality and Quantity

The questionnaire sought to ascertain respondent's perceptions of Marlborough's freshwater quality and quantity (Figure 6.3). Respondents were asked to assess freshwater quantity in their catchment in general, with no specific mention to human induced activities exerting pressures on the environment (Q.8). Most respondents either disagreed (33%) or strongly disagreed (25%) that overall, the freshwater quantity in their catchment was worse now than 5 years ago indicating that people believe the amount and extent of Marlborough's freshwater resources are typically no worse today than 5 years ago (Table 6.1).

**Table 6.1** Indicators suggested by respondents as commentary to why Marlborough's freshwater quantity is no worse today than 5 years ago

| |
|---|
| The introduction of the Southern Valleys Irrigation Scheme has meant that aquifers in the area have improved along with high seasonal rainfall last winter. |
| Observation and well depth. |
| Seasonal flows of the Waihopai River are tracked by MDC by means of its Craiglochart river flow monitoring site. Sophisticated measuring and monitoring available through MDC website. |
| We have not evidenced any change to availability or quality of freshwater through this period. We are located in the Lower Wairau area and the area has never been water short, our wells do have a tidal influence which I can see from our pump test results. |
| River flows through the summer irrigation months. |
| Has always been plentiful supply, even in the driest seasons. |
| The local river where we draw our water from has had a higher mean flow this and last year than in years previous. |
| Advent of the community water scheme (Southern Valleys). MDC groundwater graphs indicate an improvement in groundwater resources over the last few years. |
| We are entering a wetter phase and the climate is cooling down hence less evaporation, also the summers are not as hot. |
| Testing for quality has not shown any lessening of quantity. |
| Above average rainfall in the last 2 years. |
| Visual. |
| Our dam catchment area in the Waihopai Valley appears unchanged. The Awatere River can have periods of low flow but we have not faced restrictions over the last 5yrs. |
| While the majority of available water for irrigation is fully allocated these takes are managed by MDC to ensure the environmental bottom lines are maintained as per the District Plan. |

Of those respondents to Q.8, 16% agreed that freshwater quantity in their catchment is a great deal worse now than 5 years ago, two provided explanations to support their point of view (Table 6.2):

**Table 6.2** Indicators of why freshwater quantity is worse now than 5 years ago

| |
|---|
| Having to stick deeper wells in the Rapaura Rd area to ensure continuity of supply. |
| A number of times in the irrigation season the scheme (Southern Valleys) has been threatened with shut down due to insufficient water at the intake in the Wairau River i.e. less than 8m3/sec. |

Of the respondents to Q.8, 25% were impartial to either be in agreement or opposition to the statement on whether freshwater quantity in their catchment was much worse now than 5 years ago. Reasoning for this was given by the respondents as being due to anecdotal evidence or that they had not personally viewed detailed statistical data on the standard of water between now and 5 years ago to have a clear standpoint.

Most respondents (83%) thought that maintaining high freshwater quantity and quality in their local catchment was important (Q.10). This is generally a positive environmental management outcome as decisive environmental management is transforming resource users' behaviour whereas awareness does not automatically convert into behaviour, it is a key predecessor.

A connection can be made between the response to Q.10 and Q.11, with Q.11 seeking feedback on whether freshwater regulations should be based on ecological sustainability (Figure 6.3). MDC is delegated to allocate water rights under the RMA which is replete with conservation-related terminology; however, the matter of the delegation on what freshwater regulations should be based upon is a vexed issue as conferred in Chapter 7.

The general level of response on whether respondents agreed or otherwise with the statement that freshwater is a finite resource (Q.12) is most positive with 38% in agreement or strong agreement (33%) (Figure 6.3). However the remainder of

respondents had varying views with 12% in disagreement and 17% strongly disagreeing that freshwater is finite.

Question 18 sought to establish whether respondents agreed that freshwater use in Marlborough can be sustainable given that Marlborough has a unique microclimate with water availability, rainfall regimes and distribution differing from month to month and year to year. Most (80%, Figure 6.3) respondents disagreed with Q.18 implying that freshwater use can be sustainable irrespective of the erratic and uncertain nature of rainfall, especially at critical times, being the main driver for irrigation.

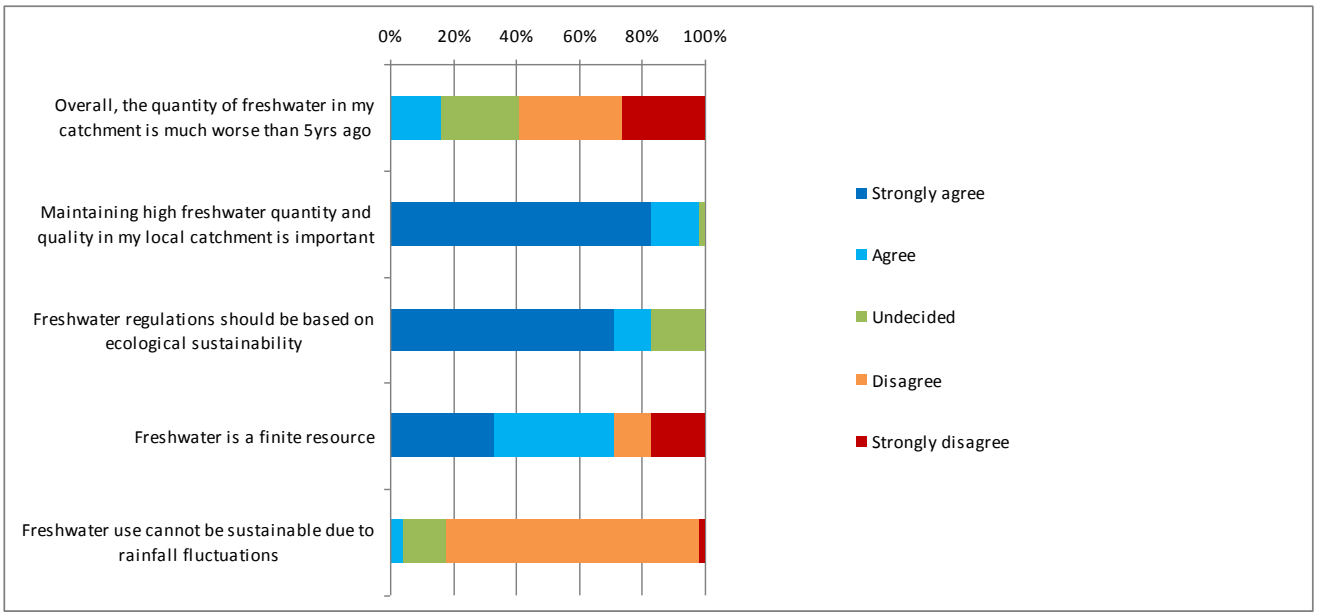


**Figure 6.3** Environmental Outcomes

## 6.4 Regulatory versus Non-Regulatory Methods of Water Management

The following section presents the findings from the questionnaire responses in regards to both regulatory and non-regulatory methods of water management.

### 6.4.1 Regulation

The distribution in responses to the statement that viticulturalists should be central to the development of freshwater regulation (Q.13) was varied with 58% strongly agreeing, 33% in agreement and 7% strongly disagreeing which indicates that differences need further investigation (Figure 6.4). While respondents were most positive that those involved in the viticulture industry should be central to research and development on local government policies and rules relating to freshwater use, the strong level of approval could be explained by the idea that regulation would not impinge greatly on vineyards. Non-regulatory standards are often at the forefront of everyday life rather than water permits that may only arise for instance every 10 or 20 years (not including on-going monitoring which forms part of the regulatory process). Furthermore, if in the past gaining a water permit has not been an issue then respondents may agree with the current rules and policies and may not see the necessity in changing what has worked for them in the past. What is unclear is whether respondents had in fact submitted on Marlborough's regional plan, the WARMP, during the public notification process, prior to it becoming operative, as this question was not asked.

Just under half (46%) of respondents were not prepared to side either way on whether they think regulatory and non-regulatory sources present the same information on freshwater practices with the remaining half mostly agreeing (45%) and a small percentage, 7.5% and 1.5% disagreeing or strongly disagreeing (Q.23, Figure 6.4). It could be concluded that half of the respondents are not confident that their knowledge of both regulatory and non regulatory sources of information is such that they are prepared to have a firm opinion. As examined in Chapter 7, regulatory and non-regulatory sources, while similar in their aim, do not present the same information.

Multiple consents are often required for an individual water abstraction including surface take, diversion, riverbed disturbance, land-use, allocation etc. Interpretation of rules can vary over time and by different Council staff. However results to Q.25 asking respondents if they thought MDC rules on freshwater are hard to understand are inconclusive with one third agreeing, one third disagreeing and the other third not willing

to sway either way. Even if rules are hard to understand duty planners, various planning and RMA based websites along with consultants are available as resource management professionals to provide explanation on rule interpretation for the lay person not familiar with policy or rule wording and interpretation.

Significant differences were apparent when respondents were asked if they thought that freshwater users are burdened by the cost of environmental regulation (Q.24, Figure 6.4). Nearly half, 48% agreed or strongly agreed, with 27% not holding an opinion and one quarter disagreeing.

No distinct trend can be found between respondents' views on whether Council have the right balance between regulation and enforcement action for managing freshwater resources (Q.26, Figure 6.4). This can also be said for the response to Q.27 with nearly one third of respondents agreeing, almost one third neutral and more or less one third disagreeing with a small minority (8%) strongly disagreeing that current enforcement action is right or should be enhanced to reduce overall regulation.

Question 28 sought to establish if respondents view regulation as the only fair way to allocate water resources. Most (67%) of respondents agree that regulation provides equitable allocation of freshwater. Of the respondents to Q.28, 16% were undecided or unclear on what fair allocation of resources is or means. 11% disagreed and 6% strongly disagreed with Q.28 with the belief that freshwater in Marlborough has not been correctly allocated (Figure 6.4)

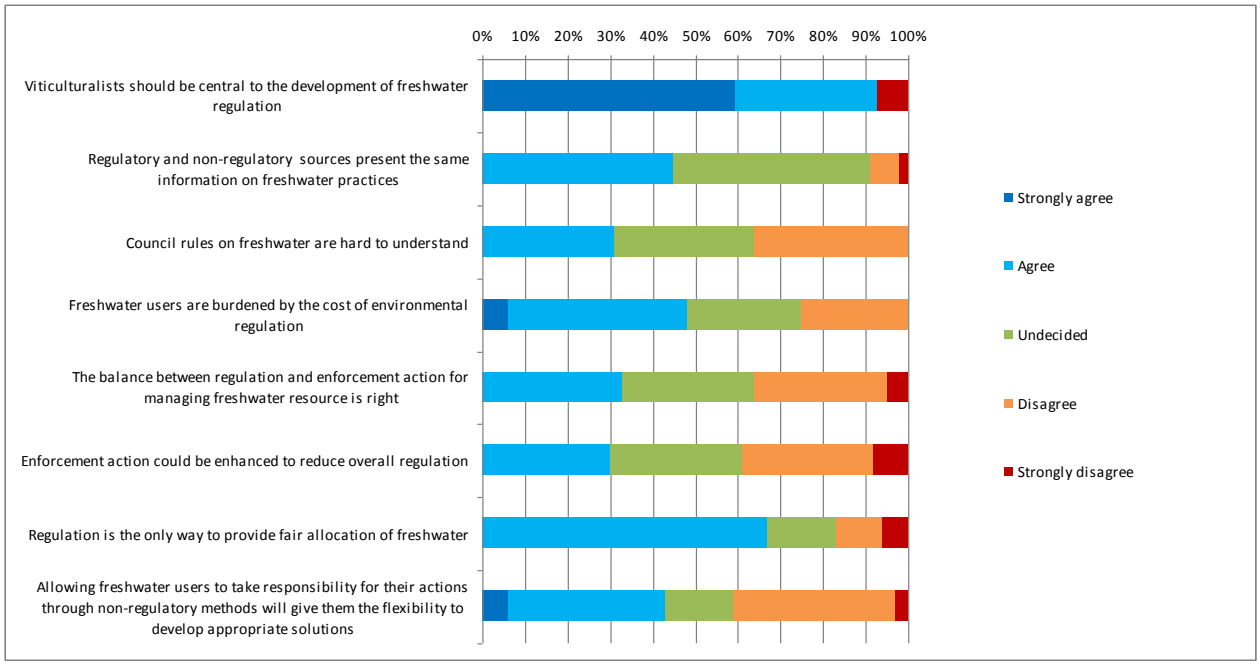


**Figure 6.4** Questionnaire Responses to Freshwater Regulation

### 6.4.2 Non-Regulatory Initiatives

Of the questionnaire respondents only four said they were not accredited to the SWNZ programme with two of those four stating they were currently working toward becoming accredited. This result is however slightly distorted as not all respondents were vineyard owners as outlined in Section 6.1 – Demographics. To give an overall insight to accreditation levels of Marlborough vineyards, 90% are predicted to be accredited sustainable by vintage 2010. The high level of accreditation is due to the fact that without it wineries would not be able to export their wine or enter wine awards. As such the grapes that make their wine along with the winery itself will both have to be accredited to the SWNZ programme for wineries to exports their produce and to enter wine award competitions.

Nearly all respondents (98%) had not implemented any changes as a direct result of becoming accredited to the non-regulatory, independently audited vineyard management programme SWNZ (Q.15). One respondent commented that the major change since

becoming SWNZ accredited is the burden of the paper trail created to ensure the scorecard and associated documents are completed to the standard required for the independent audit process.

It is accepted that being accredited to the SWNZ programme is an industry requirement by 2012 for wine export and all wine competitions. However, Question 16 sought to find additional factors to adopting the non-regulatory requirements of SWNZ when existing legislation covers the areas relating to freshwater allocation. The reasons provided (Table 6.3) suggest a generally positive outlook which aims to ensure Marlborough's grape growers protect freshwater environmental integrity within a set of industry set standards over and above legislative requirements. Furthermore, respondents are in general agreement that SWNZ accreditation is an appropriate best practice management regime for the industry to follow.

**Table 6.3** Reasons provided for adopting and complying with the non-regulatory requirements of SWNZ accreditation

| |
|---|
| To provide a market advantage through the use of the SWNZ programme. |
| SWNZ is a bare minimum environmental certification. We need something to show we were being good corporate citizens. |
| Good management practice for a variety of reasons to adopt the SWNZ methods and any other methods to optimise water use efficiency. |
| Good practice for future generations. |
| SWNZ accreditation extends well beyond freshwater use and makes a statement about our caring for the environment in which we grow our vines. |
| We all want to be in a sustainable wine industry and have enough freshwater and live in an unpolluted environment, if this happens to coincide with the efforts of SWNZ then all good. |
| To promote better perception of the industry's ethic and performance. |
| Our aim is to grow high quality grapes for winemaking. Irrigation practices being followed are aimed at this. Legislation regulates how water is to be allocated, not how is should be used to achieve a particular aim. |

| |
|---|
| To be seen to be participating in best industry practice. |

Question 17 sought feedback on whether more self-regulatory modes of education are needed to promote sustainable freshwater use (Figure 6.5) with the majority (75%) of respondents undecided. A cynical view could be that there is a lack of educational provisions and/or information available for the viticulture community regarding sustainable freshwater use. On the other hand, there may be information available however gaining existing information or having time to digest it and take on board its messages are hard enough without the burden of further information. Furthermore, promotion of self-regulatory modes of education will not solve the issues pertaining to freshwater use and vineyards. If respondents believed that promotion of freshwater use is not required then responses would be skewed to the disagree or strongly disagree end of the spectrum, which it is not. However on the flip side, a case could be said that respondents also consider that more self-regulatory modes of education are required to promote sustainable freshwater use but the way in which education is given may be the aspect causing respondents to be undecided.

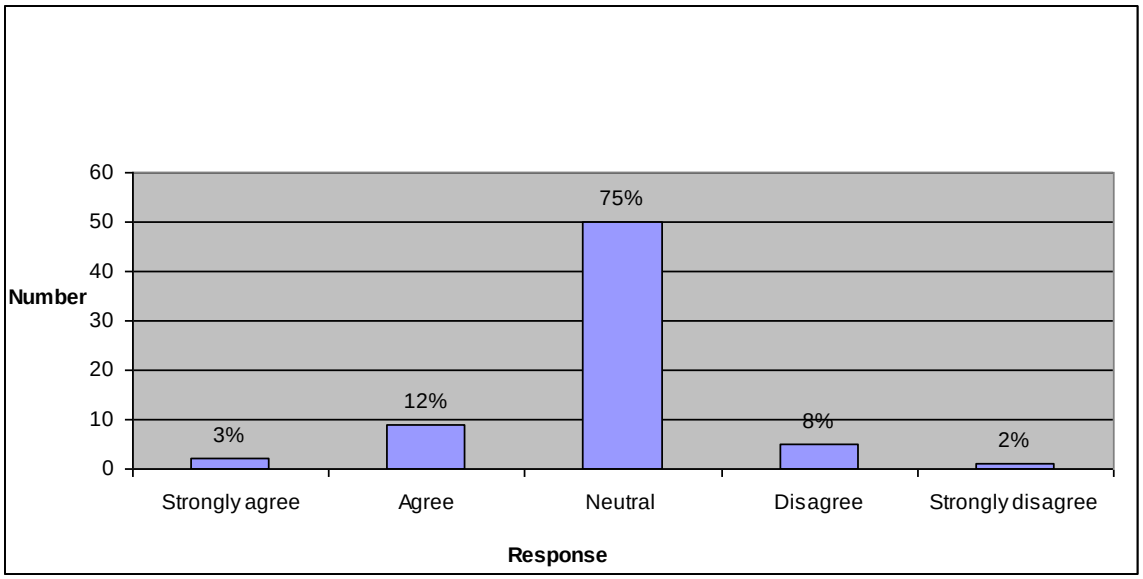


**Figure 6.5** Respondents views on the need for more self-regulatory modes of education on sustainable freshwater use

Belief that a purely non-regulatory framework to allow freshwater users to take responsibility for their actions and give them the flexibility to develop appropriate solutions is inconclusive from the questionnaire results (Q.21). Nearly half of the respondents agree and the other half disagree that this is a good idea. While currently it is necessary to have regulatory methods to ensure equitable allocation of the water resources within the region and between water users, in the future there may be the need for some flexibility.

## 6.5 The Challenges Facing the Viticulture Industry Now and in 10 Years Time

All the respondents were asked to outline the three most important challenges facing the viticulture industry at present (Q.19) and in 10 years time (Q.20) (Table 6.4). All the challenges that were mentioned are grouped into three categories:

- Biophysical considerations
- Social considerations
- Economic considerations

The need to maintain water access and consider environmental requirements was noted by 15% of the respondents as two of the most important challenges facing the viticulture industry now, with a third biophysical challenge added by a respondent being that of limited suitable land and water to enable further plantings. A greater importance (21%) was placed on biophysical considerations as being the more important than social or economic challenges that the viticulture industry will be faced with in 10 years time.

A greater reference to social challenges facing the viticulture industry in 10 years time (48%) is apparent as opposed to at the present time (38%). The defining influence of management plays a vital role in social considerations. It is the vineyard manager and the workers, along with external unpredictable perturbations such as soil, climate, or market fluctuations that regulate the performance and quality of wine grapes produced and social challenges.

Marlborough and wider New Zealand is placed within a capitalist society. With a general downturn in the economy as a whole at present, economic considerations were mentioned by 47% of respondents as the most significant challenges facing the viticulture industry today. Economically, consumer preferences are constantly changing therefore economic challenges will always be at the forefront of the minds of those associated with making a livelihood in viticulture. The economic components feature less (31%) than the social challenges (48%) but greater than the biophysical challenges (21%) facing the viticulture industry in 10 years time.

**Table 6.4** Most important challenges facing the viticulture industry perceived by respondents

| **BIOPHYSICAL** |
|---|
| Access to freshwater for irrigation and frost protection |
| Environmental requirements including resource management |
| Limited suitable land and water to enable further plantings |
| **SOCIAL** |
| Freshwater management |
| Producing quality grape harvests |
| Agreeing on wine quality |
| Viticulture industry co-operation |
| **ECONOMIC** |
| Low grape prices |
| Oversupply |
| Selling wine/grapes |
| The NZ dollar value |
| Getting contracts |
| Margins/profitability |
| Production/cost management |
| Export market development |

Questions 19 and 20 had an 'other' option for challenges facing the viticulture industry now and in 10 years time. These have also been grouped into the same three categories used in Table 6.4 with the addition of overarching themes (Table 6.5).

**Table 6.5** Other challenges facing the viticulture industry perceived by respondents

| **BIOPHYSICAL** |
|---|
| Avoid/minimise environmental degradation |
| Minimise external inputs |
| Need to consider cumulative effects of freshwater use |
| Consider indigenous environment/habitats |
| Consideration of aesthetic aspects |
| **SOCIAL** |
| Co-operate with those involved with viticulture and the wider community |
| Increase the knowledge of the viticulture system |
| Includes a stewardship ethic |
| Consider the need of future generations |
| **ECONOMIC** |
| Accommodate fluctuations – in production, commodity prices, weather events |
| Incorporating a quality assurance programme |
| **OVERARCHING THEMES** |
| Entails that biophysical, social and economic sustainability components are integrated |
| Involves monitoring the state of the environment |
| Sustainability is a moving target defined by society at that point in time |
| Requires a systems approach as opposed to reductionist |

## 6.6 Constraints to Adopting Environmentally Friendly Practices

Question 22 asked respondents to identify what, if any, constraints to adopting more 'environmentally friendly' freshwater uses in the vineyard context. Answers have been

grouped in no particular order into four categories: Financial, technological, education and other (Table 6.6). A lack of education was signified as a grey area in terms of allowing for the adoption of more environmentally friendly practices. Hence, a greater need for education was prevalent if environmentally friendly practices in the industry are to be an addition to achieving sustainable freshwater use. Without knowing who are actively involved in either providing education to others or educating themselves in environmentally friendly freshwater use practices makes the link between education and attitudes difficult to draw firm conclusions from. This links with early discussions under Section 6.4.2.

The loss of production in the short to medium term was mentioned by fifteen respondents as a constraint to adopting more 'environmentally friendly' freshwater uses.

The lack of economic incentives to change to environmentally friendly practices was noted by nine respondents. Apart from price incentives, it is difficult to determine what incentives are needed to alter behaviour.

The fact that environmentally friendly practices are often not cost effective was mentioned on seven occasions. How exactly the 'cost-effectiveness' can be measured and over what time period is the central issue of this constraint. In terms of long-term ecological sustainability, the measures may often be profitable, but in the short term, say a few years (typical financial planning periods), the costs may seem high. The pay-offs of adopting more environmentally friendly practices are long-term, and may seem prohibitive in the short term, which does little to aid their adoption.

**Table 6.6** Constraints to Environmentally Friendly Freshwater Uses in the Vineyard Context

| **FINANCIAL** |
|---|
| Absence of financial incentives such as tax reprieve, subsidies or grants. |
| Low profitability resulting in less reinvestment in items such as non essentials or other inputs which can reduce water usage and improve soil structures. |

| |
|---|
| Cost and time consumed by monitoring and compliance is always increasing so any further regulations will disgruntle certain people. |
| Loss of production in the short to medium term. |
| Adopting environmental friendly practices are seen as too expensive so a constraint is the fact that many people are unaware of the simple cost effective steps that can be taken and positive outcomes to be achieved. |
| Low prices might force growers to crop higher than optimum yields thus requiring excessive irrigation. |
| Environmentally friendly practices are often not cost effective. |
| Risk associated with change. |
| Small vineyards becoming uneconomic. |
| **TECHNOLOGICAL** |
| Technological advances. |
| Availability and cost of hi-tech monitoring systems. |
| Low profitability resulting in less reinvestment in technology. |
| **EDUCATION** |
| Lack of education of newer growers as to management and monitoring efficient water usage for vine seasonal growth and requirements. |
| Practices such as setting a timer for x no. of hours every second day regardless of weather or vine requirements. |
| For regional opinion on water usage focussing on a drive toward reducing regional consumption, the weighting of the majority may lead to unfair pressure being applied, perhaps through a lack of general understanding. |
| Educating growers to use the minimum required. |
| The owner best knows what suits his site. |
| Understanding irrigation requirements leading to soil mismanagement. |
| Industry cooperation and industry led education. |
| Some vineyards are still not metered. This should be mandatory. Education of growers to answer the question 'what is best practice'. |
| **OTHER** |

| |
|---|
| Personal greed and self interest. |

## 6.7 Supplementary Research

As described in Chapter 2, six key informants were interviewed to help determine the broad characteristics of sustainable freshwater practices as the ability of management to sustain freshwater use is one of the greatest direct influences on whole vineyard sustainability. Current and future issues were discussed along with the usefulness of the institutional framework that govern freshwater usage and the non-statutory approaches that guide the viticulture industry in best practice.

### 6.7.1 Perceptions of Freshwater Quality and Quantity

One interviewee from Council felt that freshwater bodies have become a hot topic as both rural and urban users continue to place pressure on the quality and quantity of waterways in this region (Marlborough). This is exacerbated by the allocation and abstraction of water, which may reduce flow levels. In addition to these pressures, another interviewee from Council's identified other factors they believe are affecting or have the potential to affect waterways and their values for them. These include environmental stresses such as climate change and policy issues such as tradable water rights and the first-in first served system for allocating water.

The vineyard managers interviewed spoke about a range of values for freshwater. These values included universal values that all societies hold for water, multiple uses requiring water and the control over the management of water as a public resource. Added to this is the fact that everybody wants it so it is very much fought for on that basis. The viticulture industry are cognisant of the fact that allocation of, and access to, water are issues of political and national importance.

The planning consultant interviewed thought that providing for greater participation in plan making and at the resource consent stage would allow for better protection of

freshwater quality and quantity and ultimately an increase in wider societal values associated with water.

> I think viticulturalists have a higher threshold in terms of protecting freshwater resources and I think that's really important. Having meaningful voices in decision making is critical to obtaining complete information about the values for freshwater. It has been ridiculed but they'll (viticulturalists) still bring into the debating chamber and into the arena the real issues around freshwater management which I think will raise overall awareness of freshwater resources.

One vineyard manager agreed with the statement above and thought that the greatest gains would be those involved in the viticulture industry having a more meaningful involvement in decision making and potentially being decision makers:

> When it actually comes to the crunch, they (water users) don't… I think, have a voice in resource management.

### 6.7.2 Water Allocation

Interview participants identified many current issues in relation to water allocation. Allocative efficiency was identified as the most important issue with respect to freshwater in the region at the moment. Concerns about groundwater allocation were also frequently raised. One interviewee explained the difficulties in allocating groundwater and managing the effects of groundwater abstraction on surface water bodies:

> When you're dealing with groundwater things are slightly more complicated because it all comes out of storage underground and you can't actually see what you're taking and it's not easy to identify the effects. The thing that we most often have to grapple with is the effects of taking groundwater on a stream somewhere. It is the cumulative effect of a whole lot of groundwater takes that makes the management and allocation of resources and determining how much groundwater you can allocate a lot more complicated.

Connections between groundwater and surface water do not appear to be fully understood yet. One interview participant expressed frustration with what they perceived as a lack of

understanding by Council and resource consent applicants of these connections. Other participants said that more is becoming known about these interactions, but further work is required to understand them and, in particular, how the viticulture industry affects them.

One interview participant illustrated evidence of why water allocation is the current issue to be debated:

> The water resources are almost all fully allocated and we are moving into a phase where we (Council) will look more closely at whether the volumes of water allocated to individuals accurately reflects their requirements. In many cases the allocation will exceed actual use and that provides the Council with an opportunity to reallocate unused water to new water users. Some of the evidence is scientific/factual - meter data, allocation frameworks, research and some is more anecdotal like increasing submissions in water short areas and the content of the submissions being more focused on issues of equitability and efficient use of water.

The vineyard managers interviewed identified several benefits of greater participation in water allocation. These benefits included technicians and politicians having a more complete view of water bodies leading to better recognition, distribution and decision making producing social and potentially economic benefits to both the viticulture industry and the community at large.

Driving the consideration of alternative methods for allocating water is full and over allocation of some of Marlborough's water bodies currently. One interview participant expressed concern about the difficulty of 'clawing back' water (returning it to waterways after water permits expire) in fully or over allocated catchments:

> In the Awatere Valley (Marlborough), everything is over allocated…I thought the sunset clause in the RMA was going to be wonderful because everyone would have to apply again, but in Marlborough if it's a replacement consent it's virtually rolled over. That makes claw-back really hard.

Another vineyard manager interviewed had the following to say:

> We grow grapes in heavier Awatere soils that retain moisture at a much better level when compared to Rapaura Rd in Blenheim where soils are lighter and of a silty nature, yet we are allowed to use the same amount of water per vine per day. Added to this is the ability of a manager to make the water used go further and be retained for longer.

### 6.7.3 Future Water Issues

Interviewees were asked what they think will be the critical issues in the future (10 years from now) and if they had any suggestions for how these issues can be addressed.

One interviewee asserted that "in the future my pick of the most pressing issue will be the need to accommodate changing expectations of environmental bottom lines with increasing water demand as crops change and a variable climate".

"A societal assumption that water is abundant and a desire to develop is contributing to catchments approaching full or over allocation", said one interview participant.

The debate that education regarding the universal value of water is needed to accommodate multiple values for water in the allocation process was further raised as a critical issue.

Also mentioned as a significant issue that will need addressing into the future is political judgement regarding the acceptable level of freshwater decline associated with economic development and the unacceptable level of decline.

Equitable allocation of water resources and the efficient use of water were suggested by one participant as ongoing issues for the foreseeable future:

> As the resources that are not currently fully allocated become so these matters will become more and more in the focus of the community. There is also the

> associated issue of re-allocating water that has come back into the pool when consent volumes have been reduced. Reallocation of this water in such a way that doesn't unfairly advantage new water users over older users is a challenge. For example, in the situation of A and B Class water, B Class is not allocated until all the A Class has been allocated but if A Class comes back into the allocation pool, someone applies for it and you grant it on the basis of first-in, first-served then you create a situation where the new water user has a considerable advantage over older B Class water users who could not get A Class water because none was available at the time they sought water. With the current reviews of the Regional Policy Statement and the Regional Plan these issues need to be thoroughly thought through and frameworks set up so allocation and reallocation of water can be equitably carried out.

Many respondents expected the future to be tougher than at present, noting recent lower prices and more difficulty getting contracts with wine companies, water restrictions and industry competition. To respond to that pressure, key changes said to be needed were as follows:

- Improved quality;
- Better water management to cope with lower water allocations;
- Improved operational and production efficiency; and
- Changing the varietal mix, and to an extent, clones and rootstock.

Four main changes were seen as necessary, being:

- Overseas marketing to deal with competition and potential local over-supply;
- Better communication and co-operation to get agreement on the changes needed, and work together to achieve them;
- Agreement on quality parameters and how to achieve them, with the wine companies being critical in this regard; and
- Better water management at national and local government levels.

### 6.7.4 Cumulative Effects

The decline in the state of some of the lowland streams in Marlborough may be the result of the cumulative effects of small, multiple and continuing takes over time. One interviewee was of the opinion that:

> The paramount one for me is managing the cumulative effects generated by many hundreds of water permits pumping wells distributed over a large area.

The same participant was doubtful that cumulative effects could be addressed under the current legislative framework and said that Council would need to "take a very different approach and start thinking holistically" before these effects could be rectified.

### 6.7.5 Departure from First-In First-Served

The need for such a judgement (first-in first-served) to be made is highlighted by the range of competing economic uses for water, and the pressure these uses place on ecosystems and other values for water. One interview participant suggested that the Councils and central government will be placing new emphasis on how water is allocated to out-of-stream users, and using different mechanisms (apart from issuing consents on a first-come first-served basis) to provide for these uses.

### 6.7.6 Environmental Regulation

Legislative methods to regulate freshwater use were deemed essential by all those interviewed:

> Equitable allocation along with the quality and quantity of freshwater are all achieved more rapidly with a robust enforcement system found through regulation.

The underlying assumption of all those interviewed is that freshwater management in Marlborough under the existing regime has not achieved good outcomes. Several suggestions were identified as goals to guide future management as follows:

- To improve the quality and efficient use of freshwater by building and enhancing partnerships with local government, the viticulture industry, science agencies and providers, and rural and urban communities;
- To encourage efficient water management through increased national direction and partnerships with communities and resource users; and
- To work with local government on options to support and enhance local decision making and the continual development of best practice.

Interview participants commented on the usefulness of some of the water allocation provisions in the RMA. These provisions relate to the Regional Plan and rules contained within it. One interviewee presents the following viewpoint on MDC's environmental regulation protocol:

> Council now has a much more rigorous process to go through for people seeking to gain resource consent to take and use water. The RMA has resulted in a shift in the consideration of water quality rather than merely flooding and drainage efficiency as was the emphasis under Catchment Boards in the 80's. This has meant in particular a greater emphasis to support natural ecosystems. Also there is greater time taken for community consultation. Nearly all water permit applications to the MDC are notified however at present the compliance monitoring cost is minimal.

Council staff interviewed emphasised that central government policies have a direct effect on regulation. In some cases this is positive but can also pose a threat to a well established and effective regime:

> Council here reacts according to past experience and data collected. We are unique here (in Marlborough) with our monoculture of vineyards, our climate, soils and topological setting and these all affect the policies and rules set to regulate water. Therefore the top down management approach does not necessarily work for us. While the National Policy Statement for Freshwater Management has been proposed by Central Government to provide national direction and guidance to local authorities on how they management freshwater

> resource in their area, there is significant regional variation making such an assessment difficult to implement succinctly.

One interviewee felt that regulation provides the framework for equitable allocation of water:

> Unfortunately with human greed and water becoming recognised as a more valuable asset than in the past, to protect all users regulation is required. If you don't have the necessary regulatory guidelines then you are unlikely to have the framework for enforcement action.

### 6.7.7 Non-Regulatory Methods of Freshwater Management

Interview participants were all of the view that the SWNZ non-regulatory approach to managing freshwater is to ensure 'best practice' so that the industry (viticulture) continues to develop. This is opposed to the regulatory approach which participants agreed is to avoid, remedy or mitigate adverse environmental effects.

Self-regulation was deemed an acceptable method to managing freshwater use provided the regulator has a supporting programme of checks and audits. One interviewee thought that the SWNZ audit process has further potential for improvement through increased data and knowledge sharing and more sophisticated reporting systems. An appreciation of the scope for significantly reduced enforcement action over time was noted by one vineyard manager interviewed as a strength of a non-regulatory approach to freshwater management.

## 6.8 Summary

The findings discussed in this chapter reveal, overall, that there are marked differences in how respondents view environmental consideration to the management, both legislatively and voluntary, of freshwater usage by vineyards in Marlborough. Generally though, the level of concern regarding the maintenance of Marlborough's freshwater quality and quantity is high. Challenges facing environmentally sustainable vineyard management

have also been identified. The key issues associated with these findings and their implications for sustainable management are discussed in the following chapter.

# 7.0 APPROACHES TO ENVIRONMENTAL PROTECTION

This chapter synthesises the main research findings and is based around the key themes explored in the literature and results of the research. Current challenges, future implications and a suggested management strategy for sustainable freshwater use are discussed. This section has an overall aim of identifying the relatively efficacy of regulative and non-regulative methods in achieving sustainable freshwater use in the vineyard context.

## 7.1 Environmental Sustainability

Environmental sustainability is an often used and loosely defined term therefore defining the concept is subject to a number of interpretations. Inevitably, these generate various meanings for different people. Each vineyard manager that was interviewed seemed to think that they were operating in a sustainable manner, even though each had different methods of management, different business goals and different philosophies of viticulture. Management plays a very important role in sustainable resource use. In the realm of vineyards this means maximising yield to achieve the commercial and wine quality goals from a limited water resource base.

In recent years, there seems to be a coalition of interest in promoting sustainability as a development goal for viticulturalists. Very general definitions of what a sustainable vineyard encompasses according to the vineyard managers interviewed typically included the following development objectives:

- Ensuring the yearly harvest produces adequate supplies of quality grapes, produced within accordance with generally accepted environmental and social standards;
- Ensuring effective protection of the environment and prudent use of natural resources;
- Achieves the integration of natural biological cycles and controls;
- Increased recycling;

- Optimises the management and use of on-site resources;
- Reduces the use of non-renewable resources and purchased production inputs
- Reduce waste generation;
- Provides an adequate and dependable income; and
- A high level of participation in developmental decisions by the viticulturalists themselves.

All these goals are considered to be desirable, yet are not fully attainable as it is clear that there will be trade-offs in the process. It is therefore important to develop a concept that will encompass and evaluate these goals. As Ikerd (1990) points out, "trade-off is the key to sustainability". Any criterion should not be maximised at the expense of another, thus systems must be chosen to consider trade-offs between resource conservation and environmental soundness on the one hand, and productivity and competitiveness on the other, or between social equity and productivity.

Dr Cliff Ohmart, director of research at the Californian Wine Institute deduces that the first steps towards sustainable vineyards cover all aspects of viticulture including water management, human resources, wildlife habitat protection and water quantity and quality. Dr Ohmart further reiterates that sustainable freshwater use in vineyards is accomplished by implementing a set of practices which vary for each individual vineyard. SWNZ view sustainable vineyards as meeting the needs of today, without adversely impacting on the needs of tomorrow through the economic production of market quality grapes, giving priority to methods that are the safest possible to the environment and human health.

## 7.2 Values for Water

The value of freshwater is typically considered in three ways: for its current uses, for its future or reasonably expected uses, and for its intrinsic value. Current use value depends to a large part on need. Future or reasonably expected values refer to the value people place on the resource they expect to use in the future and the value will depend on the particular expected use or uses. To this, the implementation of sustainable resource management through regulatory and non-regulatory methods is required.

Consistent with the literature reviewed, the data collected in this research reveals that sustaining water quality and quantity is paramount. As more and more grapevines have been planted in Marlborough, the drain on the regions natural water resources has become a hot topic (Figure 7.1). This is amplified by the fact that Marlborough has a monoculture in that vineyards dominate the region's landscape and all want water for irrigating the vines at the same time (October through to the following April). A number of water liaison groups have been formed in Marlborough with the odd water conference held locally. However, there is a greater scope for more participation in water user groups and conferences.

Monitoring of the Regional Plan, State of the Environment monitoring (baseline water quality/quantity studies), project monitoring and finally resource consent compliance monitoring are all undertaken by the MDC to hopefully ensure Marlborough's freshwater does not become finite due to over usage by humans. This perspective of water fits easily with the purpose of the RMA – that natural resources should be sustainable managed, whilst protecting their life-supporting capacity. It may also be applied to enhance the understanding of and interconnections between ground and surface water.

Jackson and Schuster (1997, p33) state that:

> Monitoring helps us operate our vineyards better to ensure that we do not do anything that is not necessary, such as unneeded irrigation application and also ensure water quality and quantity is sustained. One of the underlying goals of sustainable viticulture is to minimise vineyard inputs.

Monitoring is the way this is achieved since managers will only add inputs when monitoring tells them it is necessary.

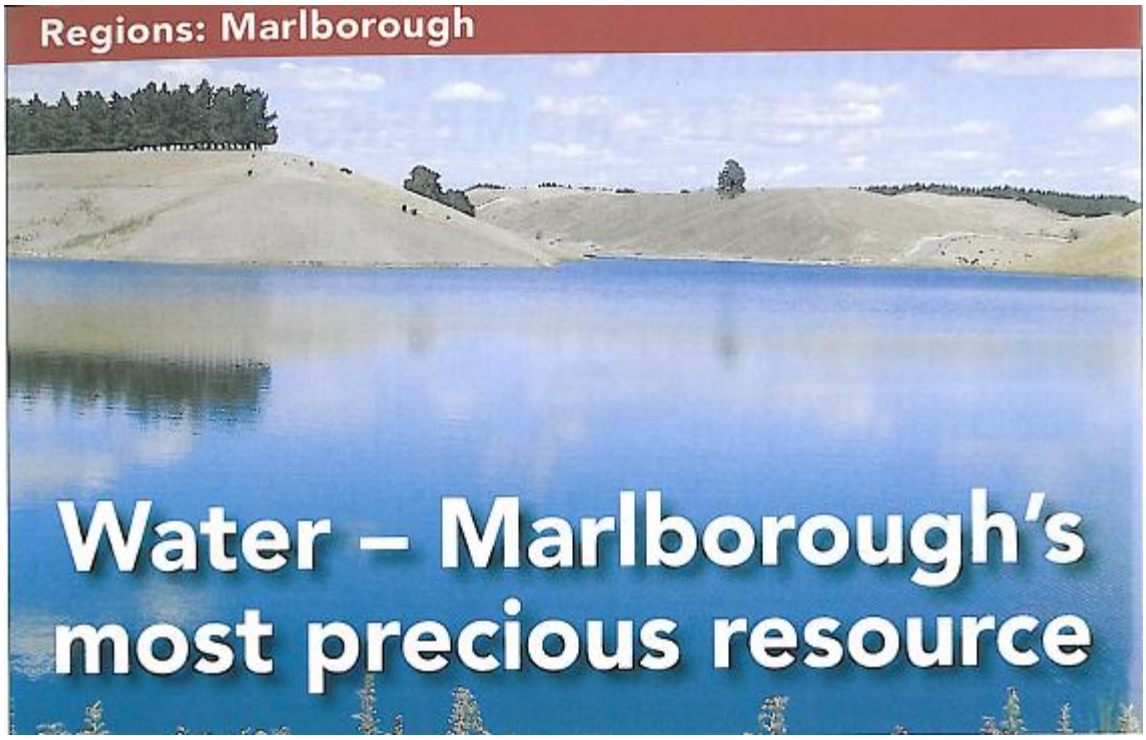


**Figure 7** Article Heading by Nicholson in NZ Winegrower (2006)

### 7.3 The Need for Water

Rainfall is a key factor determining irrigation need. However, Marlborough's rainfall fluctuates month to month and year to year therefore to quantify appropriate irrigation levels to achieve consistent yields and optimum fruit quality is as much an art as a science. The majority of questionnaire respondents were of the opinion that freshwater sustainability is a human induced phenomenon with management of water allocation the key in maximising the limited freshwater resources available in Marlborough. Natural barriers hindering freshwater quantity such as droughts are common in Marlborough (MDC, 2008) however the data collected exposed that respondents do not associate freshwater sustainability to rainfall. However, the erratic and uncertain nature of rainfall at critical times is the main driver for irrigation, all other factors being equal.

MDC have set minimum flows for the major water bodies in the region, that is, the amount of water that should remain in the water body to protect its natural values. These limits were based on 'rule of thumb' or as MDC's hydrologist put it, 'only an expert

guestimate based on whatever data was available at the time'. No minimum flows have been set for the minor tributaries and streams throughout the region and the current minimum flow limits have not been revisited since they were established over 15 years ago. Ideally, these methods should be revisited as technology improves and as data and knowledge on the regions freshwater resources also improves. Furthermore, these methods should be supplemented by public consultation. This would enable MDC to identify the community values for a water body and use these values to help set the minimum flow.

Although rainfall is uncertain water savings are possible with Marlborough's regional plan determining the quantity of water to be either set aside for the environment or assigned to the public. With less water being drawn than water permit allocations allow, with the vines producing fruit with acceptable yields and quality attributes proven in a "progressive increase in Marlborough wine sales and exports year to date July 2009" (Winegrowers NZ, 2009), clearly there is some scope for reducing irrigation allocations for grapes. Long term trials on different soils (e.g. clay v. sandy v. stones) and in different microclimates within the region may help to identify some of the unknown factors that influence water demand and irrigation need.

Over the last 15 years new measurement techniques (e.g. sap flow and soil moisture measurements) have been refined to measure water use efficiency in vineyards. Simple computer models have also been developed to interpret soil moisture measurements and improve irrigation scheduling with "local trials confirming significant water savings are possible using carefully managed deficit-irrigation strategies" (MDC Hydrologist, 11 December 2009). Such data will see improved understanding of vine water use and assessing irrigation needs. Publicly funded research is an integral part of environmentally progressive policy making. As a result, MDC is currently reviewing the water component of its regional plan with the aim of summarising key findings from the last 20 years of research on grape irrigation in the region. Information gathered is targeted to help MDC decide whether the grape irrigation guidelines in the regional plan need reviewing.

Water allocation requires MDC to assess whether or not the benefits of any proposed use of water will outweigh any adverse environmental effect that might arise from that use, and make a judgement as to whether or not the activity should proceed. A criticism of this approach is that natural values are at risk of being overshadowed in the decision making process by development interests. Three ways are suggested to address this issue. The first is to create more specific environmental baselines through the use of NPS and environmental standards. Second, MDC should be clearer about the meaning of sustainable management as it applies to water use in its Regional Plan and rules. Third, MDC need to strengthen the position of environmental values in the decision making process.

## 7.4 Effectiveness and Efficiency of Non-regulatory Methods

Non-regulatory methods of freshwater management comprise many elements which can include setting objectives, implementation, assessment and reporting. They are not only stand alone measures but can be used as a supplement to laws and regulations and can serve as an efficient tool to implement politically defined objectives. In recognition of their voluntary nature and flexibility, they can offer innovative solutions and reduce regulation. For non-regulatory actions to be most successful, it is essential that government, industry and the public co-operate and that policies be designed to promote cost-effective voluntary action.

When implemented wisely, non-regulatory approaches in freshwater management help reduce both compliance and enforcement costs and can provide industries such as Marlborough's viticulture industry with additional flexibility and motivation to tailor approaches to their specific needs. They are a flexible instrument of environmental policy, which can stimulate the development of cost-effective and 'clean' methods and encourage vineyard managers, in this instance, to respond to environmental demands. They can help promote partnerships with Councils and allow for a quicker and smoother achievement of environmental objectives.

Non-regulatory approaches in isolation are not considered as being effective in the management of water resources. They are however a very effective tool when considered collectively with regulatory methods. The amount of time necessary for non-regulatory approaches as a management mechanism to result in the desired goal of sustainable freshwater use makes it inappropriate when considering freshwater being a heavily utilised resource under increasing pressure. For non-regulatory approaches to work well, a guarantee is required that the public will change their actions. This necessity is unlikely in the use of freshwater, where livelihoods of vineyard owners may be at stake.

In summary,

- Non-regulatory approaches provide a framework for innovation and creativity that allows for new initiatives, the opportunity to improve environmental competitiveness and more rapid changes than not would otherwise be possible under a straight regulatory approach;
- Non-regulatory approaches allow for easier and more rapid adaptation to changing conditions than regulatory measures;
- Non-regulatory approaches promote awareness of existing and new technical management practices and can serve to improve standards; and
- Non-regulatory approaches can have a long-term application and include continual improvement, which should be supported by government policies wherever possible.

## 7.5 Effectiveness of SWNZ as a Non-regulatory Method to Freshwater Management

The SWNZ programme seeks to:

> Promote the protection, maintenance and enhancement of the natural, ecological and amenity values of rivers, lakes, wetlands and their margins through education, the provision of information and advice and through implementation of soil and irrigation analysis and management.

The generalised summary that can be made about the SWNZ non-regulatory management method is the insurance that best practice is at the forefront of decisions so that the viticulture industry continues to develop in a sustainable way.

One of the principle intentions of the SWNZ accreditation programme is to demonstrate to local government and the international market that the industry is taking its environmental responsibilities seriously. Its guidelines are intended to form a code of conduct by which the industry will judge itself. In this respect the programme is an indication of the furthest that the industry is prepared to go on a voluntary basis to meet its environmental commitments. The SWNZ programme does not ensure a wide participation in environmental management. Rather, it relies on the market and competition to persuade vineyards to commit to it. The NZ wine industry set a goal that has the aim of 100% of the industry operating in accordance with the SWNZ programme by vintage 2012. The results collected indicate that this pledge to undertake direct environmental action has received a very enthusiastic response from the industry. Marred by this is the fact that those not accredited by 2012 will be unable to export wines.

It was revealed in the interviews with local vineyard managers that grower self-assessments required by the SWNZ programme take the approach that localised efforts for environmental improvement in water management are possible and possibly the most influential as the industry grows. The fact that there is an active local interest in the preservation of water quality is a positive indicator of the level of environmental awareness. Ideally, this translates to progressive environmental policy making.

### 7.6 Production of Guidelines and Information

The results collected confirmed that commitment to communication and environmental education, a critical part of fulfilling the SWNZ accreditation criteria, are the most effective ways to influence management decisions. The primary methods for providing information, education and advice used by SWNZ are its members manual, face to face contact with individual vineyard managers, press releases to local media, news letters and

emails, environmental awards, its website, and workshops provided throughout the year. These all allow for communication and information exchange.

The data collected highlights that the guidelines and information sheets SWNZ have prepared allow for communication and information exchange to assist with implementing their best practice guidelines and also enables grape growers to manage freshwater within the realm of their vineyard needs. However, external experts and Council staff interviewed suggested that they should be involved when forming freshwater guidelines at a non-regulatory level as they hold expert knowledge which would assist in policy formation. Astute participation on a decision making body can be an effective way to recognise and provide for local values in non-regulatory planning, perhaps more effective than consultation.

## 7.7 SWNZ Environmental Policies

There is no longer much debate about the aim of environmental policy, which is now widely recognised as being that of sustainable development. However, there is considerable debate about the most appropriate means of achieving this end. The failure of non-regulatory approaches in bringing about a significant change in the commitment that industries give to environmental action can be demonstrated if the contents of their environmental policies are examined. Environmental policies are, after all, the preliminary step in any environmental initiative and they reflect not only current actions, but also define future intentions.

When examining SWNZ policies pertaining to water management, it was found that the main focus surrounds the issues of legislative compliance and resource conservation. Since efficient resource management brings direct-cost savings, and all vineyard managers seek to avoid prosecution by ensuring regulatory compliance, it could be argued that genuine ‘concern for the environment’ is not a principle motive in encouraging the viticulture industry to undertake environmental action under a non-regulatory management approach. SWNZ focuses more on the nitty gritty of water use

and water budgeting where as MDC focus on water permits and the legal requirements governed by the RMA.

## 7.8 Environmental Results of Non-regulatory Management Methods

Through SWNZ the viticulture industry sets its own environmental objectives and targets for improvement so it can progress its environmental performance as little or as much as fast or as slow as it likes. Comments received from Council staff have suggested that the freshwater objectives and guidelines set by SWNZ represent environmental tokenism rather than a solid commitment to decreasing environmental impact on the regions freshwater resources. Therefore, a self-regulated industry lead water management system could never guarantee significant improvements in performance, in terms of environmental sustainability issues.

It has also been suggested that, in using a non-regulated water management system, there will be a tendency for the industry to concentrate on satisfying achieving improvements in performance rather than concentrating upon the resulting achievement of improvements. What can be concluded from this is the resource (freshwater in this instance) could be forgotten about once the standard is achieved with standards not necessarily setting specific limits upon resource consumption, levels of degradation or levels of performance. Rather there would be only the commitment to continual improvement through the management system loop and no aims specifically for environmental protection.

Results collected have found that the majority of questionnaire respondents feel that the SWNZ non-regulatory approach to freshwater management can achieve improvements and are regarded as a good tool to work with if achieving freshwater sustainability is the ultimate aim. This will occur as stakeholder pressure will ensure the necessary improvements in environmental performance. However some doubts about this approach were raised regarding its ability to deliver sustainable practices given the wide geographical variations Marlborough's vineyards are set within. What must be

considered is the question of how far the SWNZ programme takes the industry towards sustainable freshwater use?

Under the SWNZ non-regulatory method for managing freshwater resources the viticulture industry of its own volition bring about the necessary improvements to secure sustainable resource use in conjunction with legislative requirements. This approach consists of compliance actions not legally required but which vineyard managers chose to take on. Results gathered argue that this voluntary approach will not deliver the increase in environmental performance necessary to bring about sustainable development and that the increase required will result only from adopting a legislative approach. External experts that were interviewed indicated that a sole reliance on non-regulatory methods will result in a considerable degree of environmental degradation – a cost not only for today's society but passed on to future generations. This will be amplified as freshwater use will not be contained within legal boundaries and therefore it will be economically rational for vineyards to take as much as they require. If freshwater is legally sanctioned then its protection can be monitored to ensure a degree of sustainability.

The RMA is an important medium for ensuring that adverse effects of freshwater use are avoided, remedied or mitigated. However, with increased participation from the viticultural industry in sustainable freshwater management, non-regulatory components such as education and partnership creation are important tools in minimising environmental effects. SWNZ is a non-statutory tool which provides best practice guidelines on matters including water management and enables participation beyond a regulatory minimum. Vineyards can choose to undertake freshwater use to at least meet resource consent requirements and take environmental performance beyond what is legally required by becoming SWNZ accredited.

There is no doubt that many regard the SWNZ programme useful as a motivating factor and as a framework to initiate freshwater management and many see this approach as a toolbox to facilitate this. However it is also apparent that non-regulatory approaches do not provide guarantees or assurances to the public that the industry's impacts on

freshwater resources are being minimised and that the organisation is moving towards sustainability. It is therefore suggested that non-regulatory approaches to freshwater management not be the sole requirement, rather are sub-optimal, if the ultimate objective is sustainable freshwater use.

The implications of non-regulatory procedures are the strengthening of integrated methods for achieving community goals, including environmental outcomes surrounding sustainable freshwater use. Vineyards in New Zealand can take steps in order to become more environmentally sustainable, however the reward of the SWNZ accreditation is one of the only incentives to improve practices as a result of consumer recognition attached to the title. SWNZ accredited vineyards have the reputation for environmental stewardship, and these management practices are generally cost-effective as well as environmentally sustainable. Both vineyard managers that were interviewed indicated that these practices were a result of personal and industry lead initiatives rather than encouragement from local government.

The potential increase in paperwork and further operational changes that are required when adopting self-regulating practices may be the reason respondents are less enthusiastic to adopting their own methods to manage freshwater use as opposed to the economic incentives accreditation to the programme provides in terms of exports and wine competitions. The potential scale of change that could be required for any self governance would be large not to mention the increase in administrative burden and co-ordination that would be required which would be further barriers to reaching the goal of sustainable freshwater use.

### 7.9 Logic for Regulatory Methods in Freshwater Management

The current environmental policies that govern Marlborough's wine industry are predictably related to the preservation of water quality. MDC have a legislative responsibility to carry our sustainable resource management. This implies commitment to managing resources, including freshwater, within the life supporting capacity of the

environment. Challenges to implementing this responsibility include freshwater allocation.

Allocations are difficult to distinguish with the cycling of external and internal inputs associated with various water users and the viticulture industry being just one user amongst many. A problem also arises when determining how far inputs, such as freshwater degradation, can be directly related to the viticulture industry and what substitutes or management practices can compensate for the changes. Minimisation of biophysical effects on the environment are covered in the RMA in subsection 5(2)(c), as "avoiding, remedying, or mitigating any adverse effects of activities on the environment". This is consistent with the ecological sustainability theory in which the majority of questionnaire respondents where accepting that freshwater regulations should be based upon.

Most questionnaire respondents agree that regulation provides equitable allocation of freshwater. However what is uncertain is if freshwater in Marlborough is fairly allocated. Water allocation is not based on the current level of soil moisture retention or potential moisture retention levels or the area of a vineyard nor is it based on land values, or the row spacing of vines. Rather water allocations are tied to summer low flow assessments that were undertaken in the early nineties. There is some doubt as to whether Marlborough's freshwater resources have been correctly allocated given the exponential rise in grape plantings in Marlborough (Figure 4.7, Chapter 4).

Doubts about the effectiveness of a regulatory approach to water management came from advocates of enhanced protection as well as from those who would resist such a trend. While the data collected reveals that some people feel that regulation is a useful but imperfect instrument and/or a necessary but not sufficient means of achieving important ends. It also may be the case that the use of more non-regulatory methods would enhance water protection while at the same time ameliorating some of the concerns raised by thoughtful critics of regulation.

The results collected confirm that values such as water quality are given practical effect at the local planning regulatory level, and some reasons for this are suggested. Within local government decision making in the Marlborough context, politicians place heavy emphasis on scientific information helping them arrive at a decision. This results in such values as water quality being given effect through methods, such as rules in the regional plan, which enables water to be divided between allocation and protection. The data collected confirms that methods for giving practical effect to equitable water allocation are currently limited. For example, in an interview conducted with Council's groundwater scientist it was noted that no there are "no golden rules for safe aquifer withdraw and no rules pertaining to small streams developed. The development of appropriate tools that would enable this to occur is an area for future research".

The maintenance and preservation of Marlborough's freshwater quality and quantity is of utmost importance, if anything close to the state of sustainable freshwater use is to be achieved. This point was made by Lowrance (1990) and is mentioned by IUCN (1990). The need to achieve this is outlined in Sections 5(2)(a) and 5(2)(b) of the RMA. The recognition of these issues by the professionals interviewed as part of this research is important as the biophysical environment and water resources base on which Marlborough's viticulture production is dependent are linked with those who make decisions on how water is allocated and managed.

The enforcement approach aims to halt adverse environmental effects by attaching a financial penalty to the practice which to be effective the penalty needs to be high enough to make not implementing the adverse effects more attractive. This value may not please all involved, as it may be too high for offenders and too low for other members of society who use the environment, such as downstream water users. A problem with enforcement action is that people will do things until getting caught, if they are not caught this may seem like a waste of time to spend additional means on enforcement action when it has no real benefit. Maybe the question should have asked respondents their viewpoint on whether achieving sustainable freshwater use is an enforcement issue or an allocation issue?

## 7.10 Effectiveness and Efficiency of Regulatory Methods

Regulatory and non-regulatory methods of management, while similar in their aim, do not present the same information. Naturally, the laws of the land supersede the SWNZ certification standards. Regulation provides the framework for equitable allocation of Marlborough's water resources. Unfortunately with human greed and water becoming recognised as a more valuable asset than in the past, to protect all users' regulation is required unless we can get society to a utopia. However it could be said that if you do not have the necessary regulatory guidelines then you are unlikely to have the framework for enforcement action. Further there would be no incentive for the industry to have stricter enforcement with potentially stricter means to halt any adverse effects being more of a burden than a positive.

The existing tools for freshwater management have had mixed success at delivering improved environmental results. There are a number of gaps in the current policy framework, as noted by Council staff interviewed, creating inadequacies and inefficiencies in the management of Marlborough's freshwater and include:

1. Decline in a wide range of freshwater quality indicators;
2. Lack of integrated management;
3. Lack of focus on the uses of freshwater resources;
4. Freshwater demand management is not presently sustainable; and
5. Insufficient information, reporting and enforcement.

In part these arise because the cumulative effects of viticulture use on water are difficult to manage coupled with the lack of national guidance on freshwater policy. Other inadequacies arising from the current freshwater management regime include:

- Poor strategic planning, resulting in uncertainty;
- Demand for water use exceeding available water supply;
- Over-allocation of water resources; and
- Inadequate promotion of water usage efficiency measures at the national level.

Marlborough is unique with its monoculture of vineyards, its climate, soils and topological setting which all affect the policies and rules set to regulate water. While the National Policy Statement for Freshwater Management has been proposed by Central Government to provide national direction and guidance to local authorities on how they management freshwater resource in their area, there is significant regional variation in Marlborough making such an assessment difficult to implement succinctly.

Rightly or wrongly, it appears that regulation alone is not entirely effective as an approach to managing freshwater, in part because it has been instituted as much to avoid using the full powers of local and national government to intervene directly. It can lead at times to political antagonism without producing adequate resource protection. The undue complexities of regulation are a result of compromises which might sometimes be best avoided. Uneven enforcement and expensive administrative regimes equally often are the result of complex compromises. Regulation is also potentially inflexible and unpredictable as regulations cannot react quickly to change in the state of water resources, therefore achieving a goal may take time.

The level of efficiency mandated in local government rules and standards is limited to that which can be monitored. Without these rules and standards it is highly doubtful that much, if any, sustainable freshwater use would be achieved. This is the case as without regulation, little delegation of authority would occur. Further, enforcement would not be ongoing or be even carried out at all.

### 7.11 What the Future Holds

The future of the New Zealand wine industry rests with global exports, in highly competitive markets where wine volumes are growing dramatically. Currently, an element of competitive advantage is still available through environmental sustainability. However, the time is coming when lack of environmental sustainability will be a barrier to trade. It has happened in other primary production sectors and it would be naïve to assume that the wine industry is immune to this global trend. It is therefore prudent to

have the SWNZ scheme implemented on an industry wide basis before sustainable production systems are imposed.

Schemes like SWNZ can provide powerful tools for those involved in the lobbying process on behalf of industry. Sustainability programmes such as SWNZ are a means of assuring regulatory bodies that the viticulture industry is acting responsibly and can assess how well it is doing when it comes to managing water.

There is increasing demand for wines that have an auditable production record, which confirms a sound ecological basis to the production system. There is already evidence of Tesco's and other large supermarkets such as Sainsbury's in the United Kingdom selecting suppliers that can demonstrate environmental responsibility. At least one major supermarket chain supplied in Europe (Carrefour) has indicated that it would no longer accept New Zealand wine unless the grapes that made the wine were grown to an auditable or equivalent standard. Credibility is added by an auditable system that demonstrates that quality assurance is taken seriously.

Internationally, EUREP-GAP (European produce retailers, good agricultural practice) has to be considered by those exporting products to the EEC. The day may not be too far away when not only wine labels will have to comply with regulations but what standard the grapes are grown to that made the wine in the bottle will be affected too. Suffice to say that compliance with these regulatory standards may become mandatory for some markets. In general, the presence of an audited sustainable production system will go a long way towards fulfilling EUREP-GAP or similar requirements.

### 7.12 Adaptive Management

It has been argued that sustainable freshwater use in vineyards can be achieved however there is the need to resort to both legislation and voluntary regimes as industry pressure will ensure the necessary improvements in freshwater management. Non-regulatory approaches to freshwater management alone will not bring about sufficient improvement if sustainable freshwater use is the ultimate goal. Regulation should continue to be

implemented in such a way as to ensure that only sustainable quantities of freshwater are used. Actions must be evaluated so that relative success can be documented and subsequent actions can be adapted for greater effectiveness.

It is suggested that adaptive management using a combination of regulatory and non-regulatory management methods should continue to be used to set management goals. Adaptive management can be successful when management goals and objectives are clearly stated so that benchmarks can be developed accordingly. Goals should be quantifiable and should address the sustainability target, the geographic area, the desired action, a measurable state or degree of change desired, and a timeframe. Adequate outcomes based on monitoring of the regions water bodies must be analysed to avoid the possibility of declaring an action unsuccessful when it was actually working or vice versa. There must be commitment of time and money from government at national and local levels and from non-regulatory bodies such as SWNZ for implementation of monitoring and for data analysis and evaluation. Finally, there must be a willingness from vineyard managers to commit to accepting monitoring results and to changing actions accordingly.

Adaptive management will also require a willingness to modify assumptions, goals and actions based on new information, something which is lacking in todays regulatory climate with Marlborough's regional water rules based on data that is now more than 15 years old. This method necessitates extensive documentation of hypothesis, action designs and results. Research is therefore a critical component of the adaptive management approach presented. Research to better understand relationships between such factors as climate, soil, vine spacing, irrigation volumes to name just a few, and to test new and existing approaches will be required. Overall, a diversity of actions to address sustainable freshwater use through adaptive management should be designed, implemented and monitored to help determine industry best practice.

The concept of sustainable freshwater use in vineyards is complex, and its definition is an ongoing point of discussion. Success in implementing this paradigm is not just getting

grape growers to adhere to a list of practices, but also changing the mind-set in peoples' approach to viticulture and management approaches. This takes time and hard work. Undoubtedly, water management regimes will continue to evolve over time. Technological advancement is unlikely to ever remove the necessity for management regimes to be put in place to protect an essential yet often vulnerable resource.

The changing nature of resource management in general, with an increased awareness of natural and ecological processes and functions, the identification of a wide variety of perspectives and values, and an appreciation that it may not always be sufficient to adopt a single management regime needs to be considered as a whole to ensure adaptive management. It is no longer necessary to adopt a single regulatory management approach and attempt to adapt the environment to the institution. There is no reason why a number of approaches cannot be applied within a targeted framework where all values are considered and all users provided for through a mosaic of management regimes. The nature of sustainable freshwater use in vineyards is one of striving for continual improvement, rather than crossing some line that indicates you are there.

## 7.13 Summary

The localised scarcity of freshwater resources in Marlborough has meant that both regulatory and non-regulatory methods occur and are required to ensure that the resource remains in a state where it can be utilised by a variety of users in a variety of ways. What is clear however is that management in what ever shape or form has strengths and weaknesses but is a fundamental component when working towards achieving sustainable freshwater use.

# 8.0 FOCUS AND IMPROVEMENTS FOR FUTURE RESEARCH

In this chapter suggestions are made for ways in which the research design and methodology can be improved.

## 8.1 Research Focus

In an effort to focus the scope of this project in the expansive field of freshwater management in a thorough and complete manner and within the time constraints placed upon research, the focus has been narrowed down to the sustainable use of freshwater surface water resource of Marlborough to give a representation from a practical perspective.

Although it is realised that groundwater especially is an integral part of the dynamic water resource system, this has only been briefly touched upon as it is complicated enough to warrant a study of its own, and the time was not available to perform a complete analysis of this system in addition to surface water. Similarly water quality and in-stream values are also major issues not only in New Zealand, but globally, which could provide the content for a number of projects.

## 8.2 Improvements for Future Research

The research topic offers considerable scope for further work. In carrying out a similar investigation in the future it is important to incorporate the lessons learned from the design of the methodology.

There are definite constraints and difficulties in conducting a small scale investigation. It is recognised that because of the small response rate to the questionnaire, it would be unwise to generalise the research findings across the country. Further research could be undertaken to investigate whether the findings of this research are replicated elsewhere in New Zealand. It would be useful to ascertain what approaches other councils and the viticulture industry in other regions have adopted to managing freshwater use.

This research set out to evaluate how regulatory and non-regulatory methods can achieve sustainable freshwater use in Marlborough vineyards. The methodological approach of focusing solely on questionnaire responses and six semi-structured interviews allowed for a manageable investigation. A more extensive research methodology would enhance this study. There are various other personnel at MDC, in the viticulture industry and SWNZ that are relevant to this topic who would be useful to interview that were not involved in this study. It would also be useful to interview community groups that play an important role in freshwater and waterway management. These groups could include Maori organisations and water user groups.

There are also means to go further in comparing and contrasting the differences in the management style of councils throughout New Zealand and in viticulture regions overseas.

No analysis of other climatic factors other than a brief insight into rainfall patterns or overall vineyard administration affecting grapevine development was undertaken which are critical in determining the quality and quantity of freshwater and subsequently affect grape harvest.

The quality of the results was affected by the ability to explain the questionnaire and ask the ‘right’ questions. Asking appropriate and meaningful questions so as to identify what is known about the management approaches affecting Marlborough’s freshwater resource from a general public perspective. Accordingly, any inferences made from the data collected should be tempered against a recognition that the results may not be flawlessly representative of how the viticulture industry or MDC are attempting to work towards the sustainable management of freshwater.

It is believed that these limitations in scope do not detract from the intentions of the project to provide an assessment of the issues, opinions and options of using freshwater

in the context of Marlborough and the regulatory and non-regulatory methods pertaining to its management.

# 9.0 CONCLUSIONS

This chapter brings the research to a conclusion by examining whether the aim and objectives set out in Chapter One have been achieved. A number of aspects to consider are made concerning freshwater and its management. Finally, some reflective comments are made about this research topic.

## 9.1 Overview of Research Aim, Objectives and Findings

The aim of this research was to examine how regulatory and non-regulatory methods can achieve sustainable freshwater use in vineyards. Following a review of the literature (Chapter Three), it was concluded that the concepts associated with sustainability fall generally into one of three schools of thought: economic, social and ecological. What is required for the implementation of sustainable resource management is the integration of these three schools.

An outline of New Zealand viticulture and then more specifically Marlborough, the case study area, were presented in Chapter Four. The opportunities for carrying out the different approaches to freshwater management, provided by institutional arrangements in New Zealand and the case study area were examined (Chapter Five). The relevant parts of the RMA were identified and discussed and the role that MDC has in implementing freshwater management was examined along with SWNZ, a non-regulatory viticulture initiative programme (Chapter Five). These chapters showed that there are potentially a range of regulatory and non-regulatory regimes available to manage freshwater in Marlborough and wider New Zealand.

The research undertaken has enable comparisons to be made on sustainable freshwater practices undertaken in vineyards. The opportunities and constrains of regulatory and non-regulatory management approaches have been compared in order to assess how the industry is working towards sustainable freshwater use. An insight into public opinion

towards freshwater and its management through various regimes has been outlined in Chapter Six.

What has become apparent in the case study area is that freshwater is an important yet scarce commodity with real value, and as such, some form of management intervention is required to prevent societal breakdown and to ensure that the resource remains in a state where it can be utilised by a variety of users, in a variety of ways. It is recognised that management regimes are a fundamental component in the water planning process. It was found that methods for ensuring the sustainable management of freshwater resources have been constantly evolving over time. Particular concern was expressed about the localised scarcity of freshwater resources in the case study area, with increasing demand placed on a limited resource base that has inherently lead to regulatory intervention along with non-regulatory regimes to control and manage water use.

Regulatory and non-regulatory methods of management, while similar in their aim, do not present the same information. It has been argued that regulation should continue to be implemented in such a way as to ensure that only sustainable quantities of freshwater are used. Non-regulatory approaches are not only 'stand alone' measures, but can be used as a supplement to laws and regulations and can serve as an efficient tool to implement politically defined objectives. Due to their voluntary nature and flexibility, non-regulatory approaches can offer innovative solutions to freshwater management. If implemented alone non-regulatory approaches will not bring about sufficient improvement to achieve sustainable freshwater use however are useful to assist with implementing best practice guidelines and also enable grape growers to manage freshwater within the realm of their vineyard needs.

The current environmental policies that govern freshwater use in vineyards are generally progressive, although there is still room for improvement. Support for environmentally sustainable freshwater use is increasing as a result of non-regulatory management regimes however there should be more local government incentives for vineyards to produce in an environmentally sustainable manner.

Marlborough is still developing as a viticulture region and this is a critical period for decision makers to shape the direction and character of freshwater management. Adaptive management using a combination of regulatory and non-regulatory management methods is presented as a targeted framework where all values can be considered and all users provided for. When management goals and objectives are clearly stated using a variety of methods, a diversity of actions to address specific sustainability goals can be implemented when working towards achieving sustainable freshwater use.

## 9.2 Reflections on the Research

Researching how management considerations have been incorporated into freshwater sustainability in relation to vineyards has proved to be a fascinating topic. It is the interface between many disciplines such as planning, environmental sciences, oenology, hydrology and sociology.

Given that vineyards are criticised by some as the so called “consumers” of freshwater resources, various management regimes represent a particularly good indicator of the overall commitment of the industry and local government to improving environmental quality. The issues involved lie at the heart of the conflict between development and the environment. If a co-existence of nature and vineyards can be obtained through both regulatory and non-regulatory management approaches, then major progress towards the goal of sustainable freshwater use will be achieved.

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# APPENDIX 1

## Massey University Human Ethics Low Risk Approvals

Massey University

OFFICE OF THE ASSISTANT
TO THE VICE-CHANCELLOR
(RESEARCH ETHICS)
Private Bag 11 222
Palmerston North 4442
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T 64 6 350 5573
64 6 350 5575
F 64 6 350 5622
humanethics@massey.ac.nz
animalethics@massey.ac.nz
gtc@massey.ac.nz
www.massey.ac.nz

31 July 2009

Catherine Johnson
44A Weld Street
**BLENHEIM 7201**

Dear Catherine

**Re: How to Achieve Sustainable Freshwater Use in Vineyards: Marlborough – A Case Study**

Thank you for your Low Risk Notification which was received on 29 July 2009.

Your project has been recorded on the Low Risk Database which is reported in the Annual Report of the Massey University Human Ethics Committees.

The low risk notification for this project is valid for a maximum of three years.

Please notify me if situations subsequently occur which cause you to reconsider your initial ethical analysis that it is safe to proceed without approval by one of the University's Human Ethics Committees.

Please note that travel undertaken by students must be approved by the supervisor and the relevant Pro Vice-Chancellor and be in accordance with the Policy and Procedures for Course-Related Student Travel Overseas. In addition, the supervisor must advise the University's Insurance Officer.

**Please ensure that the following statement is included in all information provided to participants during recruitment (eg, information sheet, preamble to questionnaire, etc):**

> *"This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research.*
>
> *If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact Professor Sylvia Rumball, Assistant to the Vice-Chancellor (Research Ethics), telephone 06 350 5249, e-mail humanethics@massey.ac.nz".*

Please note that if a sponsoring organisation, funding authority or a journal in which you wish to publish requires evidence of committee approval (with an approval number), you will have to provide a full application to one of the University's Human Ethics Committees. You should also note that such an approval can only be provided prior to the commencement of the research.

Yours sincerely

Sylvia V Rumball (Professor)
**Chair, Human Ethics Chairs' Committee and**
**Assistant to the Vice-Chancellor (Research Ethics)**

cc Dr Jeff McNeill
School of People, Environment and Planning
**PN331**

Mrs Mary Roberts, HoS Secretary
School of People, Environment and Planning
**PN331**

MASSEY UNIVERSITY

9 December 2009

Catherine Johnson
44A Weld Street
**BLENHEIM 7201**

Dear Catherine

**Re: How to Achieve Sustainable Fresh Water Use in Vineyards: Marlborough – A Case Study**

Thank you for your Low Risk Notification which was received on 9 December 2009.

Your project has been recorded on the Low Risk Database which is reported in the Annual Report of the Massey University Human Ethics Committees.

The low risk notification for this project is valid for a maximum of three years.

Please notify me if situations subsequently occur which cause you to reconsider your initial ethical analysis that it is safe to proceed without approval by one of the University's Human Ethics Committees.

Please note that travel undertaken by students must be approved by the supervisor and the relevant Pro Vice-Chancellor and be in accordance with the Policy and Procedures for Course-Related Student Travel Overseas. In addition, the supervisor must advise the University's Insurance Officer.

**A reminder to include the following statement on all public documents:**

> *"This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research.*
>
> *If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher(s), please contact Professor John O'Neill, Director (Research Ethics), telephone 06 350 5249, e-mail humanethics@massey.ac.nz".*

Please note that if a sponsoring organisation, funding authority or a journal in which you wish to publish requires evidence of committee approval (with an approval number), you will have to provide a full application to one of the University's Human Ethics Committees. You should also note that such an approval can only be provided prior to the commencement of the research.

Yours sincerely

J. O'Neill

John G O'Neill (Professor)
**Chair, Human Ethics Chairs' Committee and**
**Director (Research Ethics)**

cc Dr Jeffrey McNeill
School of People, Environment and Planning
**PN331**

Mrs Mary Roberts, HoS Secretary
School of People, Environment and Planning
**PN331**

# APPENDIX 2

## Questionnaire

MASSEY UNIVERSITY
COLLEGE OF HUMANITIES
AND SOCIAL SCIENCES

# Sustainable Freshwater Use in Vineyards

**Industry Questionnaire on Sustainable Vineyard Practices**

Project Title: HOW TO ACHIEVE SUSTAINABLE FRESHWATER USE IN VINEYARDS. MARLBOROUGH: A CASE STUDY

Investigator: Catherine Johnson, MRP Thesis, Massey University

**NB: PLEASE RETURN THE COMPLETED SURVEY TO THIS EMAIL ADDRESS** catherinejohnson4@gmail.com

## WHAT IS THE PURPOSE OF THIS STUDY?

You are being invited to take part in a research study designed to identify sustainable freshwater practices undertaken in vineyards as the ability of management to sustain freshwater use is one of the greatest direct influences on whole-vineyard sustainability.

Sustainability is a broad topic that means many things to many people. I am seeking industry responses in 'sustainable' freshwater practices undertaken in vineyards throughout Marlborough. This questionnaire has been developed and results will be used as part of my Masters thesis. Results will be used to gauge freshwater vineyard practices in order to assess how the industry is working towards sustainable freshwater use.

## WHAT IS THE PURPOSE OF THIS FORM?

This consent form gives you the information you will need to help you decide whether to participate in the study or not. Please read the form carefully. You may ask any questions about the research, the possible risks and benefits, your rights as a volunteer, and anything else that is not clear. When all of your questions have been answered, you can decide if you want to be in this study or not.

## WHY AM I BEING INVITED TO TAKE PART IN THIS STUDY?

You are being invited to take part in this study because you are involved in Marlborough's viticultural industry and have dealt with vineyard development, practices or management decisions.

## WHAT WILL HAPPEN DURING THIS STUDY AND HOW LONG WILL IT TAKE?

As a participant in the study, you simply will be asked to fill out a short questionnaire. This questionnaire will be administered via the email survey (see below) in which you can email your response back to the sender.

## EMAIL QUESTIONNAIRE

If you participate in the questionnaire, it should not take more than 5 minutes to complete. Once you are done, your participation is no longer necessary.

## WHAT ARE THE RISKS OF THIS STUDY?

There are no foreseeable risks to participating.

## WHAT ARE THE BENEFITS OF THIS STUDY?

You will not benefit directly from being in this study. However, we hope that, in the future, other people might benefit from this study because of the information gained about sustainable freshwater practices and management.

## WHO WILL SEE THE INFORMATION I GIVE?

The information you provide during this research study will be kept confidential to the extent permitted by law and will be grouped with others for reporting purposes. To help protect your confidentiality, I will keep all responses secure using password-protected computer files. If the results of this project are published, your identity will not be made public, nor will the information be reported in a way that individuals or firms could be identified with responses.

## DO I HAVE A CHOICE TO BE IN THE STUDY?

If you decide to take part in the study, it should be because you really want to volunteer. You will not lose any benefits or rights you would normally have if you choose not to volunteer. You can stop at any time during the study and still keep the benefits and rights you had before volunteering.

You will not be treated differently if you decide to stop taking part in the study. As a participant, you are free to skip any questions that you prefer not to answer. If you choose to withdraw from this project before it ends, the investigator may keep information collected and this information may be included in the thesis.

## WHAT IF I HAVE QUESTIONS?

If you have any questions about this research project, please contact: Catherine Johnson, telephone (03) 579 2613, email catherinejohnson4@gmail.com

The project has been evaluated by, peer review and judged to be low risk. Consequently it has not been reviewed by one of Massey University's Human Ethics Committees. The researcher named above is responsible for the ethical conduct of this research.

If you have concerns about the conduct of this research that you wish to raise with someone other than the researcher, please contact Professor Sylvia Rumball, Assistant to the Vice-Chancellor (Research Ethics), telephone (06) 350 5249, email humanethicspn@massey.ac.nz

## COMPLETING THE SURVEY

The supervisor for this research is Dr Jeffrey McNeill, Massey University, who can be contacted: email J.K.McNeill@massey.ac.nz telephone 06 356 9099 x 2507.

Please if you could complete this survey by **20 August 2009.**

Thank you in advance for your time and contribution to this questionnaire.

## QUESTIONNAIRE:

Some question are open ended and therefore require a short explanation. However, most questions ask that you circle the letter or number that best describes your point of view. The extent to which you agree with some of the questions uses the key below:

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Strongly agree | Agree | Neither agree nor disagree | Disagree | Strongly disagree |

Do not think too long about your answers – your first, quick response is often the best. Rather, try and work through the questions at a steady pace.

## Demographics

**1. Indicate the descriptor that best describes your position in the industry:**

A – Vineyard Owner
B – Vineyard Manager
C – Winery owner/manager
D – Winemaker
E – Vineyard Consultant
F - Field Representative
G – Other

ANSWER =

**2. Provide your vineyard location. If you have multiple sites, list the multiple locations.**

**3. Please indicate your total managed vineyard acreage.**

**4. Do you use irrigation?**

## Freshwater

**5. Where do you get most of your irrigation water from?**

A - Water Permit – surface water
B - Water Permit – well water
C - Dam
D - Irrigation scheme
E - Don't irrigate

ANSWER =

**6. If you had water allocation during the 2008-2009 summer did you take your maximum allowance of water?**

Yes
No
N/a

ANSWER =

**7. Are you aware of your allocation requirements to take and use water for irrigating your vineyard?**

A - Aware of the requirement for metering
B - Aware of the requirement for monitoring
C - Not aware
D - Someone else is in charge of this and is aware

ANSWER =

**8. The quantity of freshwater in my catchment is much worse than 5 years ago.**

1 - Strongly agree
2 - Agree
3 - Undecided
4 - Disagree
5 - Strongly disagree

ANSWER =

Comment: What evidence supports your answer:

**9. How do you decide when and how much water to apply?**

A - Consider growth stage and water requirements of vines
  - Consider water holding capacity of soil
  - Consider soil moisture
  - Consider weather conditions
B - Consider all or some of the factors listed in 'A' above
C - An irrigation consultancy decides for me

ANSWER =

**10. Maintaining high freshwater quantity and quality in my local catchment is important.**

1 - Strongly agree
2 - Agree
3 - Undecided
4 - Disagree
5 - Strongly disagree

ANSWER =

**11. Freshwater regulations should be based on the establishment of resource use limits (the ecological sustainability theory).**

1 - Strongly agree
2 - Agree
3 - Undecided
4 - Disagree
5 - Strongly disagree

ANSWER =

## Point of View

**12. Freshwater is a finite resource.**

1 - Strongly agree
2 - Agree
3 - Undecided
4 - Disagree
5 - Strongly disagree

ANSWER =

**13. Those involved in viticulture should be central to any research and development required to make regulatory policies and rules relating to sustainable freshwater.**

1 - Strongly agree
2 - Agree
3 - Undecided
4 - Disagree
5 - Strongly disagree

ANSWER =

**14. Are you an accredited SWNZ vineyard?**

Yes, go to question 15
No, skip to question 17

**15. Have you had to change the way you manage/monitor freshwater use since becoming SWNZ accredited?**

Yes
No

If yes, please specify what changes you have made

**16. Existing legislation covers the areas relating to freshwater allocation so why adopt/use/meet/comply with the non-regulatory requirements of SWNZ accreditation?**

**17. More self-regulatory modes of education are needed to promote sustainable freshwater use.**

1 - Strongly agree
2 - Agree
3 - Undecided
4 - Disagree
5 - Strongly disagree

ANSWER =

**18. Freshwater use <u>cannot</u> be sustainable due to the fluctuations in rainfall from year to year.**

1 - Strongly agree
2 - Agree
3 - Undecided
4 - Disagree
5 - Strongly disagree

ANSWER =

**19. Circle what you consider are the 3 <u>most important challenges</u> facing the viticulture industry at present.**

A - Low grape prices
B - Water access
C - Water management
D - Producing quality
E - Agreeing on wine quality
F - Getting contracts/selling grapes
G - Industry co-operation
H - Margins/ profitability
I - Environmental requirements
J – Other
K - Don't know

ANSWER =

**20. Circle what you consider are the 3 <u>most important challenges</u> facing the viticulture industry in 10 years time**

A - Low grape prices
B - Water access
C - Water management
D - Producing quality
E - Agreeing on wine quality
F - Getting contracts/selling grapes
G - Industry co-operation
H - Margins/ profitability
I - Environmental requirements
J – Other
K - Don't know

ANSWER =

**21. Allowing freshwater resource users to take responsibility for their actions through non-regulatory methods will give them the flexibility to develop appropriate solutions.**

1 - Strongly agree
2 - Agree
3 - Undecided
4 - Disagree
5 - Strongly disagree

ANSWER =

**22. What constraints to adopting more 'environmentally friendly' freshwater uses in the vineyard context can you identify?**

**23. Regulatory (Marlborough District Council) and non-regulatory (SWNZ) sources present the same type of information on freshwater practices.**

1 - Strongly agree
2 - Agree
3 - Undecided
4 - Disagree
5 - Strongly disagree

ANSWER =

**24. Freshwater resource users are burdened by the costs associated with environmental regulation.**

1 - Strongly agree
2 - Agree
3 - Undecided
4 - Disagree
5 - Strongly disagree

ANSWER =

**25. Council rules on freshwater use are hard to understand?**

1 - Strongly agree
2 - Agree
3 - Undecided
4 - Disagree
5 - Strongly disagree

ANSWER =

**26. Council has got the right balance between regulation (in the form of rules and resource consents), and enforcement action for managing freshwater resources.**

1 - Strongly agree
2 - Agree
3 - Undecided
4 - Disagree
5 - Strongly disagree

ANSWER =

**27. The use of enforcement action could be enhanced, as a means of reducing the overall level of regulation.**

1 - Strongly agree
2 - Agree
3 - Undecided
4 - Disagree
5 - Strongly disagree

ANSWER =

**28. Regulation is the only fair way to provide fair allocation of resources**

1 - Strongly agree
2 - Agree
3 - Undecided
4 - Disagree
5 - Strongly disagree

ANSWER =

# APPENDIX 3

## Interview Schedule for External Experts and Vineyard Managers

MASSEY UNIVERSITY
COLLEGE OF HUMANITIES
AND SOCIAL SCIENCES

**Interview on Sustainable Freshwater Practices in Vineyards**

Project Title: HOW TO ACHIEVE SUSTAINABLE FRESHWATER USE IN VINEYARDS. MARLBOROUGH: A CASE STUDY

Investigator: Catherine Johnson, MRP Thesis, Massey University

I have read the information sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time. I agree to participate in this study under the conditions set out in the information sheet.

**Signature:……. Date:…….**

**Full Name Printed:…….**

**Interview Questions: External experts and vineyard managers**

What is your background with respect to water allocation and use? What do you do in your current role in relation to water management? How long have you been in the business/in Marlborough

Can you tell me about your perception of Marlborough's freshwater quality?

Can you tell me about your perception of Marlborough's freshwater quantity?

Do you think the expanse of vineyards throughout Marlborough's effect the regions freshwater quality and quantity?

How has water quality changed in the district over the last five years? In what ways?
Thinking about your local creek/river: has it changed over last five years? In what way?
How do you feel about these changes? Why? are you doing anything about it?

What do you think are the 3 most important principles that should be upheld or observed in relation to water management? What do they mean to you? Do you implement these on your own vineyard? Examples? What are the benefits? What makes it difficult? Why? Do they impact the bottom line? How?

How do you feel about the extent to which the public currently participates in decisions and management processes regarding water allocation?

What does sustainable vineyards mean to you?

What do you think is the most important issue with respect to freshwater in the region at the moment? What makes you think that? Evidence?

What do you think will be the critical issues in the future (10 years from now)? Why? Do you have any suggestions for how these issues can be addressed? What changes can be made now to avoid them in the future? How can these changes be made – what needs to change to make them happen? What would happen if the industry does not make the changes? What will happen to your firm?

What does sustainable freshwater use mean for you? What barriers do you consider exist in achieving sustainable freshwater use? What opportunities exist?

Are regulatory or non-regulatory methods (or a combination of both) most appropriate to achieve sustainable freshwater use? Why?
What do you consider to be the strengths and weaknesses of non-regulatory methods in managing water?

What do you think are the benefits of having a greater level of non-regulatory participation in water management in the region?

Is regulation the only fair way to provide fair allocation of resources?

# APPENDIX 4

**Interview Schedule for MDC staff**

MASSEY UNIVERSITY
COLLEGE OF HUMANITIES
AND SOCIAL SCIENCES

**Interview on Sustainable Freshwater Practices in Vineyards**

Project Title: HOW TO ACHIEVE SUSTAINABLE FRESHWATER USE IN VINEYARDS. MARLBOROUGH: A CASE STUDY

Investigator: Catherine Johnson, MRP Thesis, Massey University

I have read the information sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time. I agree to participate in this study under the conditions set out in the information sheet.

**Signature:……. Date:…….**

**Full Name Printed:…….**

**Interview Questions: MDC staff**

What is your background with respect to water allocation and use? What do you do in your current role?

Can you tell me a bit about the process of allocating water? How do the decision making and management processes work in practice?

Where do you think the opportunities for the public to participate in water allocation lie?

What criteria or frameworks are used to make decisions about water allocation? What are some of the strengths of these frameworks? What are some of the weaknesses?

I am interested in how water is allocated to different parts of the region, and the effect this has on waterways and people. What effect have past and current water allocation regimes had on the waterways in this area?

What do you think is the most important issue with respect to freshwater in the region at the moment? What makes you think that? Evidence?

What do you think will be the critical issues in the future10 years from now? Why? Do you have any suggestions for how these issues can be addressed? What changes can be made now to avoid them in the future? How can these changes be made – what needs to change to make them happen? What would happen if the changes are not made?

What does sustainable freshwater use mean for you?

Is sustainable freshwater use simply crystal ball gazing or something that can be achieved?

What barriers exist to achieving sustainable freshwater use? What opportunities exist?

Are regulatory or non-regulatory methods (or a combination of both) most appropriate to achieve sustainable freshwater use? Why?

What do you consider to be the strengths and weaknesses of non-regulatory methods in managing water?

What do you think are the benefits of having a greater level of non-regulatory participation in water management in the region?

Is regulation the only fair way to provide fair allocation of resources?

# APPENDIX 5

## Information Sheet for Interviewees

MASSEY UNIVERSITY
COLLEGE OF HUMANITIES
AND SOCIAL SCIENCES

**Interview on Sustainable Freshwater Practices in Vineyards**

Project Title: HOW TO ACHIEVE SUSTAINABLE FRESHWATER USE IN VINEYARDS. MARLBOROUGH: A CASE STUDY

Investigator: Catherine Johnson, MRP Thesis, Massey University

## WHAT IS THE PURPOSE OF THIS STUDY?

You are being invited to take part in a research study designed to identify sustainable freshwater practices undertaken in vineyards as the ability of management to sustain freshwater use is one of the greatest direct influences on whole-vineyard sustainability.

Sustainability is a broad topic that means many things to many people. I am seeking responses to 'sustainable' freshwater practices undertaken in vineyards throughout Marlborough. This interview has been developed and results will be used as part of my Masters thesis. Results will be used to gauge freshwater vineyard practices in order to assess how regulatory and non-regulatory methods work towards sustainable freshwater use.

## WHAT IS THE PURPOSE OF THIS FORM?

This sheet gives you the information you will need to help you decide whether to participate in the study or not. Please read the sheet carefully. You may ask any questions about the research, the possible risks and benefits, your rights as a volunteer, and anything else that is not clear. When all of your questions have been answered, you can decide if you want to be in this study or not.

## WHY AM I BEING INVITED TO TAKE PART IN THIS STUDY?

You are being invited to take part in this study because you are involved in Marlborough's viticulture industry and have dealt with vineyard development, practices or management decisions.

## WHAT WILL HAPPEN DURING THIS STUDY AND HOW LONG WILL IT TAKE?

As a participant in the study, you simply will be asked a number of short questions. This will be administered via a semi-structured interview that will not be audio taped.

## INTERVIEW

If you participate in the interview, it should not take more than 10 minutes to complete. Once you are done, your participation is no longer necessary.

## WHAT ARE THE RISKS OF THIS STUDY?

There are no foreseeable risks to participating.

## WHAT ARE THE BENEFITS OF THIS STUDY?

You will not benefit directly from being in this study. However, we hope that, in the future, other people might benefit from this study because of the information gained about sustainable freshwater practices and management.

## WHO WILL SEE THE INFORMATION I GIVE?

The information you provide during this research study will be kept confidential to the extent permitted by law and will be grouped with others for reporting purposes. To help protect your confidentiality, I will keep all responses secure using password-protected computer files. If the results of this project are published, your identity will not be made public, nor will the information be reported in a way that individuals or firms could be identified with responses.

## DO I HAVE A CHOICE TO BE IN THE STUDY?

If you decide to take part in the study, it should be because you really want to volunteer. You will not lose any benefits or rights you would normally have if you choose not to volunteer. You can stop at any time during the study and still keep the benefits and rights you had before volunteering.

You will not be treated differently if you decide to stop taking part in the study. As a participant, you are free to skip any questions that you prefer not to answer. If you choose to withdraw from this project before it ends, the investigator may keep information collected and this information may be included in the research.

## WHAT IF I HAVE QUESTIONS?

If you have any questions about this research project, please contact: Catherine Johnson, telephone (03) 579 2613, email catherinejohnson4@gmail.com

The project has been evaluated by, peer review and judged to be low risk. Consequently it has not been reviewed by one of Massey University's Human Ethics Committees. The researcher named above is responsible for the ethical conduct of this research.

If you have concerns about the conduct of this research that you wish to raise with someone other than the researcher, please contact Professor Sylvia Rumball, Assistant to the Vice-Chancellor (Research Ethics), telephone (06) 350 5249, email humanethicspn@massey.ac.nz

The supervisor for this research is Dr Jeffrey McNeill, Massey University, who can be contacted: email J.K.McNeill@massey.ac.nz telephone 06 356 9099 x 2507.

Thank you in advance for your time and contribution to this study.