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**Re-conceptualising the Integrated Water Management Model:
Reflections from the New Zealand Experiment**

A Thesis
Submitted in partial fulfilment
of the requirements for the Degree of
Doctor of Philosophy

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by
S. Tulloch

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Abstract of a thesis submitted in partial fulfilment of the requirements for the Degree
of Doctor of Philosophy

**Re-conceptualising the Integrated Water Management Model:
Reflections from the New Zealand Experiment**

By S. Tulloch

The widely accepted, but increasingly criticised concept and process of Integrated Water Management (the IWM model) has been embedded within the wider environmental management and planning literatures for well over a century. Unfortunately, particularly over the last four decades, it has become equally well known for its ‘implementation gap’ - the inability to translate the concept into sustainable outcomes for the freshwater systems under management. The literature is increasingly clear that more conceptually robust and practically applicable approaches to IWM are urgently required. The literature is also increasingly cognisant that IWM rule-sets neither exist nor operate in a social vacuum. In particular, wider social systems of institutional arrangements are increasingly considered as key influences upon IWM outcomes. Institutional arrangements are here considered to be those formal and informal rule-sets generated by, *inter alia*: social worldviews and cultural perspectives, including perceptions of the resource system; traditional or customary uses of the resource, and; social norms, laws, or systems of property rights.

Paradoxically, the IWM implementation gap is particularly acute in places such as New Zealand, Florida, or British Columbia, which would appear to have every IWM advantage: developed, ‘Western’ jurisdictions with plentiful (if geographically and temporally heterogeneous) freshwater resources; the technology and physical infrastructure to ensure reliable freshwater supplies, and; extant collaborative (or at least, cooperative) IWM policies, programmes, or plans. Yet, these are the very places where the emergent polycentric (meaning ‘many centred’) challenges facing IWM efforts, already exceed the ability of the IWM model to address them in ways that are considered both equitable and efficient.

Three broad questions relating to the above are considered in this thesis. Firstly, why have sustainable freshwater outcomes from IWM efforts in places such as New Zealand (the selected case study nation) remained so elusive? Secondly, how do wider social systems of institutional arrangements influence the sustainability intentions of IWM rule-sets? And thirdly, how may institutional design address the current generation of polycentric difficulties facing IWM, which already exceed the capacity of institutional design to address?

From the above, the thesis has two aims. The first aim is to reconceptualise IWM to provide a more robust theoretical understanding of its elements, processes and problems. Related to this, the second aim is to employ that understanding to inform an analysis of the role of institutional arrangements in IWM outcomes in New Zealand, under the RMA.

In order to achieve these two aims, four broad research objectives are identified. The first research objective is to seek more realistic and conceptually robust theoretical underpinnings for IWM. Based on this, the second objective is the development of an evaluative framework for the re-conceptualised IWM process. The third objective is the employment of the evaluative framework in the multi-scale case study analysis of the role of institutional arrangements in IWM outcomes in New Zealand. The final research objective for this thesis is: to identify insights arising from the study, and to draw conclusions on: the theoretical underpinnings for re-drawn IWM and the evaluative framework, and; the influence of key institutional arrangements on IWM outcomes in New Zealand, including some suggestions towards improved future outcomes.

Key findings from the first two (conceptual) research objectives are drawn from insights from Commons Theory and the complexity thinking approach (whereby systems adapt, or sometimes ‘learn’ through experience of changing contexts). I argue for a theoretical perspective of the IWM model as a complex adaptive process of social learning, with respect to the governance of freshwater. I also argue that the IWM model alone will not be able to overcome historically embedded unsustainable social perspectives of freshwater. Thus, a complex adaptive systems perspective of IWM, and consideration of the potential influence of institutional arrangements, are

key to the ‘success’ or otherwise of IWM efforts, especially with respect to the emergence of problematic polycentric IWM challenges.

Key empirical findings from the multi-scale case study indicate that existing institutional arrangements relating to the expressions of property rights, markets, and cosmologies and worldviews, are deeply embedded in the national, regional, and local histories, and are key barriers to sustainable freshwater outcomes. At the national scale, the internationally renowned Resource Management Act (1991) has become a symbolic policy through non-implementation. At this scale, the change from a pioneer, exploitative perspective to a more mature, conservationist one with respect to New Zealand’s freshwater systems, is yet to be achieved. Findings for Canterbury (the regional scale) indicate that the recent, potentially sustainable Canterbury Water Management Strategy has been a victim of its own success, undermined by national government response to a perceived threat to abstractive ‘business as usual’. This is particularly with respect to the continued development of the economically valuable dairy industry in that region. Study findings also suggest that New Zealand and Canterbury are now in real danger of being locked-in to the export of freshwater in the shape of low-value-added milk powder. However, in a typical IWM paradox, the potential compromise of sustainability at the national and regional scales may yet result in benefits at the local level, for Te Waihora/Lake Ellesmere, the local-scale element of the study.

Keywords: Integrated Water Management; Institutional Arrangements; Commons Theory; Complexity Thinking; Polycentric; Social Transformations; New Zealand; Te Waihora/Lake Ellesmere.

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1 Sustainable Freshwater Systems?

1.1 The Sustainable Freshwater Challenge

Sustainable freshwater system limits are those within which cumulative patterns of freshwater use may be indefinitely supported by both the resource, and its dependent human societies. It is widely accepted that the identification and acceptance of sustainable limits to freshwater system use is critical to societal, and individual, wellbeing (Abernethy, 2005; Anderies et al., 2004; Hardin, 1968; Mitchell, 2005; Ostrom, 1990). After all, at the very least, a continuing supply of sufficient potable water is an essential and non-substitutable requirement for life: thus, if humanity as a species wishes to thrive, the importance of achieving and maintaining sustainable freshwater outcomes is difficult to overstate.

Regrettably, it would seem that the difficulties implicit within any such enterprise are almost as acute as the need for their success (Biswas, 2004; Kerr, 2007). Many countries around the world are now struggling with detrimental consequences of freshwater overexploitation at national, regional, and local scales (Gibson et al., 2000; Kerr, 2007; Lovell et al., 2002; Margerum, 2008). Inexorable rises in cumulative socio-economic pressures are resulting in overuse, threatening the current and future productive capacity of these resources, as well as their dependent human and non-human communities (Abernethy, 2005; Carpenter et al., 1999; Hedelin, 2007; Janssen & Anderies, 2007; Scholz & Stiffler, 2005).

Institutions, also called rules or rule-sets, are designed to regulate, manage, or govern (in a widening range of decision-making activities), types and levels of freshwater use within a social-ecological-system (SES) (Anderies et al., 2004; Bakker, 2003; Edwards & Steins, 1998; Gibbs & Bromley, 2003; Schlager et al., 1994). In accordance with social science usage, the terms institutions and rules are used synonymously in this study (Ostrom, 1990). Institutions are widely recognised as being designed over three levels of decision-making: the constitutional-choice level, where normative issues of how a society views itself and its freshwater systems are decided; the collective-choice-level, considered as potentially the most influential as well as the most problematic, where specifics of provision and allocation are

negotiated, and; the operational-choice level, where individuals make decisions about whether, and how, they will use their allocation of freshwater system benefits (Edwards & Steins, 1998; Ostrom, 1990).

Social-ecological-systems (SESs) are here considered as human societies and their supporting freshwater systems, connected through sets of rules that guide interpersonal and inter-group interactions, as well as individual or group interactions with the resource. Social-ecological-systems may be of any scale, and their characteristic of, *inter alia*, investing in the design, implementation, and monitoring of rules whose purpose is to generate and maintain sustainable freshwater outcomes, is of particular interest to this study (Anderies et al., 2004; Janssen & Anderies, 2007; Ostrom, 2008).

1.2 Integrated Water Management

The term integration means ‘to bring together’, and Integrated Water Management (IWM) has been recommended in the environmental management and planning literatures in one form or another since the 1880s (Reisner, 1986; Roche, 1994). The IWM model is comprised of a concept and a process, and as a whole aims to protect or enhance the long-term ability of complex and interconnected land, water, and ecological systems to continue their production of socially desired, multi-dimensional benefits over time (Hooper, 2006; Margerum, 2008). The IWM concept suggests that this aim is best achieved through the consideration of ongoing interactions between selected key elements or subsystems (such as annual floods and attendant soil erosion, for instance), often managed at the scale of the catchment (Blomquist & Schlager, 2005; Mitchell, 2005). For some decades now, IWM has been the preferred approach to institutional design in the natural resources policy literature (Abernethy, 2005; Born & Sonzogni, 1995; Cairns, 1991; Margerum, 1999b; Mitchell, 2005).

Unfortunately, the IWM model has been badly compromised by perverse outcomes for freshwater systems, and by extension, their dependent human and ecological communities. The perverse outcomes have been identified as the result of an ongoing IWM implementation gap, which is a critical and increasingly urgent problem that has begun to call the underpinning concept into question (Biswas, 2004; Hooper, 2006;

Hooper et al., 1999; Margerum & Hooper, 2001; Mitchell, 1997; Ostrom, 1999; Owens et al., 2004).

The IWM *process* is essentially one of quantifying availability and cost of freshwater system benefits, and distributing those multidimensional costs and benefits between competing uses and users through the design and implementation of sets of rules (Hooper, 2006; Margerum & Born, 2000). The IWM process is used to address ‘wicked’ problems: those which have exceeded the capacity of simpler management strategies - the intractable, ‘wicked,’ ‘messes’ and ‘metaproblems’ (Bardwell, 1991; Cairns, 1991; Margerum & Born, 1995; Swaffield, 1998). More specifically, Gunningham (2008, p8) suggests that they are ‘wicked’ because they are of “such a scale, persistency, and complexity as to defy solution”. Therefore, almost by definition, IWM must address problems that are typically characterised by a high degree of diversity within the water resource, its uses, users, and user groups, and the costs and benefits accruing to those individuals or groups. This means that the decision-making process in IWM will be an inherently contested, and politically negotiated, one (Ascher, 2001; Blomquist & Schlager, 2005; Koontz & Johnson, 2004; Rhoades, 2000; Ryan, 2001).

It should be made plain at this point that IWM is *not* the same thing as sustainability, (as demonstrated by, for example, Carter et al., 2005; Margerum, 1999b, 2001, 2008; Margerum & Hooper, 2001; Scrase & Sheate, 2002), even although IWM institutions are designed specifically to generate and maintain sustainable freshwater outcomes. It is, however, the *intention* of IWM institutions (in the form of, for example, policies, plans, and programmes), to generate and maintain sustainable freshwater outcomes (Bakker, 2003; Blomquist & Schlager, 2005; Bruns & Meinzen-Dick, 2005; Dolsak & Ostrom, 2003; Ostrom, 2008). Since the 1980s, efforts to address perverse outcomes from the IWM implementation gap, noted above, have largely focused on the development of a more collaborative (inclusive and deliberative), planning process (Born & Sonzogni, 1995; Hooper et al., 1999; Margerum & Born, 1995; Margerum & Hooper, 2001; Meppem, 2000; Mitchell, 1990; Ryan, 2001; Singleton, 2002). Unfortunately, these efforts are not succeeding (Biswas, 2004; Blomquist & Schlager, 2005; Mitchell, 2005).

1.2.1 Challenges for IWM

Despite the considerable advancements in the processes of decision-making in freshwater planning and management, and of improvement in IWM plan quality and implementation, IWM has become increasingly criticised for its ‘failure’ to reliably generate and maintain sustainable freshwater outcomes (Biswas, 2004; Blomquist & Schlager, 2005; Carter et al., 2005; Healy, 2005; Hooper, 2006). Further, emergent problems facing decision-makers are now considered to exceed the capacity of extant institutional designs (Hajer, 2003; Lovell et al., 2002; Scholz & Stiftel, 2005; Steins et al., 2000).

Paradoxically, issues with institutional design for ‘successful’ IWM are particularly acute in some jurisdictions such as those in New Zealand, Florida, or British Columbia, and which appear to have every IWM advantage (Hooper et al., 1999; Memon & Weber, 2008; Olsson et al., 2006; Scholz & Stiftel, 2005). In this study, I consider IWM advantages to include: extant collaborative (or at least, cooperative) IWM policies, plans, and programmes; abundant freshwater (albeit spatially and temporally heterogeneous), and the technological and physical infrastructure to ensure reliable potable supplies to their populations. Yet these are the very SESs where emergent, polycentric challenges to sustainable IWM outcomes are already beyond the ability of collaborative institutional designs to address in a manner “perceived to be both legitimate and effective” (Hajer, 2003, p. 176). ‘Polycentric’ as applied to IWM challenges and structures is described in greater detail in chapters 3-5. Broadly, ‘polycentric’ IWM is considered in this thesis as: presenting Hajer’s (2003) five preconditions for a good deliberation (locus of decision-making power is unclear; a new multi-scale spatiality to decision-making; a need to re-think the form of citizen involvement; scientific authority has been undermined, and; the context of policy-making is unclear); emerging from ‘failed’ collaborative IWM efforts; having no single decision-making authority, and thus being subject to emergent, self-organising change and actions. In other words, polycentric IWM will be uncontrollable from ‘above’ (i.e., higher levels of decision-making). Polycentric challenges to IWM include the need to coordinate increasingly normative and contested collaborative decision-making at multiple scales, by multiple authorities, on perennial problems. Perennial in this case is used to indicate the tendency of unresolved IWM problems to

become more contested and difficult as time passes, rather than remaining in a stable chronic state.

This incapacity to address polycentric problems is recognised in the wider literature relating to sustainable freshwater governance, as well as the IWM scholarship (Connick & Innes, 2003; Healy, 2005; Ostrom, 2008; Scholz & Stiftel, 2005). The literature is very clear that given the complexity and context-dependent nature of freshwater governance, there is no ‘one way’, or single scale, which can reliably generate and maintain sustainable freshwater outcomes (Bruns & Meinzen-Dick, 2005; Gibson et al., 2000; Guerin, 2007; Lovell et al., 2002; McNeill, 2008). New perspectives are urgently needed, as are new institutional designs capable of their accommodation (Blomquist & Schlager, 2005; Lovell et al., 2002; Ostrom, 2001; Scholz & Stiftel, 2005; Wilson & Bryant, 1997; Yaffee, 1999).

1.2.2 Research Problem

Arising from the IWM implementation gap and resulting unsustainable freshwater system outcomes discussed above, the overarching research problem of interest to this study is therefore that more realistic and conceptually robust perspectives for IWM, along with new approaches to institutional designs, are urgently required (Blomquist & Schlager, 2005; Bruns & Meinzen-Dick, 2005; Connick & Innes, 2003; Hajer, 2003; Healy, 2005; Lovell et al., 2002; Ostrom, 2008).

In response to this problem, two broad areas of interest to this research have been identified from the wider freshwater governance literature.

The first area of interest to this study is the influence of wider institutional arrangements on the outcomes of IWM rules. Institutional arrangements are the ‘operational rules-in-use’, (Ostrom, 1990), which have endured, and ‘accreted’ in an SES over time (Healy, 2005), and can include *inter alia* formal and informal, new and old, rules, social norms and appreciations of water, worldviews, systems of property rights, customs, or laws.

The second area of interest to this study, related to the first, is the complex adaptive process (whereby systems ‘learn’ through experience of failure), of social freshwater sustainability transformation from an exploitative freshwater appreciation to a conservationist one, as a key driver for ‘successful’ (i.e. sustainable) IWM outcomes. A social sustainability transformation is defined in this thesis as essentially the change in a society’s appreciation of the freshwater system from one that considers it as ‘limitless’ to one that understands the importance of its conservation.

As stated above, the first area of interest for this study is the influence of institutional arrangements on the outcomes of IWM rules. It has become increasingly apparent that freshwater institutions are neither crafted, nor operate in a social vacuum (Blomquist, 1992), and are “seldom politically innocent” (Singleton, 2002, p. p71). On the contrary, IWM rule-sets are only one part of the wider institutional arrangements which guide freshwater decision-making in an SES (Blomquist & Schlager, 2005; Connick & Innes, 2003; Healy, 2005; Memon & Selsky, 2001; Olsson et al., 2006; Ostrom, 2008). It is increasingly argued that it is, in fact, the wider institutional arrangements of an SES which will generate emergent patterns of interaction and outcomes, perverse or sustainable, from the *intention* of IWM institutions (Bakker, 2003; Blomquist & Schlager, 2005; Healy, 2005; Memon & Selsky, 2001; Ostrom, 2008; Steins & Edwards, 1999a). This perspective promotes consideration of the influence of institutional arrangements on institutional design for IWM, and evaluation of IWM outcomes (Anderies et al., 2004; Connick & Innes, 2003; Healy, 2005; Memon & Skelton, 2007; Ostrom, 2001, 2008; Owens, 1997; Woolley & McGinnis, 1999; Young, 2002).

Following on from the above, the second area of interest to this research on IWM is the closely related complex adaptive process of social sustainability transformation, with respect to freshwater systems (identified from ideas including those from: Janssen & Anderies, 2007; Olsson et al., 2006; Ostrom, 1999, 2001, 2008). In this study, I will identify the social sustainability transformation as a crucial and non-substitutable driver for ‘successful’ IWM outcomes. Analysis of IWM literature from a complexity thinking viewpoint suggests that IWM has been “failing” to address increasingly wicked problems. Hence, in this study I will argue that when IWM is viewed as a process of social learning (a complex adaptive process), this increasing

wickedness of IWM problems arguably also suggests that IWM may, in fact, be working reasonably well.

Broadly, in this thesis I will argue that long-term failure to transform social appreciation of freshwater systems is typically the outcome of successful use of avoidance tactics, e.g., the use of more efficient technology, or even better coordination of uses through IWM. Unfortunately, this means that unsustainable social appreciations of water have been reinforced, and further embedded in the society as an institutional arrangement, which is more difficult to change than a simple rule, such as granting water consents. This obviously creates a feedback loop, through which the initial problem has become a more wicked challenge for the next cycle of social learning and development. In each successive cycle of 'failed' IWM, the freshwater sustainability gap will be larger, and more difficult and costly to close. Thus, the whole system becomes less robust, and more vulnerable to disturbance (Healy, 2005; Janssen & Anderies, 2007; Olsson et al., 2006; Ostrom, 2001). This is described by Olsson et al., (2006, p8) as a process whereby "the costs of maintaining the current system continue to mount, the natural resource base is degrading further, and the regional economy is becoming increasingly brittle". Brittle is here used as the antonym for robustness: the ability of any system to withstand disturbance, arising either internally or externally. Where a region's economy is concerned, brittleness therefore refers to the degree to which the region is 'locked in' to a particular sector or economic driver.

The scenario of increased costs, a degrading resource base, and an increasingly brittle regional economy, described above, certainly appears to be the case in New Zealand generally, and in the Canterbury Region in particular. As already noted, New Zealand is one of the jurisdictions worldwide where IWM has failed to generate and maintain sustainable freshwater outcomes. The IWM situation in New Zealand is overviewed in the following section.

1.3 IWM in New Zealand

New Zealand is a small island nation comparable in size to the UK or the State of Colorado with little more than 4 million people, ("Statistics New Zealand," 2009

accessed 5th Dec 2009). The country lies approximately 2,000km south-east of Australia, and enjoys plentiful rainfall, although this is unevenly distributed across the country and over annual cycles. New Zealand is ranked 12th out of 193 countries for its abundance of freshwater. Yet, per capita water demand is 2-3 times higher than other OECD countries (MfE, 2009a)

New Zealand would seem to have every IWM advantage, particularly including low population density, plentiful freshwater, and the technological, physical, and institutional infrastructure to make the best advantage of these. However, the country is on a highly unsustainable trajectory of socio-economic pressures on freshwater systems (National Policy Statement for Freshwater, 2009; OECD, 2007; MfE, 2008; Barnett & Pauling, 2005). Furthermore, New Zealand is experiencing exactly the type of emergent polycentric water governance challenges that are of particular interest to this study. These include multiple normative values of freshwater benefits, multiple decision-making authorities, and multiple governance scales. At the regional scale, IWM challenges are particularly notable in the Canterbury Region in the South Island. In Canterbury, a number of contributing factors have conspired to create a very wicked problem indeed (Memon, 2008a; Memon & Weber, 2008; Painter et al., 2008; Rodgers, 2009).

1.3.1 New Zealand's Resource Management Act, 1991

The Resource Management Act 1991 (henceforth RMA), as New Zealand's national-scale IWM rule-set, is a world-leading and internationally admired mandate for devolved, catchment-based regional governance (Crawford, 2007; Ericksen et al., 2003; Memon, 1993). This is to be achieved through 'the integrated management of natural and physical resources' ("Resource Management Act," 1991 Pt4, s. 30 (1)) by locally elected Regional Councils, in order to 'promote sustainable management' ("Resource Management Act," 1991 Part 2 s. 5 (1)). Unfortunately, the RMA has not succeeded with respect to freshwater systems (MfE, 2008; OECD, 2007; Resource Management (Simplify and Streamline) Amendment Bill ", 2009).

There is a wealth of literature on IWM in New Zealand, and on the RMA in particular (a small selection of this includes: Burton, 1995; Cocklin & Blunden, 1998; Crawford, 2007; Cullen et al., 2006; Ericksen et al., 2003; Hooper, 2006; Jackson & Dixon, 2007; Memon, 2008a; Memon & Skelton, 2007; Oram, 2007; Rodgers, 2009; Salmon, 2007; Tipa & Welch, 2006; Valentine et al., 2007; Wheen, 1997; J. Williams, 2006). Issues such as lack of vision, lack of political will, shortfalls in leadership, and in capacity, are already widely acknowledged as central to the failures of the RMA in freshwater governance. However, these issues cannot be addressed through the narrow confines of IWM institutions or their planning processes. These are problems whose roots lie within the broader social scope of institutional arrangements.

Studies have yet to address the origins and processes of multi-scale emergence of polycentric IWM in New Zealand. In particular, the analysis of the way that New Zealand's institutional arrangements have compromised the sustainability intention of the RMA (as IWM rules) from a perspective of cycles of complex adaptive change in SESs at multiple scales, are yet to be undertaken. This study intends to contribute to these topics.

1.4 Research Aims and Objectives

Following on from the above discussion, the two aims of this thesis are as follows. The first aim is to reconceptualise IWM to provide a more robust theoretical understanding of its elements, processes and problems. Related to this, the second aim is to employ that understanding to inform an analysis of the role of institutional arrangements in IWM outcomes in New Zealand, under the RMA.

In order to analyse the causes and extent of the IWM implementation gap in New Zealand (or any other country for that matter), I need to analyse the way that the multi-scale IWM institutions within the RMA framework have interacted with the wider, multi-scale institutional *arrangements* of the society, to generate the current overlapping and interacting problems at national, regional, and local scales. A problem for IWM is the multi-dimensional domain, or extent, of the freshwater governance problem under consideration (Giordano, 2003; Margerum & Born, 2000).

In order to achieve the two aims of this study as proposed above, I must fulfil the following four broad research objectives:

- The first research objective is the search for more realistic and conceptually robust theoretical underpinnings for IWM.
- Based on this, the second objective is the development of an evaluative framework for the re-conceptualised IWM process.
- The third objective is the employment of the evaluative framework in the multi-scale case study analysis of the role of institutional arrangements in IWM outcomes in New Zealand.
- The final research objective for this thesis is to identify insights arising from the study, and to draw conclusions on:
 - a) The theoretical underpinnings for re-drawn IWM;
 - b) The evaluative framework, and;
 - c) The influence of key institutional arrangements on IWM outcomes in New Zealand, and some suggestions towards improved future outcomes.

1.5 Methods

This study employs a qualitative, purposively constructed multi-scale case study of institutional arrangements for IWM in New Zealand. The multi-process evaluative framework for IWM, developed in Chapter Four, will be used in three ways. Firstly, it will be used to identify key institutional arrangements, and analyse their roles in the emergent polycentric IWM problems at the national, and regional/local, scales. Secondly, it will be used to seek evidence of historical origins of the institutional arrangements identified as problematic. Thirdly, this information will inform analysis of the New Zealand freshwater sustainability transformation process, and the wider question of why sustainable freshwater outcomes from IWM have been so elusive in New Zealand, and other similar jurisdictions. Data was collected from multiple published and unpublished sources, including government documents, national statistics, books, peer-reviewed articles, media reporting and personal interviews. Collected data was analysed using the increasingly recognised technique of crystallisation (Denzin & Lincoln, 2003; Maree et al., 2009; Miller & Crabtree, 1999). Crystallisation is described in greater detail in the following chapter, but may be

summarised as, “consist[ing] of the analyst’s prolonged immersion into and experience of the text and then emerging, after concerned reflection, with an intuitive crystallisation of the text. This cycle of immersion and crystallisation is repeated until the reported interpretation is reached” (Miller & Crabtree, 1999, p. 19).

1.6 Thesis Overview

The remaining chapters in this thesis address the research problem, aim, and objectives as follows. Chapter Two presents the methods used in this study. Chapter Three presents a critique of the IWM literature on the origins, attributes, and challenges to sustainable IWM freshwater outcomes.

Then, in Chapter Four, I turn to the wider literature on freshwater governance, seeking insights to help address the IWM challenges from related perspectives. I note a theoretical convergence within the IWM, Commons Theory, and complexity thinking approaches, regarding the attributes of collaborative planning and decision making. This can help to improve conceptual and practical understanding of IWM and its challenges. The identification of convergent insights from all three perspectives (IWM, Commons, and complexity thinking) enables me to develop a more robust, re-framed model of what I term in this study collaborative IWM. From these contributing literatures, collaborative IWM is considered primarily as a process of social change and collective re-negotiation of different types of property rights, rather than being necessarily confined to ‘rational’ allocation processes for freshwater.

However, although arguably more robust, I argue that this collaborative IWM model remains inadequate for polycentric challenges (as outlined in section 1.2.1), internationally or in New Zealand (Connick & Innes, 2003; Hajer, 2003; Healy, 2005; Janssen & Anderies, 2007; Ostrom, 2001, 2008; Scholz & Stiftel, 2005).

Chapter Five addresses these challenges through a more critical consideration of three main questions raised in earlier chapters. Why have sustainable IWM freshwater outcomes been so elusive in jurisdictions such as New Zealand? What is the role of institutional arrangements in IWM outcomes? And, how do IWM problems in countries like New Zealand exceed the capacity of current institutional design to

address them? In Chapter Five, I propose a conceptual synthesis for IWM that addresses these challenges.

In Chapter Six I will develop an evaluative framework for the re-drawn IWM process, able to analyse the emergence and processes of polycentric IWM as the most currently problematic area in the literature. In particular, the focus of this framework is on the way that the intentions of IWM institutions have been compromised by the society's broader institutional arrangements, generating perverse IWM outcomes.

In Chapter Seven I will apply the evaluative framework to the New Zealand national-level SES (as a single jurisdiction that invests in the design of rules whose aim is to promote sustainable management of freshwater systems), during the IWM cycle of the RMA (1991-2009). Chapter Seven has three main sections. In section 7.2, I will identify the current national-scale IWM outcomes as a polycentric IWM problemshd. In section 7.3, I will identify particularly problematic institutional arrangements. I will then analyse the role of those problematic institutional arrangements in the compromise of the RMA intention at the national scale of freshwater governance (section 7.4).

I will then re-focus the framework to evaluate the regional/local case study of Te Waihora/Lake Ellesmere and Canterbury Region, during the same period (Chapter Eight). The same process is used in this chapter as in the previous one. A polycentric IWM problemshd, and particularly heavily implicated institutional arrangements, are identified. The problematic institutional arrangements are then analysed from the perspective of their influence on the IWM outcomes of the RMA in Canterbury, and for Te Waihora/Lake Ellesmere.

In Chapter Nine I present an analysis of the historical origins of the problematic institutional arrangements, identified in Chapters Seven and Eight. Firstly, I seek evidence to suggest that these are institutional sediments (Healy, 2005), and the result of many cycles of avoidance, as expected from the synthesised conceptual perspective of IWM developed in Chapter Five. Secondly, I consider the role of the problematic institutional arrangements in New Zealand's, potential multi-scale SES freshwater sustainability transformations.

In Chapter Ten I will first reflect upon and discuss the study findings, from the theoretical perspective of IWM argued for in Chapter Five. I will then present the conclusions of this study, including study strengths and shortcomings, suggestions for future research, and suggestions for future institutional arrangements for IWM in New Zealand.

2 Research Methods

2.1 Chapter Introduction

In this chapter, I present the methods employed in order to achieve the research aims. Following this broad introduction, the conceptual perspectives from which analysis is undertaken are developed and discussed in Chapters Three, Four, and Five. Framework elements that directed data collection are listed in section 2.3.1, and are detailed in Chapter Six. The following sections present the qualitative, and thus “inherently multi-method” (Denzin & Lincoln, 2003, p. 5) research approach used in this study.

Broadly, the following steps were undertaken. Firstly, a more theoretically robust model of collaborative IWM was identified through a comparative analysis of theoretical freshwater governance perspectives (detailed in Chapter Four). This model also identifies key polycentric IWM challenges, as the currently most problematic area. These polycentric challenges to collaborative IWM and sustainable freshwater outcomes are addressed through a conceptual synthesis in Chapter Five. The multi-process evaluative framework for re-drawn IWM, developed in Chapter Six, is then tested through its use as a guide in the analysis of a purposively constructed, multi-scale case study. Institutional arrangements for IWM in New Zealand at the national scale, and at the regional/local scale in the case of Te Waihora/Lake Ellesmere in Canterbury, were selected as especially wicked, interconnected examples of the emergent polycentric IWM challenges that are of particular interest to this research, and thus as a good trial of the framework’s capacity ‘in the field’. In these analyses reported in Chapters Seven and Eight, the evaluative focus is on the IWM process, and specifically on the influence of institutional arrangements on IWM outcomes. Following this, in Chapter Nine the focus of the evaluative framework is directed towards analysis of the historical origins of the currently problematic institutional arrangements. Finally, I employ the insights crystallised from the above analyses to consider the implications for New Zealand’s national, Canterbury’s regional, and Te Waihora/Lake Ellesmere’s local SES freshwater sustainability transformation processes, reported in Chapter Ten.

2.2 Research Methodology

As already stated, this research employs a qualitative, multi-scale (including time) case study approach. As I have noted above, multiple methods are inherent within the qualitative paradigm, and

“the combination of multiple methodological practices, empirical materials, perspectives, and observers in a single study is best understood, then, as a strategy that adds rigour, breath, complexity, richness, and depth to any inquiry” (Denzin & Lincoln, 2003, p. 5).

A case study attempts to achieve a ‘holistic understanding’ of a phenomenon as it plays out, through the multiple sources of data and in-depth investigation noted above, providing a richness not available to surveys (Becker, 1998; Davidson & Tolich, 2003; Johnson, 2004; Lofland et al., 2006; Margerum, 2001). In particular, the qualitative paradigm has been selected because of its capacity to “grapple with complexity and pluralism”, and its focus on relationships (Davidson & Tolich, 2003, p. 123). Margerum (2001, p. 422) further suggests that “...the complexity of the phenomenon being studied [may] necessitate an iterative approach to the research analysis”. In line with complexity thinking, introduced in the previous chapter, qualitative research adopts the perspective that “no problem can be understood or solved in isolation from its greater environment. This is most simply expressed in the belief that ‘the whole [under analysis] is greater than the sum of the parts’ “ (Tolich & Davidson, 1999, p. 27). Evaluation research customises widely-used research methods to address context-specific issues (Davidson & Tolich, 2003), as described in the following sub-section. Typically addressing questions of why rather than how, evaluative research attempts to address specific real-world problems and facilitate goals in the field, and is often employed to analyse policy or management programme effectiveness (Ellingson, 2008).

2.2.1 Crystallisation and Normative Analysis

The flexibility in qualitative research to accommodate and integrate sometimes rapidly changing situations through adaptation of research focus, is supported by its

proponents as a valuable attribute. On the other hand, this flexibility is criticised by quantitative researchers as lacking rigour or repeatability, and of being affected by unidentified (or implicit) researcher bias (Agrawal, 2002; Davidson & Tolich, 2003). As I will discuss in future Chapters, because IWM in collaborative and emergent polycentric IWM problems is increasingly recognised as a-rational, or normative, any study findings will necessarily be open to multiple interpretations. In other words, in such analyses, “objective reality can never be captured. We know a thing only through its representations” (Denzin & Lincoln, 2003, p. 5).

Crystallisation is an emerging and increasingly recognised extension of the widely-employed triangulation approach. Triangulation aims for the reduction of ‘unreliability’ inherent in qualitative research, through development of greater “interpretative validity” and the confirmation of “data trustworthiness” (Maree et al., 2009, p. 34). This is achieved through the use of multiple collection methods to identify the same data (or information) from multiple sources (perspectives of reporting), since this reduces the risks of either “chance associations [or] systematic biases” (Ibid, p34).

Crystallisation, then, may be considered as an extension of the triangulation technique, developed as an interface between the more positive ‘hard’ Natural Science, and normative social science humanities and/or Arts (Denzin & Lincoln, 2003; Ellingson, 2008; Maree et al., 2009; Miller & Crabtree, 1999). The increasingly recognised status of IWM as both Art and Science in the literature supports this approach (Blomquist & Schlager, 2005; Guerin, 2007; Gunningham, 2008; Healy, 2005; Jones, 2002; Laerhoven & Ostrom, 2007; Margerum & Whithall, 2004; Olsson et al., 2006; Ostrom, 2008; Steins et al., 2000). As with the challenges of institutional design for IWM noted in subsection 1.2.1, crystallisation acknowledges that there is “no one ‘correct’ telling of [an] event” (Denzin & Lincoln, 2003, p. 6). Rather, ‘intuitive’ crystallisation, as the result of reflective and iterative consideration of a subject from multiple perspectives, (sometimes drawn from multiple genres) “provides us with a deepened, complex, thoroughly partial, understanding of the topic. Paradoxically, we know more and doubt what we know. Ingeniously, we know that there is always more to know” (Richardson, 2000, c.f. Ellingson, 2008, p. 3).

This research adopts the more constrained immersion/crystallisation approach advocated by Miller and Crabtree (1999),¹ rather than the multi-genre crystallisation approach advocated by Ellingson (2008). The crystallisation of insights from the analysis of institutional arrangements for IWM in New Zealand was therefore an iterative, reflexive why and how process, including:

- Real-world problem observation (e.g. why is the RMA under review? why is Canterbury experiencing such wicked problems? Why is Te Waihora/Lake Ellesmere considered to be so degraded?);
- Identification of gaps in IWM literature and practice (e.g. the need for new perspectives to address emerging polycentric IWM problems), and the identification of theoretical convergence for collaborative IWM;
- Synthesis of theoretical perspective and analytical framework (How can the emergence of polycentric IWM be better understood and analysed, as an effect of institutional arrangements on the sustainability intention of IWM rules? From which perspective does a crystallisation/consilience occur?);
- Researcher observation of IWM practices in New Zealand, and the development of long-term informal relationships with individuals operating across a wide scale of national, regional, and local sectors. These include, for example: farming; facilitation of institutional design, and the interpretation, implementation, and evaluation of the resulting rule-sets; Environmental Law, or; sports and recreation.
- Multi-scale evaluation of institutional arrangements for IWM in New Zealand, and analysis of empirical results (How have polycentric IWM challenges, nationally, regionally, and for Te Waihora/Lake Ellesmere, come about?);
- Reflection on empirical results, and generation or identification of insights, and;
- Adjustment (e.g. how do insights affect the real situation, and/or the theoretical perspective? why are they important?).

It should be noted, however, that in keeping with the ideas of the crystallisation process, these were not always addressed in the above linear order.

¹ cited in section 1.5 as “consist[ing] of the analyst’s prolonged immersion into and experience of the text and then emerging, after concerned reflection, with an intuitive crystallisation of the text. This cycle of immersion and crystallisation is repeated until the reported interpretation is reached” (Miller and Crabtree, 1999, p19)

2.3 Case Study Design: A Multi-scale, Interacting, IWM Wickedness

As I have noted above, the case study in this thesis has been purposively selected in order to offer a prime example of the wickedness inherent in IWM, within and across multiple scales of SES. The decision to select what is arguably one of the most complex and fiercely contested governance nestings in New Zealand is related to the untested nature of the evaluative framework and its underpinning conceptual perspective. In particular, as has been noted in the literature, it is increasingly important for any evaluative framework, and analysis, of inherently imbricated (meaning overlapping and interacting, Gunderson and Holling, 2002) SESs to be able to move with ease across and within multiple levels of governance (Blomquist & Schlager, 2005; Edwards & Steins, 1998; Gibson et al., 2000; Healy, 2005; Ostrom, 1990, 1999). Thus, the case study of New Zealand's IWM wickedness and emergent multi-scale polycentric challenges was constructed to focus on three key levels of decision-making in that nation. Specifically, these were the national scale SES, the Regional level SES as represented by Canterbury, and the local scale as represented by Te Waihora/Lake Ellesmere. The main focus for analysis was on the period between 1991 and 2009 (termed in this study the RMA cycle). The exception to this is the Creech Report, released on the 18th of February, 2010, and its surrounding context. Although released immediately prior to submission, this document was considered to be too significant, and too influential to the evaluation here undertaken, to omit.

Analysis of each level of SES within the overall case study has brought its own results and conclusions. These have then been used to refine the research questions for the following SES level, as well as reflect upon the implications for the SES under analysis. These imbricated, particularly wicked SESs, together with an historical consideration of their social underpinnings, together offer an integrated, single package, reflecting governance challenges at each scale of IWM decision-making.

As I will discuss in greater depth in Chapter Four, hidden contexts and hidden agendas are implicit within the whole topic of freshwater governance (Connick & Innes, 2003; Healy, 2005; Singleton, 2002; Steins & Edwards, 1999a). Thus it is the detailed nature of case studies (rather than statistical generalisation), that makes them ideally suited to analysis of emerging behaviours and theories (Davidson & Tolich, 2003). Case studies are not readily transferable, but then, despite Hooper's (2006, p1) definition of IWM as a "unified process", neither is IWM (Hooper et al., 1999). However, a sufficiently generic framework for evaluation remains a requirement for individual IWM case studies, as well as for comparative analysis across cases, to continue the development of the framework (Adams et al., 2002; Agrawal, 2002; Edwards & Steins, 1998; Laerhoven & Ostrom, 2007). It is hoped that as a generic evaluative tool, the framework developed in Chapter Six and applied in the New Zealand context to the national-scale SES, and in regional/local-scale SESs, can contribute in this respect.

2.3.1 Data Collection Methods

The collection of data focused upon the following main framework elements (see Chapter Six in particular, for a detailed description), as they pertain to each scale of interconnected SES:

- External (higher scale SES) and historical contexts (the existing 'institutional sediments' Healy, 2005);
- Internal contexts, comprising the resource characteristics, the extant IWM rule-sets, and the characteristics of user-groups;
- Key institutional arrangements, such as laws, markets, cosmologies, or socially accepted customs;
- Emerging patterns of resource exploitation and cumulative levels of multi-dimensional resource use, and;
- Resource, institutional, and social outcomes, together comprising the IWM outcomes for the SES under analysis.

Data was collected from multiple published and unpublished sources, including: government documents; Laws, policies, plans and methods at multiple scales; peer-reviewed articles; books; national statistics; committee minutes; media reports;

researcher observation, and; personal interviews. I have already noted the deliberate selection of particularly wicked SESs in the construction of the multi-scale IWM case study through which the evaluative framework was tested. Naturally, the selection of data sources was subject to the same question of potential to provide information most relevant to the research questions. The selection of interview respondents was also carefully considered, particularly in order to provide the richest contextual insight to: positive support in the development of a collaborative IWM process, and the emerging polycentric IWM challenges at multiple scales; and the broadest range of Te-Waihora/Lake Ellesmere management perspectives, with greatest experiential depth and familiarity. Interview respondents were therefore selected from the following groups: Community Trusts (Water Rights Trust and Waihora Ellesmere Trust); practising IWM facilitators in Canterbury; research scientists; academia (in particular, the facets of environmental management, policy, and law); Environment Court Judges; mixed farming businesses; Ngai Tahu; Environment Canterbury (council and executive), and; Fish and Game.

It is clear from the above list that several key perspectives have been omitted from this set of respondents. These include, for example, Ministry for the Environment, Federated Farmers, and Fonterra (a highly successful dairy cooperative), for example. Although these actors represent a significant aspect of the problemshed, it was decided to follow Anderies et al (2004) and Janssen and Anderies (2007), and to focus on SESs where stakeholders had already invested time and resources on collaborative planning. Also, in light of the untried status of the framework, and the inherent wickedness of the case study examples, as Connick and Innes (2003) suggest, ‘failures’ were left as a topic for another time. This study has focused attention on those who have actively helped to drive the development of new polycentric IWM governance practices for New Zealand, and particularly for Te Waihora/Lake Ellesmere, and for Canterbury Region.

2.3.2 Personal Interviews: Ethical Considerations

The protection of participant confidentiality and wellbeing is, of course, a critical part of any social science. Accordingly, before any interviews were undertaken or

participants approached, the Ethics Guidelines of Lincoln University were consulted. In light of these guidelines, and after consultation with the supervisory team, it was decided that since interview respondents were being questioned in their capacity as public figures (as representatives of their affiliated organisations, and not as ‘individuals’, *per se*), ethical clearance would not be required for this study.

This chapter has provided the details of the research approach employed in this thesis, and the emergent crystallisation of insights. Results from this research can help to explain why sustainable freshwater outcomes have been so elusive in New Zealand. They can also help to develop a theory to explain the origins and processes of emergent, multi-scale polycentric IWM problemsheds. It is hoped that the study will contribute to the development of a more realistic and robust model for IWM, as called for in the literature. The next chapter, (Chapter Three), critiques the IWM literature and describes the concept, procedural development, collaborative planning process, and the polycentric challenges to IWM, as currently portrayed.

3 Origins and Attributes of IWM

3.1 Chapter Introduction

As noted in section 1.2, Integrated Water Management (IWM) approaches the wicked policy problems of providing and allocating limited, valued freshwater resource system benefits, and their associated costs and responsibilities, in two ways:

- The **concept** of integration, and;
- The **process** of integrated management, (Born & Sonzogni, 1995; Carpenter et al., 1999; Hooper, 2006; Hooper et al., 1999; Margerum, 1999b, 2008; Margerum & Born, 1995; Medema et al., 2008; Mitchell, 1997; Yaffee, 1999).

The purpose of this chapter is to critique the IWM concept (section 3.2), the development of IWM process as portrayed in the literature (section 3.3), and to specify the challenges to IWM that will be addressed in this research (section 3.4).

3.2 Integration as a Management Concept for Freshwater Systems

As stated in Chapter One, IWM has been advocated in the water management literature in one form or another since at least the late 1800s (Reisner, 1986; Roche, 1994). In its current form, the concept of Integration was developed during the late 1970s and early 1980s in response to the ‘narrow, sectoral, and uncoordinated’ (Born & Sonzogni, 1995; Cairns, 1991) planning failures of single resource/single benefit productivity maximisation, and the ‘impossibility’ of comprehensive environmental management (Bartlett, 1990; Born & Sonzogni, 1995; Margerum & Born, 1995; Mitchell, 2005; Slocombe, 1993; Yaffee, 1999). Achieving a balance between these management extremes remains an ongoing problem, and Mitchell (2005, p. 1342) has noted that there remains a driving need for balance between breadth of management (arising from the comprehensive approach) and depth of management (arising from a sectoral approach), in order to avoid what he terms “profound superficiality”.

As a concept, integration aims to maintain desired environmental system functions through attention to key elements or subsystems, which are essential to the continuing productivity and wellbeing of the system whole. Integration as a concept has become widely accepted, and the idea of identifying critical subsystems for management of a wider whole, has endured for over a century as a robust and pragmatic approach to maintaining overall system health in highly complex, interconnected, and lamentably unpredictable natural resources, where information demands exceed the capacity of management systems (Bellamy et al., 1999; Born & Sonzogni, 1995; Bührs, 2009; Hooper, 2006; Hooper et al., 1999; Margerum, 1999b; Margerum & Born, 1995; Mitchell, 1997).

3.3 The Development of IWM Process

The process of IWM has two elements, the substantive (the ‘what gets done’) and the procedural (the ‘how it gets done’), described in the subsections below. The IWM literature has increasingly discussed these IWM process elements in terms of the planning process (plan development and implementation) for management of freshwater systems. The literature now defines IWM as a single, or unified, process that can result in collaborative and integrated management plans, designed to generate and maintain sustainable freshwater outcomes (Cardwell et al., 2006; Davis & Threlfall, 2006; Hooper, 2006; Medema et al., 2008; Mitchell, 2005).

3.3.1 Substantive Attributes of IWM

One widely cited definition of the substantive elements (the ‘what’ of integration), defines them as:

- “A holistic approach, that considers the entire system rather than certain elements of subcomponents, and
- Acknowledges interconnections in both the physical and human systems.
- Is goal-oriented or focused on end points, and
- Strategic, which includes focusing analysis early and biasing planning toward implementing actions” (Margerum, 1999, p152).

There is an obvious paradox implicit within a holistic perspective (acknowledging that the whole being managed is greater than the sum of the parts) employing a process of rational reduction to identify elements for management. In Integration, this

tension is understood to be accommodated by the expectation that trade-offs will be central to management (Blomquist & Schlager, 2005; Margerum & Hooper, 2001). Unfortunately, there is widespread agreement that making trade-offs is one of the most difficult tasks in IWM (Margerum, 1999b, 2008; Margerum & Hooper, 2001; McGinnis, 1999). The types of trade-offs that are made, the perspective from which criteria are considered, decision-makers authorised, and decisions reached and implemented, are critical social challenges to the implementation of any management concept (Margerum & Born, 2000; Steins & Edwards, 1999; Steins et al., 2000).

3.3.2 Procedural Attributes of IWM

Procedural aspects of IEM address the way in which the substantive elements are achieved and implemented. Despite the general acceptance of the concept, the procedural elements have been slow to emerge, and despite much work, have remained difficult to identify (Born & Sonzogni, 1995; Hooper et al., 1999; Margerum, 1999b; Margerum & Born, 1995). There are many reasons for this, including the complexity, difficulty, and contestation inherent within the process, and the vast range of contexts in which IWM operates. Another reason is that decision-making processes have been changing from the regulatory origins and technical solutions of three decades ago, to the now more often employed art of political negotiation (Connick & Innes, 2003; Hajer, 2003; Healy, 2005).

Over the last four decades, the procedural attributes of IWM have changed significantly from coercive, to cooperative, to collaborative, and now must develop further, to accommodate emerging polycentric challenges. Broadly, the process of planning for IWM may be either coercive (such as the early technical-rational ‘command and control’ approaches to point source pollution) or cooperative (Ericksen et al., 2003). Coercive processes continue to be highly successful at resolving ‘objective’ issues such as point source pollution. However, ‘command and control’ through centralised direction was unable to address the more normative aspects of IWM, such as competition between uses (Born & Sonzogni, 1995; Margerum & Born, 1995). Cooperative processes for designing and implementing rules worked well for issues that could be resolved through the coordination of multiple uses, but were unable to address the more difficult topic of cumulative effects, or wider social issues

underlying the allocation of multi-dimensional resource benefits between users (Ericksen et al., 2003; Mitchell, 1997).

The category of cooperative IWM, in turn, can be further defined as what I label in this study as either collaborative IWM or polycentric IWM. Collaborative IWM processes were developed in response to cooperative difficulties noted above, but have struggled to cope with emerging polycentric challenges (Hajer, 2003; Ostrom, 2001; Scholz & Stiftel, 2005). In this study, I consider collaborative IWM as organised around a single decision-making authority. Polycentric IWM, on the other hand, is based not on a single decision-making authority, but on many. These will be of differing jurisdictional or physical scales, extent of decision-making power, degrees of social development, or sectoral interest, and some should be expected to be in direct conflict with others (Blomquist & Schlager, 2005; Hajer, 2003; McGinnis, 1999; McNeill, 2008; Ostrom, 2001). Ostrom (1999) notes that it is not possible to understand polycentric systems from the perspective of an organisation with a central director. As I will demonstrate in later chapters, the nature of the problemshed for polycentric IWM means that this process will need to simultaneously employ various SES-dependent procedural approaches to IWM planning for the management of multi-dimensional, multi-use competition between users. Furthermore, the IWM planning process will be repeated within and between every one of the multiple SESs present in polycentric systems, which exist across and over multiple jurisdictional scales (Berkes, 2002; Blomquist & Schlager, 2005; Gibbs & Bromley, 2003; Gunderson & Holling, 2002; Hajer, 2003; Scholz & Stiftel, 2005).

As currently portrayed in the literature, IWM is a context-dependent, collaborative approach to the coordination of human activities and interactions within a defined freshwater system. Two aspects are addressed in this approach. The first is the protection or enhancement of the long-term productive capacity of the freshwater system, over the widest possible range of socially desired, freshwater resource system functions and benefits. The second is the equitable distribution of those benefits, and their costs (allocation). Ongoing, long-term interaction and information exchange, based on trust, personal honour, and mutual respect between the different stakeholder representatives and decision-makers is therefore the key to collaborative planning for the coordination of a diverse range of management agencies, stakeholders, policies or

laws, and actions, towards consensually agreed goals (Abernethy, 2005; Blomquist & Schlager, 2005; Born & Sonzogni, 1995; Cardwell et al., 2006; Ericksen et al., 2003; Hedelin, 2007; Hooper, 2006; Margerum, 2008; Margerum & Born, 1995; Mitchell, 2005; Singleton, 2002; Tortajada, 2003; Weber & Khademian, 2005).

As collaboration has “begun to supplement, if not actually substitute for more traditional forms of governance” (Connick & Innes, 2003, p. 178), the number and type of stakeholders involved has expanded, and collaborative processes now require more structured methods of information exchange and decision-making processes (Margerum, 2008; Margerum & Born, 2000). For collaborative IWM, the following procedural elements of plan development and implementation, recommended in the literature, are briefly described below (Hooper, 2006; Hooper et al., 1999; Margerum, 1999b; Margerum & Born, 2000; Margerum & Hooper, 2001; Memon & Weber, 2008).

- **Initiation:** a current or future problem is experienced or identified, and defined, and an agenda is developed.
- **Problemshd definition:** The role of this element is to make explicit, and develop agreement on three main topics. These are: the need for IWM; the multi-dimensional scope of the problemshd, and; the contexts from which the problemshd needs to be understood, in order to consider potential institutional designs to address it.
- **Resourcing for collaborative plan development and implementation:** This element often operates continuously over the whole planning process, and where it extends to the alteration or renegotiation of property rights, this element is typically a vigorously contested issue than can represent the overall IWM process.
- **Coordination of the collaborative planning process:** This is viewed as the core of IWM. The structures and processes for decision-making, particularly with respect to communication, and the sharing of information, are designed to coordinate the multi-SES (including government agencies) development of the IWM plan.
- **Outputs:** The IWM policy, plan, or programme, is the expected IWM institutional output. This should describe clear management goals, including

agreed criteria for the evaluation of the attainment or otherwise of those goals, and time-frames in which they will be reached.

- **Outcomes:** These are expected to include sustainable or improved levels of multi-dimensional freshwater resource system use. Other IWM planning outcomes identified in the literature include: the development of social learning, stakeholder familiarity, common goals, and mutual understanding; that committees assert their role in management activities; that resources are available for implementation; that there is public support for implementation actions, and; that implementation begins immediately, to build confidence and momentum (Bellamy et al., 1999; Blomquist & Schlager, 2005; Cardwell et al., 2006; Connick & Innes, 2003; Crawford, 2007; Ericksen et al., 2003; Hedelin, 2007; Hooper, 2006; Hooper et al., 1999; Margerum, 1999b; Margerum & Born, 2000; Margerum & Hooper, 2001; Medema et al., 2008).

3.4 But Good Process Does Not Equal Desired

Outcomes: Challenges to ‘Successful’ IWM

Unfortunately, as already noted, these significant improvements to the collaborative planning process in IWM have not been adequate to reliably generate sustainable freshwater outcomes. Three interdependent barriers to IWM have been identified from the literature as of particular interest to this study. These are: the perennial nature of IWM problemsheds; the presence of imbricated scales and multiple dimensions, and finally; the increasingly vigorous but normative contestation over definition of multi-dimensional resource system values, benefits, and costs, within and between SESs (Blomquist & Schlager, 2005; Gibson et al., 2000; Kerr, 2007; Owens et al., 2004).

3.4.1 Perennial Problems

As stated in section 1.2, wicked problems are those that have exceeded the capacity of more straightforward attempts to manage them. They typically offer high levels of uncertainty, involve multiple competing uses and users over multiple dimensions including time, and are perennial. The term perennial is used here rather than persistent, since it better describes the unrelenting tendency of IWM problemsheds to

become both more crowded within any given dimension, and to expand over multiple dimensions through time; generally as a result of continuing increases in socio-economic pressures. Persistent implies a chronic, but steady state problem.

The perennial nature of IWM problems is a critical issue that needs clear acknowledgement from the outset. Dealing with a problem that can never be 'resolved', but that must be periodically re-stated to keep pace with its changing context, offers a different perspective for analysis than that which may be used in a 'finite' situation. What is needed is a sound generic framework for decision-making that can help managers, stakeholders, and users to manage as best they can at the time with the tools available to them, accepting that at some future point these decisions will have to be revisited in light of contextual changes which have altered the issues. This approach is also known as 'satisficing', 'muddling through', or bounded rationality (Bellamy et al., 1999; Connick & Innes, 2003; Edwards & Steins, 1998; Ferreyra & Beard, 2007; Healy, 2005; Jones, 2002; Margerum & Born, 2000; Margerum & Hooper, 2001; Meppem & Gill, 1998; Mitchell, 1997; Steins et al., 2000).

3.4.2 Multiple Scales of Governance

The nature of freshwater as part of the global hydrological cycle means that any boundary drawn below the global level must necessarily be arbitrary (Mackenzie, 1996), and will therefore be in the first place contested (Blomquist & Schlager, 2005; O'Riordan, 2000), and in the second place, will only identify one element of a wider, imbricated system (Anderies et al., 2004; Gibson et al., 2000; Giordano, 2003; Gunderson & Holling, 2002; Janssen & Anderies, 2007). Furthermore, the physical scale of some freshwater systems, as they flow from mountains to sea, generates cross-boundary issues from down-stream effects, such as reduced levels of flow, or increased levels of pollutants. These, in turn, invoke multiple decision-making authorities, sometimes belonging to different nations. As Blomquist and Schlager (2005) point out, this means that even if a catchment level authority exists and is deemed legitimate, that will not negate the need for other forms of governance at scales above and below. This is one of the most intractable problems for catchment-based IWM that has been reported so far. Recently, the literature has begun to agree

that every scale at which more than one political jurisdiction exists will have to be considered, and that the current governance focus is on the difficulties relating to the regional scale (Abernethy, 2005; Janssen & Anderies, 2007; Kerr, 2007; Lovell et al., 2002; Margerum & Whithall, 2004).

3.4.3 Normative Contestation Within and Between Multiple SESs

Further problems reported in the literature are the increasingly normative trade-offs that must be made during the coordination of collaborative-choice level decision-making amongst multiple SESs in multi-scale, multi-dimensional freshwater systems (Bellamy et al., 1999; Blomquist & Schlager, 2005; Connick & Innes, 2003; Hajer, 2003; Jones, 2002; Lovell et al., 2002; Owens et al., 2004). A shorter description from the field is that IWM is akin to ‘herding cats’ (Donaldson, 2008).

Recent work in this area of IWM has concentrated on the process of consensus-building during the problemshd definition phase of the IWM planning process. This is because improvement of IWM outcomes has often been undermined by difficulties with the identification of goals and criteria (including time frames) for evaluation. In many cases, reaching agreement has virtually become the product, or outcome (Coggins, 1999; Connick & Innes, 2003; Ferreyra & Beard, 2007). The danger with this is that the underlying reason for the process, the health and continued productivity of the resource (particularly of the more normative, less easily quantified values), and its dependent communities (ecological and human) can easily be, and often is, compromised or subsumed in the struggle to reach agreements (McGinnis, 1999a; Owens, 1997; Singleton, 2002).

The complexity and uncertainty inherent in freshwater systems means that ecological parameters are always open to challenge. This gives rise to the idea that the rational origins of IWM decision-making may in fact be a Quixotic enterprise: that without explicit consideration of normative influences, there is little reliability of ecologically rational outcomes (Blomquist & Schlager, 2005; McGinnis, 1999a; Owens et al., 2004). What Ostrom (1999, p494) describes as an approach based on the perception that

“...what is needed is to gather reliable, statistical information on key variables, determine what the optimal harvesting pattern should be, divide the harvesting level into quotas, and assign quotas to users [...] was not [...] supported by the empirical research”.

As socio-economic pressures increase, and resource uses become increasingly intensive, this is an attitude that is becoming more frequently voiced in the literature. For instance, “...the modern ‘resource management paradigm’ is maladaptive, bureaucratic, dysfunctional, and based principally on the economic values associated with ‘natural resources’ (Woolley & McGinnis, 1999, p. 579). Hajer, (2003, p190), meanwhile, stresses the need to “address the explicitly normative issues that come with the introduction of new practices in which some will be able to participate and others will not”. Unfortunately, Blomquist and Schlager (2005; p102) opine that “Emerging collaborative efforts are no better - they are impossible (because of collective action problems), impractical (because collaboration can emerge only on small scales) and perhaps even illegal”. It should be remembered, though, that proponents of integration have never claimed it to be a panacea for environmental planning problems. Rather, its supporters take care to repeat often that it is a ‘step towards’ desired outcomes; a step which, if taken, can lead on to sustainability, not a management end in and of itself (Margerum, 1999b).

3.5 Chapter Summary

This chapter has provided a critique of the concept, procedural development, collaborative and integrated planning process, and challenges pertaining to IWM as currently portrayed in the literature. In order to address the IWM challenges described, the following two chapters broaden the field of enquiry. In the following chapter, I will introduce key literatures pertaining to the characteristics of freshwater systems that relate to the potentially improved understanding of polycentric IWM challenges. Firstly, I will discuss complex adaptive systems, which as already noted, learn or adapt over time (section 4.2). Secondly, freshwater systems are also complex common-pool resources (section 4.3). Insights arising from a theoretical convergence amongst these two scholarships, and that of collaborative IWM as described in this chapter, can then be used to inform the problem of institutional design for ‘successful’ IWM, whether coercive, cooperative, collaborative, or polycentric (Chapter Five).

4 Managing Freshwater as a Complex, Adaptive, Common-Pool Resource

4.1 Introduction

The previous chapter provided a critique of IWM as currently portrayed in the literature, which included the identification of three main challenges to the generation and maintenance of sustainable IWM freshwater outcomes. These were the perennial nature of IWM problems, the need to deal with multiple scales of governance, and the increasingly normative nature of IWM conflicts and contestations. In this chapter, I extend and focus the literature review, to broaden the conceptual field of enquiry in an effort to address these three challenges to IWM.

I will introduce key freshwater system characteristics and theoretical perspectives on the generation and maintenance of sustainable freshwater outcomes, from two fields of scholarship in particular. The first theoretical perspective considered in this chapter is complexity thinking, as it relates to the process of complex adaptive change, and the emergence of self-organising constitutional hierarchies (section 4.2). The second theoretical perspective is Commons Theory, particularly as this relates to the characteristics, systems of property rights, and decision-making for complex, common-pool resources such as freshwater (section 4.3).

Then, in section 4.4, I will propose a model for IWM, with particular focus on collaborative IWM. This model is drawn from a theoretical convergence identified in the complexity thinking, Commons Theory, and IWM literatures, and covers the IWM concept, systems perspective, and IWM processes. Section 4.5 provides a brief summary of the chapter and its contribution to the conceptual synthesis undertaken in Chapter Five.

4.2 IWM for Complex Adaptive Systems

It has long been understood that institutions need to be “designed to fit the character of the resource involved” (Schlager et al, 1994, p295, note 1). But “when our norms,

concepts, and expectations offer a poor match to reality, it is time to rethink our world-view” (Connick and Innes 2003, p179). This section introduces the complexity thinking perspective, and describes the characteristics and processes of change in Complex Adaptive Systems (CASs), including complex adaptive processes involved in IWM, and wider social change.

4.2.1 Complex Adaptive Systems and their Processes of Change

The advent of the complex adaptive systems (CAS) perspective has dramatically redrawn the IWM landscape to great advantage, since clearer understanding of the systems under management and their processes of change are central to improved freshwater outcomes. However, complexity thinking and associated adaptive governance approaches represent a development in the understanding of the systems under management, not the underpinning management concept of integration itself. The CAS perspective is essentially a further development of the linear, interconnected systems perspective that preceded it, and the single-sector maximisation perspective which preceded that. However, complexity thinking has provided vital insights for a more realistic and richly contextual understanding of social systems, their structures, and processes of change over time.

Complex Adaptive Systems occur in all shapes, dimensions, and scales, including freshwater systems, ecological and human societies, and institutional arrangements. These systems change over time through abrupt, non-linear cycles of adaptive change, learning, and development (Gunderson & Holling, 2002; Holling, 2004; Hughey & Taylor, 2009; Janssen & Anderies, 2007). Complex adaptive change happens over four stages: entrepreneurial exploitation (r), organisational consolidation (or capital accumulation) (K), creative destruction (Ω), and re-, or de- structuring (or capital release) (α), shown in Figure 1.

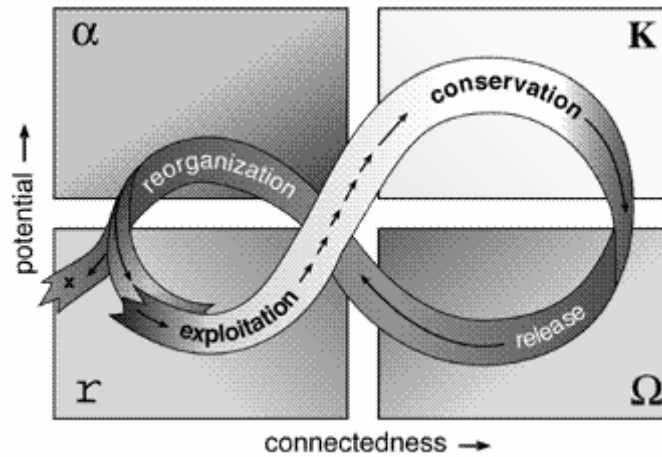


Figure 1: The Phases of Complex Adaptive Change (Holling, 2004)

In this thesis, I have adapted this representation to follow the process of complex adaptive change over linear time (Figure 2), and to reflect the fact that systems are not ‘closed’. This is to say that systems do not reset to the same starting context at the end of each cycle.

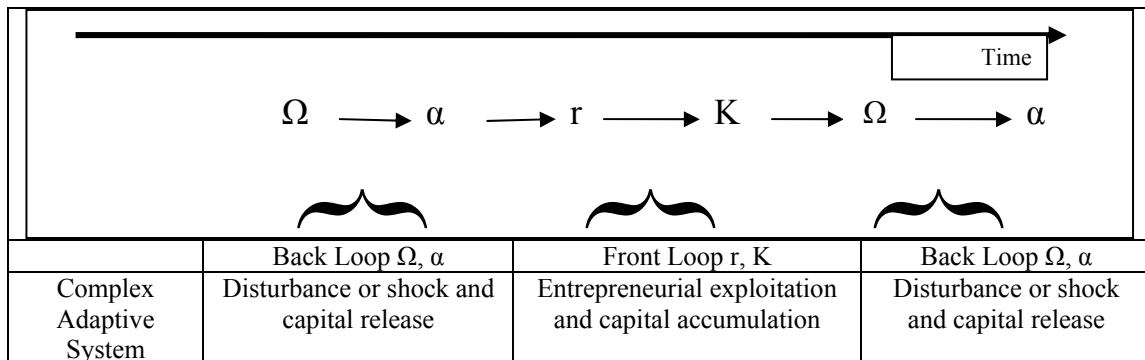


Figure 2: Complex Adaptive Change Over Time

The ‘front loop’ is the relatively steady, incremental growth and capital accumulation stage, r and K (exploitation and emerging patterns of interaction). The ‘back loop’ is typically more rapid and unpredictable, and involves the creative destruction of the system (Ω), and its subsequent elemental re-organisation (α). The back loop reorganises the system, and the cycle begins again. For instance, in natural systems, this process gives rise to ecological succession, whereby a trigger (a fire, a flood, or the turning of the seasons) will disturb the system, leading to resources being made available for a new generation (Gunderson & Holling, 2002; Hughey & Taylor, 2009; Janssen & Anderies, 2007). The length of time a CAS takes to complete the cycle from exploitation to collapse and renewal will vary from system to system.

In multi-scale or multi-element systems, new behaviours or characteristics can emerge from a coincidence of back loops in multiple cycles. This is one of the main reasons that chance – ‘the alignment of the stars’ - plays such a prominent (although little researched) role in IWM (Gunderson & Holling, 2002; Janssen & Anderies, 2007; Olsson et al., 2006; Ostrom, 2008). Any IWM outcome is, at least in part, the coincidental product of several processes of complex adaptive change, operating across different scales of many dimensions.

The characteristics of Complex Adaptive Systems (CAS) are central to understanding the process of change that underpins IWM problems. Through iterations of the front- and back-loop processes described above, CASs ‘learn’ from experience, and alter their patterns of behaviour in light of changing contexts. Such systems typically present four broad characteristics that make “fixed policy a route to disaster” (Carpenter et al., 1999, p. 13). These are non-linearity, flows, diversity, and aggregation (Ostrom, 1999). Aggregation is a key theme in complexity-related literature, since it refers to the tendency of such systems to generate emergent properties that produce unanticipated outcomes (Bühns, 2009; Gunderson & Holling, 2002; Janssen & Anderies, 2007; Ostrom, 1999).

In the battle against entropy and disorder, it seems that some CASs naturally form into constitutional hierarchies. In a constitutional hierarchy, a group of individual CASs at a lower operating level can coalesce into larger units that, once emerged, display their own particular characteristics and have their own functions, organisations, and emergent properties, including new collective behaviours (Gibson et al., 2000; Ostrom, 1999). In such systems, Gibson et al, (2000, p221) observe that “there is no single ‘correct’ level to study”.

From a complexity thinking perspective of cycles of learning and change, IWM can be viewed as a process of ongoing developmental cycles in an SES. Integrated water management is thus identified in this study as primarily a process of complex adaptive social change.

4.2.1.1 Adaptive Governance

The complexity thinking perspective has also given rise to ideas of adaptive governance. Adaptive Governance addresses the issues of complexity and uncertain change by enhancing the adaptive capacity of an SES through the process of social learning (Medema et al., 2008; Memon & Weber, 2008; Olsson et al., 2006; Painter & Memon, 2007; Scholz & Stiftel, 2005). The goals of adaptive governance are broadly twofold: firstly, to minimise abrupt, non-linear back-loop disturbances to the system as much as possible, through the enhancement of steady, incremental front-loop learning. Secondly, adaptive governance aims to enhance local-level capacity and diversity through institutional experimentation.

While the above mentioned aims of adaptive governance are admirable in themselves, both aims contain serious flaws. The first aim of back-loop minimisation does not address the abrupt and non-linear changes that cannot be avoided, or those that should not be minimised, but enhanced as a source of transformative potential in an SES (Olsson et al., 2006; Ostrom, 2001). Complexity thinking therefore requires that decision-makers at all levels be able to ‘go with the flow’ of human ingenuity, particularly as it applies to the enhancement of individual benefit through new ways of exploiting resources. This highlights the need for decision-makers to be able to recognise long-term trends and indicators of market changes as part of strategic planning.

Secondly, while institutional experimentation may well be a necessary aspect of social change, it also generates a difficult tension for decision-makers who may be asked to gamble the SES’s freshwater and social capital on new, or untried institutions, with a statistically high probability of failure (Ostrom, 1999). Furthermore, the high probability of failure means that there needs to be a degree of redundancy or ‘spare’ capacity present in the freshwater system, with which decision-makers may gamble. This is to ensure that the potential costs of institutional failure (for example, further degradation of the system through failure to identify and enforce limits to use) can be met by the SES, and do not exacerbate the freshwater overshoot for which institutional change was initially required. Unfortunately, ‘unused’ or ‘un-allocated’

freshwater benefits become increasingly scarce as systems near their sustainability limits.

This situation can become particularly difficult where decision-makers are elected representatives who require local support to remain in office, and ‘agency’ capture is a well-recognised risk in collaborative decision-making (Coggins, 1999; Mitchell, 1997; Owens, 1997; Singleton, 2000). It can be difficult to generate required levels of social support for approaches considered expensive and/or risky. The result of this is often an effective lock-in to inappropriate technologies, markets, and/or decision-making structures and processes (Kline, 2001).

4.2.1.2 Robustness for SESs

Robustness in the governance of complex adaptive systems such as freshwater or societies, is a concept that has recently gained much ground, particularly as a contingent outcome for these communities (Anderies et al., 2004; Holling, 2004; Janssen & Anderies, 2007; Laerhoven & Ostrom, 2007; Ostrom, 2001).

The robustness of a complex adaptive system is the capacity of that system to continue to generate a desired benefit (for example, potable water, or the support of fisheries), in the face of internal or external system shocks (such as drought, for example). In other words, robustness can be considered as the system’s resilience to disturbance. However, disturbance in socially constructed complex adaptive systems (such as change or development in SESs or their institutional arrangements) is not subject solely to the laws of evolution (Blomquist, 1992; Janssen & Anderies, 2007). Therefore, the engineering term robustness is used in the literature, rather than the ecological term resilience, to reflect the element of conscious design that is sometimes present in human systems (Anderies et al, 2004).

Robustness is needed for a system to withstand stress through provision of sufficient time and resources for adaptation to, or amelioration of that stress. As stated above, system robustness is increasingly cited as a desired outcome for IWM. This highlights the fact that while governance is an ongoing and non-substitutable requirement for sustainability, its structures and processes must sometimes be re-negotiated in

response to, and importantly, in anticipation of, changing governance contexts. As a complexity thinking restatement of the Sustainability goals, robustness is an intuitively appealing notion. Unfortunately, unlike sustainability which is always desired, robustness may be a curse as well as a blessing, if it reifies inadequate or inequitable decision-making (Anderies et al., 2004; Giordano, 2003; Hajer, 2003; Steins & Edwards, 1999). Moreover, there remain the same difficulties with evaluating robustness as there are with evaluating sustainability: the identification of clear, objective targets in a world of normatively contested trade-offs (Blomquist & Schlager, 2005; McGinnis, 1999a; Owens et al., 2004).

Institutions are increasingly being designed to enhance or generate robustness in an SES, but robustness also implies the closure of system limits: someone is going to have to decrease their rate of use in order to benefit other users. So far, that ‘someone’ has typically been the freshwater systems and their dependent ecological communities (McGinnis, 1999a; Owens, 1997; Owens et al., 2004). The concept of robustness implies that there are no more ‘avoidance tactics’ to be employed (Olsson et al., 2006). Someone will have to ‘surrender’ something for the wellbeing of everyone: individual freedoms need to be curtailed for a collective benefit. The question then becomes how to distribute the loss? Moreover, robustness in complex adaptive systems, including SESs (as comprising freshwater, human societies, and their institutional arrangements), predicates on Goldilocks levels of redundancy: ‘just right’ (Olsson et al., 2006; Yorque et al., 2002). This is expensive to maintain (although arguably cheaper than a failed system in the long run), and in contradiction to the ‘streamlining’ approach, which has been dominant in the jurisdictions of particular interest to this study, such as New Zealand.

4.2.2 Social Change and Potential Sustainability Transformation

From the perspective described above, IWM can be viewed as one of many complex adaptive processes of social change, which run concurrently in an SES. Social-Ecological-Systems will go through successive IWM cycles as their contexts change over time. From a broader perspective of social change in freshwater governance, some social change can result in a social sustainability transformation with respect to the freshwater systems of an SES. Social transformation in societies is a back-loop

process of change dependent on, in the first place, ecological crises, social change, or economic or political disturbances (Olsson et al., 2006). These three triggers open the ‘window of opportunity’ (Ibid).

After that, the route to social transformation in terms of freshwater sustainability depends on: the past, present, and expected contexts internal and external to the system; the type and degree of change required (the extent of the sustainability gap); and on who defines ecological limits from which perspective. In short, social transformation depends upon five key questions. Who or what benefits? Who or what pays? Who or what decides? How? How can the rules be changed? (Ostrom, 1990). These questions must be addressed not just in the redesign of IWM institutions, but in any redistribution of resource costs and benefits. The answers to these questions are expressed in an SES as individual bundles of re-negotiated property rights (Edwards & Steins, 1998; Ostrom, 2008; Schlager, 2005; Schlager & Ostrom, 1992).

The process of sustainability transformation (rather than the more common change, or adaptation) in societies, follows three main phases. The first phase is termed ‘preparation’, and refers to the front-loop processes of exploration, experience and learning. The second phase is the opening of a window of opportunity, which is essentially a disturbance in one or several key SES systems. Windows of opportunity can be the result of: environmental crises, policy failure, fiscal crises, activist groups, lawsuits, or slowly changing institutional structures (Hajer, 2003; Healy, 2005; Olsson et al., 2006). The third phase is transition, where the system reorganises itself, and re-designs rules (Gunderson & Holling, 2002; Olsson et al., 2006).

Windows of opportunity and resulting social change, adaptation, avoidance tactics, or sustainability transitions are largely about timing, and, critically, *chance*. Problems, solutions, and politics and policy entrepreneurs, must converge to open a window of opportunity. In other words, “a problem is recognised, a solution is available, the political climate makes the time right for change, and the constraints do not inhibit actions” (Olsson et al., 2006, p. 5).

This section has briefly introduced complexity thinking, and its potential to contribute to the research problems. In particular, complexity thinking offers:

- A view of IWM as ongoing cycles of social change, and learning from experience.
- Further, it indicates that the complex adaptive IWM process is one of many running concurrently in SESs. Associated processes of interest to this study are those of social sustainability transformations, and coupled institutional change/collaborative planning processes.
- Lastly, a complexity thinking perspective provides a theoretical understanding of constitutional hierarchies, and their emergent, self-organising, higher-scale systems.

The next section introduces the characteristics of freshwater systems as complex common-pool resources (CCPRs). It is argued here that as a CCPR, the key aspect of decision-making is the re-negotiation of bundles of property rights.

4.3 IWM for Complex Common-Pool Resources

It is widely acknowledged that cumulative use of shared resources must be regulated in order to prevent the Tragedy of Open Access (Edwards & Steins, 1998; Giordano, 2003; Ostrom, 1999). As with system robustness (section 4.2.1.2), this is another restatement of the sustainability challenge. In other words, renewable, limited, and shared natural resources must be managed in order to avoid over-exploitation and degradation, resulting in the loss of current or future benefits to the interdependent users. The heart of the Commons lies in property rights, and as Giordano (2003, p369) notes, “The Commons problem occurs when a *resource* domain² is coincident with or intersects the *rights* domains of two or more resource users”, and that therefore, “the problem for any resource must be defined for a particular socio-political scale [SES] if its nature is to be fully articulated” (Ibid, p367). This is a key insight, reinforcing the idea that all governance scales should be involved in IWM.

Commons Theory adopts the position that the people most fitted to decide on resource management issues are those most immediately affected by those decisions (the

² A resource domain may be spatial extent or qualitative measure, and is the area through which the resource travels to fulfil its natural function. This is not fixed, but should be expected to change over time (Hajer, 2003).

principle of subsidiarity). The management of common-pool resources has typically emerged from longer-term time-scales and small social and physical scales, since it draws heavily on detailed local knowledge of the resource system vagaries, as well as community and individual characteristics, for effective management (Agrawal, 2002; Anderies et al., 2004; Ostrom, 1990; Taylor, 1998). One of the shortfalls of more 'traditional' Commons Theory, as it has developed since Hardin's (1968) tragic, and by now notorious, misnomer, is that it has been largely limited to single-use resources, appropriated by relatively homogeneous user groups in stable circumstances (Agrawal, 2002; Anderies et al., 2004; Edwards & Steins, 1998). This is understandable, and even appropriate, given that the early intention was to show that collective ownership and management of CPRs can be as effective as either of the alternatives, (then perceived as market or state management, as a result of Hardin's use of the term 'commons' instead of 'open access').

However, the narrower focus of early Commons Theory as described above has led to limitations in the range of applicable approaches for contemporary multiple-use and complex (multi-scale) CPRs such as freshwater systems (Abernethy, 2005; Anderies et al., 2004; Edwards & Steins, 1998; Meinzen-Dick & Bakker, 1999; Ostrom, 1999). Commons scholarship has now come of age (Agrawal, 2002), and can contribute much to the richer, more imbricated process of governance for water, called for in the literature.

4.3.1 Complex Common-Pool Resources

As apparently inexorable socio-economic pressures continue to rise in catchments worldwide, and new system limits are identified through experiences of the consequences of breaking them, freshwater systems have become recognised as Complex Common Pool Resources. Definitions of Complex, or multiple-use Common Pool Resources include that from Steins and Edwards, (1999a, p309) who describe them as "...resources that are used for different types of extractive and non-extractive purposes by different stakeholder groups and are managed under a mixture of property rights regimes". The terms complex and multiple-use as used in the literature are not always clear, so in this research a Complex Common-Pool Resource is taken to mean mobile, multi-scale, multi-dimensional, and multiple-use.

As with IWM, the heavily exploited benefits of water and its fugitive, diverse, ubiquitous yet subtractable flows of positive and normative values, make the equitable and efficient provision and allocation of these benefits an ongoing, hugely complex, and generally strongly contested affair. Further, it is becoming recognised that a full range of rights and responsibilities must be collectively renegotiated at every level of political jurisdiction where there exists more than one SES (Giordano, 2003). As Common Pool Resources evolve through increased levels of use into Complex Common Pool Resources, institutions need to be renegotiated to avoid adverse impacts resulting from the increased levels of cumulative use, and the resulting increase in user-group interdependence (Steins & Edwards, 1999). This iterative decision-making, inevitably, greatly increases transaction costs for system management as already noted in subsection 3.4.

4.3.2 Institutions and Complex Common-Pool Resources

As is by now widely appreciated, Common-Pool Resources display the conflicting property rights characteristics of ubiquity (making exclusion difficult and/or costly - a public property characteristic), and subtractability - a private property characteristic (Giordano, 2003; Ostrom, 1990; Schlager et al., 1994; Schlager & Ostrom, 1992). Common Pool Resources are not necessarily common property. They can be 'owned' in several ways, each of which generates a different management approach, as shown in Table 1. Common-Pool Resources can be: public property, where the right of management is awarded to a government agency; common property, where the resource is managed by and for a defined community of individuals (or individual entities); or they can be private property, which is associated with the decision-making of individual autonomies under market conditions.

Table 1 Types of Water Allocation or Provision Approaches. Adapted from: Bakker, 2001; Bruns and Meinzen-Dick, 2005; Steins and Edwards, 1999

	User Group Management	Agency Allocation	Markets	MIXED MODEL
Management paradigm	Complex Commons Management	Integrated Water Management (IWM)	Economic valuation	A Mixed Model will draw from all three approaches
Approach to Social arena	Platforms for Resource use (re)negotiation	Coordinated Collaborative Planning	Markets for water and its uses/benefits.	
Key Characteristics	Collective decision-making among water users, for example, an irrigator's association	Bureaucratic agency controls directly	Trading among users, temporary or permanent transfers.	
Property Rights Systems	Common Property	Public Property	Private property (can be an individual or an individual entity).	
Advantages	Legitimacy based on custom Local knowledge and experience. Adaptable	Standard procedures Technical expertise River basin perspective	Voluntary Prices reveal opportunity costs for users, create incentives to conserve.	
Disadvantages	More difficult if users do not know each other and lack existing relationships, or if only selected users are represented.	Information intensive Difficult to customise to particular conditions.	Risk of neglecting impacts on third parties If transactions are rare or complex, then hard to establish prices.	

As decision-making rule-sets to define the “conditions of access to and control over a range of benefits arising from a collectively used resource system” (Edwards and Steins, 1998, p349), each of these systems of property rights offers benefits and problems. Further, property rights regimes are increasingly being viewed as lying along a continuum, rather than as competing and exclusive management approaches, and are increasingly being used in combination as a ‘mixed system’ (Bruns & Meinzen-Dick, 2005). It is critical to successful institutional design for complex common pool resources, to understand that property rights are not about the relationships between users and the resource. They are about defining the interpersonal relationships of society members, with respect to a resource (Bromley, 1992; Bruns & Meinzen-Dick, 2005; Giordano, 2003). This is a form of social standing, also known as a ‘pecking order’.

As stated above, Commons problems are defined as the intersection of property rights domains with respect to the domain of a resource (Giordano, 2003). As water is part of the global hydrological cycle, this means that any boundary drawn below the global will be arbitrary. Since the definition of any Commons problem is dependent upon the scale at which it is analysed, in light of the multiple scales, dimensions, and values offered by water, it may therefore be suggested that the definition of a freshwater CCPR problem will be dependent upon the *perspective* from which it is viewed. This reinforces the surprisingly recent idea that governance of water is largely a matter of social choice (beyond defined ecological limits, which can also be contested), defined through political negotiation (Blomquist & Schlager, 2005; Hajer, 2003; McGinnis, 1999a; Owens et al., 2004; Steins & Edwards, 1999; Steins et al., 2000; Weber & Khademian, 2005). Steins and Edwards (1999a p310) observe that because the prime interest here is the balancing (or coordination) of multiple interests, "...that collective action among the user groups is required to agree upon regulations about access to, allocation of, and control over the resource, since resource uses by the different user groups are interdependent".

4.3.2.1 Levels of Decision-Making for Freshwater Systems

Decision-making for Common Pool Resources is an ongoing process that addresses the problems of provision and allocation of resource use benefits and costs, between competing users. This process has until recently been considered as occurring over three nested levels of decision-making, where each level is influenced by the decisions made at the level above (Anderies et al., 2004; Edwards & Steins, 1998; Giordano, 2003; Hooper et al., 1999; Memon & Selsky, 2001; Ostrom, 1990, 1999; Schlager & Ostrom, 1992).

The levels of decision-making for CPRs typically described in the literature, and the rule-sets typically used, are shown in Figure 3. The decision-making levels described are: the constitutional-choice level; the collective-choice level, and the operational-choice level. In short, the operational-choice level rules are designed through collective-choice level processes dictated by constitutional level choices, in order to constrain individual freedoms for the collective good.

The Constitutional-choice level forms the legal framework within which the stakeholders (managers and users) must operate, and where decisions as to how the resource should be managed are dependent upon social and environmental contexts. Outcomes of constitutional-choice level decisions are the property rights regimes. Although the constitutional level has generally been considered as external to the system (e.g., higher-scale legislation that should be ‘conducive’ to IWM) (Edwards & Steins, 1998; Margerum & Born, 2000; Ostrom, 1990), it is at the constitutional level that expressions of ‘ownership’ are decided. How a resource is perceived, and desirable uses are selected (Bakker, 2003), are processes that occur at this level of decision-making.

The Collective-choice level determines the rules for interaction between management organisations and users or user-groups. This level bestows the right to manage (to regulate internal patterns of resource use and transform the resource by making improvements) which is for practicality coupled with the right of exclusion (the right to identify who has access to the resource). Hereafter, both rights are included in the term management.

The Operational level provides resource users with day-to-day rules controlling access to, allocation of, and control over the resource, and where individual entities make decisions about whether, and how, they will exercise their property rights bundles (Anderies et al., 2004; Bromley, 1988; Edwards & Steins, 1998; Giordano, 2003; Margerum, 2008; Ostrom, 1990).

The outcomes of freshwater decision-making are so heavily dependent upon the relationship between the collective-choice and operational levels that these two levels are now considered as a coupled system, shown by the broken line (Anderies et al., 2004).

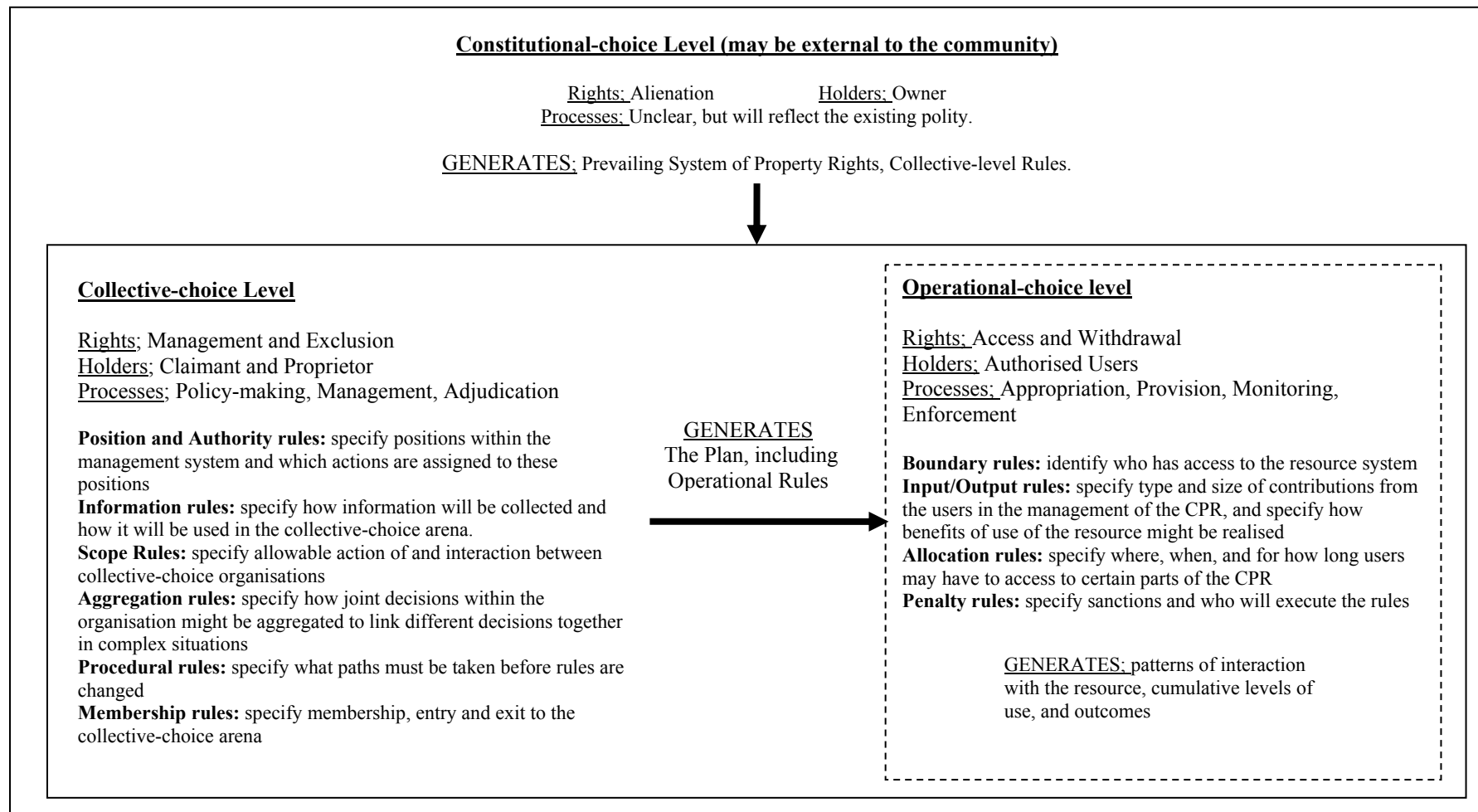


Figure 3: Rights, Processes, and rule-sets for CPR governance. Adapted from: Edwards and Steins, 1998; Memon and Selsky, 2001; Ostrom, 1990, 1999.

To summarise, managers of freshwater CCPRs can expect:

- imbricated and often conflicting resource dimensions, normative and positive values, uses, and user-groups;
- variances between formal and informal (or between new and old) rule-sets and/or property rights, and;
- volatility in uses, institutions, institutional arrangements, resource domains, and rights domains over time and space (Giordano, 2003; Memon and Selsky, 2001; Steins and Edwards, 1999).

The previous two sections have introduced insights to the research problem from complexity thinking and Commons perspectives of decision-making for the generation and maintenance of sustainable freshwater outcomes. The next section will draw from these to propose a model of IWM, with particular reference to the collaborative IWM approach.

4.4 A Proposed Model for IWM

In this section, I will propose a model of IWM which I suggest is both more realistic, and more theoretically robust, than that which I have described from the specific IWM literature reviewed in Chapter Three. I will present the elements and processes of the proposed model for IWM in the following order.

First, the management concept of integration is confirmed in subsection 4.4.1. This is followed in subsection 4.4.2, by a recap of the characteristics and adaptive phases of the complex adaptive systems being considered. In subsection 4.4.3, I offer a complexity thinking perspective of the IWM procedural developments (from coercive to cooperative to collaborative, and most recently polycentric, as described in Chapter Three), as cycles of social change and learning. This perspective can also offer a clear explanation for the repeated calls in the IWM literature for identification of procedural IWM elements, and for improved decision-making capacity.

In subsection 4.4.4, I identify the IWM process as one among several key interacting complex adaptive processes that run concurrently in SES freshwater governance. In

addition to the IWM process itself, are: the nested processes of institutional change and planning, and; the wider imbricated process of social change (and potentially social sustainability transformation). In conclusion to this section, subsection 4.4.4.3 presents a theoretical convergence on institutional design for the collaborative and integrated planning process, derived from all three contributing conceptual perspectives (IWM, Commons Theory and complexity thinking).

4.4.1 Integration

The concept of integration, as a practical method of managing impossibly complex systems remains sound, but as noted above, complexity thinking has radically redrawn the systems perspective. In particular, complexity thinking has helped to clarify the nature and properties of, and the relationships between, the multiple complex adaptive systems through which freshwater benefits and costs are produced and allocated in an SES. This has provided the opportunity for a much richer, more realistic, and more robust understanding of the SESs under consideration and their critical component subsystems in need of integrated decision-making. These particularly include the resource, its dependent human communities, and their systems of governance. These are described below.

4.4.2 A Complex Adaptive Systems Perspective for IWM

From the perspective of complexity thinking, IWM can be re-framed as a complex adaptive process of social change. Furthermore, complexity thinking suggests that while the IWM process is critical to sustainable freshwater outcomes, it should also be considered as one aspect of a wider social development towards sustainability. As already discussed, cycles of complex adaptive change are comprised of front-loop and back-loop processes. In the case of the IWM process, the front-loop is the relatively steady (although sometimes very rapid) emergence of patterns of use, generated by the cumulative influence of many individual decisions, with respect to use of available freshwater benefits. Back-loop processes are: system disturbance such as drought, or detrimental effects of over-exploitation from front-loop patterns of interaction, and; response to that disturbance, as identified by a change in rules. As already discussed, in this study it is the influence of wider SES institutional

arrangements on the front-loop phase of complex adaptive change in an SES (specifically, their influence or otherwise on emergent patterns of interaction expected from IWM institutions, which is of particular interest.

Recapping from subsection 4.2.1, the complex adaptive characteristics of freshwater systems can compound difficulties of institutional design for IWM in several ways:

- Freshwater systems are dependent on wider weather patterns, and their behaviour is therefore, to an extent, *non-linear*.
- They exist in *aggregations* of multiple scales across different dimensions, including physical, hydrological, social, political and institutional.
- They can offer different benefits within and across geographical scales (they show *diversity*).
- They are fugitive, trans-boundary resources (they *flow* through more than two SESs) and are therefore subject to governance by multiple decision-making authorities (Gibson et al., 2000; Giordano, 2003; Mackenzie, 1996; Schlager et al., 1994; Schlager & Ostrom, 1992).

From the complexity thinking perspective, it becomes very clear that any attempt at governing such hugely complex, interdependent, poorly understood, and constantly changing self-organising systems as freshwater or SESs, contains an inherent likelihood of failure, especially over longer (generational) time-scales (Ostrom, 1999, 2008). Thus, as noted above, the goal for freshwater governance has become increasingly accepted as the improvement of SES robustness, through improved robustness of the freshwater system. To recap, robustness is essentially the adaptive capacity of a complex adaptive system. For freshwater systems, this is the ability to continue the production of desired benefits such as potable water, in the face of system disturbance such as drought. From the perspective of institutional design, robustness of an SES may be considered in terms of the robustness (longevity or endurance) of the decision-making rules (Anderies et al., 2004; Edwards & Steins, 1998; Ostrom, 2008; Schlager, 2005; Schlager & Ostrom, 1992). As already noted, it is important to remember that robustness (or longevity) in institutions may be either a positive outcome for the SES, or where institutional robustness arises from the

reification of inequitable redistribution of decision-making power, a perverse outcome.

4.4.3 A Perspective on Changes in Procedural Aspects of the IWM Process

Drawing from complexity thinking, the procedural shift in the IWM planning approaches from rational command and control, to cooperative, to collaborative normative deliberation (noted in section 3.3), can be viewed as a series of cycles of social learning and development (Table 2). This perspective can draw together and explain several of the reported IWM implementation challenges, particularly the ongoing criticisms of inadequate capacity, and the difficulties of identifying procedural attributes.

Table 2: Complex Adaptive Cycles in IWM









Complex Adaptive Change	Front Loop	Back Loop	Front Loop	Back Loop	Front Loop	Back Loop	Front Loop	Back Loop
								
Freshwater Systems	Single or multiple-use CPR					Complex CPR		
Procedural IWM can be:	Coercive (regulation)	Plan development and implementation	Cooperative (management)	Plan development and implementation	Collaborative (Management/ governance: emerging double dynamic))	Plan development and implementation	Polycentric (iterative self-governance: double dynamic)	Plan development and implementation
IWM Decision-making characterised as:	Single scale, single authority		Single scale, single authority		Single scale, multiple authorities		Multiple scales, multiple authorities	
Institutional change	New Rules and emerging institutional void	New Political Space	New Rules and emerging institutional void	New Political Space	New Rules and emerging institutional void	New Political Space: DOUBLE DYNAMIC	New Rules and emerging institutional void	New Political Space
Social change or Sustainability transformation	Front-loop Preparation: exploration, experience, and learning	Window and Transition	Front-loop Preparation: exploration, experience, and learning	Window and Transition	Front-loop Preparation: exploration, experience, and learning	Window and Transition	Front-loop Preparation: exploration, experience, and learning	Window and Transition

Table 2 brings together several aspects of procedural IWM, as have been discussed in Chapter Three, and foregoing sections of this chapter. Broadly, freshwater systems have progressed from being considered as single or multiple-use common-pool resources, to being considered as complex common-pool resources. This changing common-pool-resource perspective has been matched by the steady rise in the number of governance scales and decision-making authorities involved in IWM.

The perspective of IWM procedural development as a series of cycles of social learning explains the ongoing difficulty in identifying procedural elements, and the calls in the literature for better IWM decision-making capacity. These continue to periodically re-surface, because at the beginning of each new cycle of IWM procedural development, decision-making rule-sets will need to be re-considered in light of the new decision-making context, which in turn is relatively unknown, and must first be explored and information collected (Olsson et al., 2006).

Table 2 also shows how the processes of institutional change (as will be discussed in subsection 4.4.4.1) and social change or sustainability transformation (as will be discussed in subsection 4.4.4.2), are associated with the cycles of IWM procedural development.

4.4.4 Complex Adaptive IWM Processes

The IWM model proposed in this section considers the widely-accepted ‘single’ or ‘unified’ (Hooper, 2006) IWM process to be in fact comprised of several critical processes of complex adaptive change. Key processes of complex adaptive change in IWM, identified in this model, include the already widely addressed IWM plan development and implementation (culminating in the collaborative and integrated planning process), as a sub-process of IWM that generates rules. Also identified in the proposed model for IWM are the processes of institutional change (of which planning is a part), and the process of social sustainability transformation as one type of wider social change (subsection 4.4.4.2).

4.4.4.1 *The Process of Institutional Change in IWM*

Ongoing calls in the literature for greater capacity in decision-making authorities, and for clearer definition of procedural attributes, can be explained in terms of the process of institutional change in IWM. The front-loop phase of this process comprises firstly, a shortfall in institutional capacity – the identification of an institutional void. This is followed by the emergence of a new political space in which stakeholders explore alternatives to address that void. Back-loop processes of institutional change are the re-statement of the new IWM problemshed, and re-negotiation of rules and rights bundles (the planning process).

An institutional void, or ‘preconditions for a good deliberation’ (Hajer, 2003), is filled by the emergence of new political spaces in which participants address governance issues. The term new political space “refers to the ensemble of mostly unstable practices that emerge in the struggle to address problems that the established institutions are - for a variety of reasons - unable to resolve in a manner that is perceived to be both legitimate and effective” (Hajer, 2003, p176). They represent the new conditions under which collective re-negotiation of property rights for freshwater systems must be undertaken. Thus, during every back-loop period of the IWM procedural cycles, the redesign of rules for decision-making structure and process must be undertaken.

New political spaces in IWM emerge to address the questions relating to institutional change: who or what will pay? Who or what will benefit? Who will decide? How will decisions be made? And, how can the rules be changed? These questions can be distributed over the three levels of decision-making, with attendant rights and processes, as shown in Table 3.

Table 3: Relationships in Institutional Change for IWM Decision-making

Questions	Governance Level and Rules	Processes	Rights Holders	Rights
Who or What Benefits?	Operational-choice level rules for boundary, allocation,	Appropriation Provision Monitoring Enforcement	Authorised Users	Access and Withdrawal
Who or What Pays?	Input/output, penalty			
Who or What Decides?	Collective-choice level rules for structure: scope, membership, position	Policy making Adjudication Management	Proprietor/ Claimant/ Manager	Management and Exclusion
How?	Collective-choice level rules for process: authority, information, aggregation/decision			
How Can Rules Be Changed?	Constitutional-choice level processes	Unclear- perhaps Leadership Capacity building	‘Owner’	Alienation (sale)

Who or what benefits, and who or what pays, are expressed as operational-choice level rules that are generated at the collective-choice level of decision-making. Who or what decides, and how, are expressed as collective-choice rules for structure and process, and are generated at the constitutional-choice level of decision-making. Finally, the rule-sets for the constitutional-choice level (How can rules be changed?) are unclear from the literature, although processes appear to include leadership and capacity building.

4.4.4.2 Cycles of Social Change

From the perspective of the process of social change, (and the potential social sustainability transformation), Olsson et al (2006) note that the front-loop phase in the process of social change (preparation) is also characterised by social learning, through exploration of new environments including potential benefits and problems, and identification of options for potential action. Therefore, as already noted, because at each point of change a new, more complex and wicked decision-making environment must be addressed, the SESs will obviously require increased capacity to address the more difficult problems. Connick and Innes (2003, p178) are of the opinion that the most important aspects of collaborative dialogues are “the way they reshape the policy content and instigate new forms of action”. Although each cycle of learning is necessarily preceded by IWM failure to achieve and maintain sustainable freshwater

outcomes, there are a great many benefits to social capacity for future decision-making that remain hidden from view when analysed from narrower, more 'objective' standpoints (Connick & Innes, 2003). These include increases in social capital, high quality agreements, clearer understandings, and more accurately articulated problems.

However, although the front-loop phase of preparation can help to facilitate a social sustainability transformation, this particular and critical type of social change remains heavily dependent upon the vagaries of chance, as already noted.

4.4.4.3 The Collaborative IWM Planning Process and Rule-Sets

For collaborative IWM, the following procedural elements of plan development and implementation over three levels of decision-making are recommended by the literature, as reported in subsection 3.3.2. These are: initiation; problemshd definition; resourcing for collaborative plan development and implementation, and; coordination of the collaborative planning process, outputs (the IWM policy, plan, or programme), and outcomes (Hooper, 2006; Hooper et al., 1999; Margerum, 1999b; Margerum & Born, 2000; Margerum & Hooper, 2001; Memon & Weber, 2008).

The stages of collaborative planning, and their respective rights and rule-sets, are shown in Figure 4, and are drawn from three closely convergent works in particular, which are: Margerum and Born, 2000 (IWM); Edwards and Steins, 1998 (Commons Theory) and; Ostrom, 1999 (complexity thinking and polycentric systems). Firstly, the model for the collaborative IWM planning process recognises that no SES stands alone. Collaborative plan development for IWM is typically embedded within larger SESs with greater decision-making influence and/or autonomy. The larger SES as represented in Figure 4 acknowledges that decision-making in collaborative IWM will be subject to influence from this external SES, particularly in relation to prevailing systems of property rights, and existing collective-choice level decision-making rules for scope, structure and process. Further, as already suggested, description and comprehension of the historical context to the extant IWM institutions, and the problemshd at hand, is vital to the crafting of effective IWM institutions, plans, and policies for future outcomes.

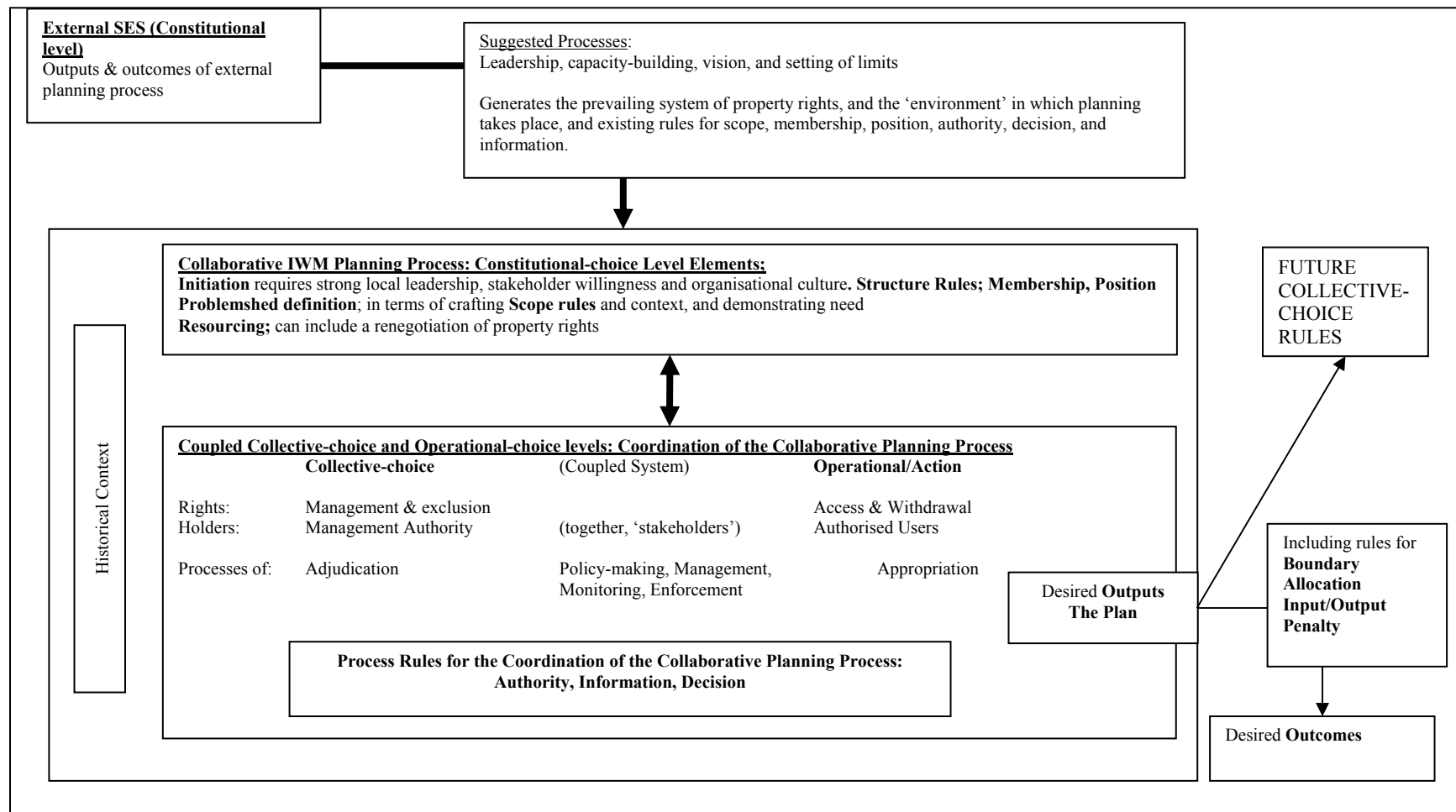


Figure 4: Elements and Rule-sets for the Collaborative IWM Planning Process (adapted from Edwards and Steins, 1998; Margerum and Born, 2000; Ostrom, 1999)

However, since collaborative IWM predicates on a single autonomous decision-making authority, it is important to highlight and make specific the constitutional-level decision-making processes that occur in collaborative IWM. The constitutional-choice level of the collaborative IWM planning process is composed of initiation of collaborative planning, problemshd definition, and resourcing of plan development and implementation. These suggest themselves as constitutional level elements because of their need for leadership, their responsibility for boundary drawing and resourcing, and their involvement with the definition of collective-choice rule-sets. These include rules that define the scope of the decision-making, the decision-making structure (membership and position), and the decision-making process (authority, information, and decision/aggregation).

The coordination of collaborative planning processes involves the coupled collective-choice and operational-choice levels of an SES. Key rule-sets for this element are process rules of authority, information, and decision/aggregation rule-sets, with which to undertake plan development. Amongst other things, such as time-scales for implementation, the IWM plan thus developed will detail operational-choice level rule-sets for boundary, allocation, input/output, and penalty. These are typically expressed as bundles of individual property rights to freshwater benefits. The operational-choice level rules are intended to shape the individual user or user-group decisions on whether, and how, to exercise their freshwater property rights. These decisions then generate new patterns of interaction and cumulative effects for the freshwater system and the SES.

However, it should be noted that the model for collaborative and integrated planning as presented here does not address the influence of institutional arrangements on IWM outcomes. This is an issue that will be addressed in Chapter Five.

Where the SESs in question have undergone the shift from management to governance, a double dynamic is identified from the literature. Under such conditions, there is widespread agreement (Hajer, 2003; Margerum, 2008; Margerum & Born, 2000; Margerum & Hooper, 2001; Ostrom, 2001; Steins & Edwards, 1999) that participants in collaborative processes:

“not only deliberate to get to favourable solutions for particular problems, but *while deliberating* they also negotiate new institutional rules, develop new norms of appropriate behaviour and devise new conceptions of legitimate political intervention” (Hajer, 2003, p175/176).

The shift from management to governance is increasingly common in collaborative IWM enterprises. This means that stakeholders are now deliberating not only on current operational-choice level rules for allocation, etc., but are also crafting the collective-choice rules by which future decision-making will be undertaken. This is a constitutional-choice level process, and further underpins the hitherto under-appreciated importance of constitutional-choice level attributes such as leadership, capacity-building, vision, and a willingness to set potentially unpalatable or unpopular limits to use, in collaborative IWM.

The key elements of the proposed model for IWM include the following:

- Integration;
- A complex adaptive systems perspective, where systems learn and change through experience, and can generate new, larger-scale systems;
- Three key inter-related processes of complex adaptive change (integrated water management, coupled processes of planning and institutional change, and sustainability transformation);
- Rule-sets for decision-making processes (at the collective-choice level, for scope, membership, position, authority, information, decision/procedure/aggregation; at the operational-choice level, for boundary, allocation, input/output, and penalty), and;
- A collaborative planning process (initiation, problemshd definition, resourcing, coordination of collaborative plan development and implementation, outputs as the management plan, and outcomes).

Thus comprised, the IWM model may be used as a ‘building-block’ (Ostrom, 1999) for the consideration of more realistic and holistic perspectives of IWM. This means that the proposed model for IWM can be used as described, but can also be used as a way of “breaking down complex processes into small chunks that can be used in multiple ways and can be combined and recombined repeatedly and at diverse levels” (Ostrom, 1999, p. 523).

4.5 Chapter Summary

In this chapter, I have introduced key concepts, characteristics, and processes, related to freshwater's status as both a complex adaptive system, and a complex common-pool resource. I have identified a theoretical convergence in the IWM, Commons Theory, and complexity thinking perspectives on collaborative planning for freshwater governance. Further, I have described a complex adaptive perspective of IWM procedural development, which explains ongoing calls in the literature for procedural clarification and greater decision-making capacity. A model for IWM as a process of social change that focuses on the management and/or governance of complex, adaptive, common-pool freshwater resources is proposed. To recap, the proposed IWM model elements as described in this chapter are: the management concept of integration; the complex adaptive systems perspective, and; the complex adaptive processes of integrated water management, coupled institutional change and planning processes, and social change (and potentially social sustainability transformation). The rule-sets for planning in IWM are identified as: at the collective-choice level, structural rules concerning scope, membership, and position, and procedural rules concerning authority, information, and decision/aggregation, and; at the operational-choice level, rules for boundary, allocation, input/output, and penalty.

The *collaborative* planning process has been identified as comprising the elements of: initiation; problemshd definition; resourcing of plan development and implementation; coordination of the collaborative planning process, and; outputs (the plan) and outcomes.

The process of institutional change has been identified as implicit within IWM cycles, and comprises front-loop emergence of firstly, an institutional void, and secondly, a new political space in which the re-negotiation of issues pertaining to the allocation of resource benefits and their costs, and of decision-making power, are addressed.

Lastly, the process of social change, which contains the potential for social sustainability transformation with respect to freshwater, has been described in terms of the front-loop phase of preparation for change, and the heavily chance-dependent back-loop phases of windows of opportunity and transition.

Finally, it is important to remember that three main misconceptions about integration, identified by Hooper et al., (1999), persist as barriers that can undermine the IWM process and outcomes. These are supported by a wide range of other authors, as noted below:

- The first misconception about IWM is that it is always possible to obtain cooperation and consensus requiring “respect, trust and goodwill, and a willingness to voluntarily participate...when the reality is one of competition, scepticism and distrust” (also noted by Ascher, 2001; Memon & Weber, 2008; Ostrom, 1999; Singleton, 2002; Weber & Khademian, 2005).
- The second is that volunteers with minimal resources can achieve and maintain results that government-resourced agencies have been unable to produce, without support from some basic capacity-building (financial and human) (also noted by Ericksen et al., 2003; Herbert, 2005; Koontz & Johnson, 2004).
- The third common misconception about IWM is that community groups should only be advisory, especially when “...there are growing expectations in community-based groups that in a partnership there will be genuine delegation of power to them from state agencies” (also noted by Blomquist & Schlager, 2005; Connick & Innes, 2003; Healy, 2005; Margerum & Hooper, 2001).

Although arguably more theoretically robust, the proposed model for IWM, and collaborative IWM, remains inadequate for the ‘effective and legitimate’ (Hajer, 2003) resolution of emerging polycentric IWM problemsheds, as reported in the literature, and noted in Chapter Three. From the complex common-pool resource and complex adaptive systems characteristics identified in the foregoing sections, problems for polycentric IWM can be identified as those that are inherent in the more robust appreciation of freshwater as a complex, adaptive, common-pool freshwater system. Clearly, as noted in the literature, attempts to resolve polycentric IWM problemsheds through the exclusive application of rational decision-making, or indeed any single decision-making approach, or at any single scale, will be inadequate to the task (Blomquist, 1992; Gibson et al., 2000; Lovell et al., 2002; Margerum, 1999a; Ostrom, 1999).

The last two chapters have demonstrated that understanding of the IWM process has developed remarkably quickly over the last four decades, from its centralised, ‘top-down’ hierarchical command and control approach. Why, then, does the implementation gap remain so large? The following Chapter Five extends the IWM

model presented in this chapter. In Chapter Five, I will identify social sustainability transformation, increasingly normative decision-making, and multi-scale (structural) challenges to institutional design, as key *polycentric* IWM challenges, and will address these key challenges through a conceptual synthesis.

5 Addressing Polycentric IWM Challenges: Towards a Conceptual Synthesis

5.1 Introduction

As observed in the foregoing chapters, the sustainable freshwater governance problematique has seen four decades of IWM procedural development, aimed at closing the IWM implementation gap. These have been only partially successful, and IWM now needs to address emergent polycentric challenges, the current area of most acute difficulty for institutional design in freshwater governance (Ostrom, 1999; Scholz & Stiftel, 2005; Steins et al., 2000). In the following sections, I will argue for a conceptual perspective that defines polycentric IWM as: an emergent product of ‘failed’ collaborative IWM attempts; presenting Hajer’s (2003) five ‘preconditions for a good deliberation’; comprising multiple SESs at multiple scales, employing multiple decision-making processes; critically, this means that there will be no single decision-making authority; it will operate at the aggregate collective-choice level of decision-making, and; polycentric IWM will therefore be self-generating, self-organising, and subject to change in unpredictable ways. In other words, it will be uncontrollable from ‘above’ (a higher scale of SES).

Since polycentric challenges exceed the capacity of current approaches to address, there is an urgent requirement for new institutional designs to decide and implement contested reductions in total levels of freshwater system use(s) over imbricated SESs (Abernethy, 2005; Healy, 2005; Hooper, 2006; Lovell et al., 2002; Margerum & Whithall, 2004; Medema et al., 2008; Schlager, 2005; Singleton, 2002).

In this chapter, I will address two key challenges inherent within polycentric IWM. Broadly, the two challenges are identified as: the difficulties of increasingly normative decision-making in IWM, and; structural challenges for institutional design across multiple jurisdictional scales. Underpinning these two IWM challenges is the question of why sustainable IWM freshwater outcomes have been so elusive. In the following section 5.2, I will propose a theoretical perspective to explain why this has been the case, particularly in SESs with IWM advantages, such as New Zealand. I

will argue that the sustainability transformation process, and the increasingly normative decision-making challenges in IWM are interdependent. Moreover, certain types of sustainability transformation failure in an SES will result in an increased degree of normative difficulty in the following cycles of IWM decision-making. I propose that emerging polycentric IWM problems in places such as New Zealand are the outcomes of a hundred and fifty years of social sustainability avoidance tactics, enabled by the particular resource, society, and institutional characteristics of those SESs. Arising from this conceptual perspective is a proposed typology of IWM contexts.

The second challenge for the design of IWM institutions in polycentric problems, addressed in section 5.3, is the structural difficulty inherent within multi-scale decision-making. In this section I will consider polycentric IWM problems from the perspective of complex adaptive system characteristics, particularly aggregation. Here, I will argue that the emergent aggregate collective-choice level of decision-making is the key to polycentric challenges, and their resolution. I propose that polycentric IWM problems cannot be addressed by institutional designs over three levels of decision-making. The emergent aggregate collective-choice level of decision-making is identified in subsection 5.3.2 as central to understanding the nature and properties of polycentric IWM. Section 5.4 provides an overview of the extended model for IWM developed in this chapter.

5.2 Increasingly Normative Decision-Making

In Chapter One, I made the point that IWM is not the same thing as sustainable freshwater governance. However, IWM is the recommended approach to the attainment of that social end goal. In this section, I will first seek a theoretical explanation as to why sustainable freshwater outcomes have been so elusive, and why polycentric IWM problems are so particularly acute in IWM advantaged jurisdictions. I will then identify a typology of IWM contexts arising (subsection 5.2.2).

5.2.1 An Essential, Non-Substitutable Driver for ‘Successful’ IWM

Why has it been so difficult to translate IWM into sustainable freshwater outcomes? The theoretical perspective developed below suggests that the emergence of polycentric IWM problems in countries like New Zealand has come about because of a particular random confluence of technology, resource abundance, and social world-view. The theory further proposes that the way a society has managed to translate IWM institutional intentions into perverse freshwater system outcomes in the past, is central to understanding these issues in the present (Healy, 2005; Medema et al., 2008).

I propose that the reason why these IWM attempts have ‘failed’ is because they have in fact been operating under a necessary, but incorrect, presumption. The presumption is that the society employing an IWM approach has either already undergone a social sustainability transformation, or the political will for a sustainability transformation exists. The perspective that this presumption is incorrect emerges because in spite of all the difficulties and challenges to IWM cited above, some societies *do* manage to translate IWM rule-sets into sustainable freshwater outcomes (Bakker, 2003; Olsson et al., 2006; Ostrom, 1999; Singleton, 2002). Arising from this fact, and supported by the increasingly reported frustration of many IWM participants with ‘politics’ (Blomquist & Schlager, 2005), is the perspective that the single key driver to sustainable patterns of freshwater use is constitutional-choice level *will*.

Constitutional-choice level will is defined in this study as the combination of social capital and political will, which drives the freshwater governance of a given SES. Until the sustainability transformation occurs, no approach will generate sustainable freshwater outcomes. However, where this critical element is present, virtually any governance approach will succeed. In other words, where there is a will to be sustainable, a procedural approach will be found, and broadly adhered to. However, this non-substitutable IWM driver is the outcome of a different, wider complex adaptive process of social change, and potentially sustainability transformation, as described in section 4.2.2.

5.2.1.1 The Challenge of Increasingly Normative Decision-Making

The Sustainability problematique is arguably a post-technological re-statement of the Malthusian Tragedy. Questions of why a sustainability transformation has not yet occurred in certain IWM advantaged SESs can be explained through a broadly Malthusian analysis of resource limits against socio-economic pressures (Figure 5). Analysis of the development of IWM problemsheds from this perspective does suggest that in spite of legislative evidence, the underpinning social transformations that can acknowledge, accept, and implement essentially unpalatable or unwelcome reductions in use (the willingness to constrain individual freedoms for collective benefit), have not yet been made in the type of SESs that are of interest to this study, such as New Zealand.

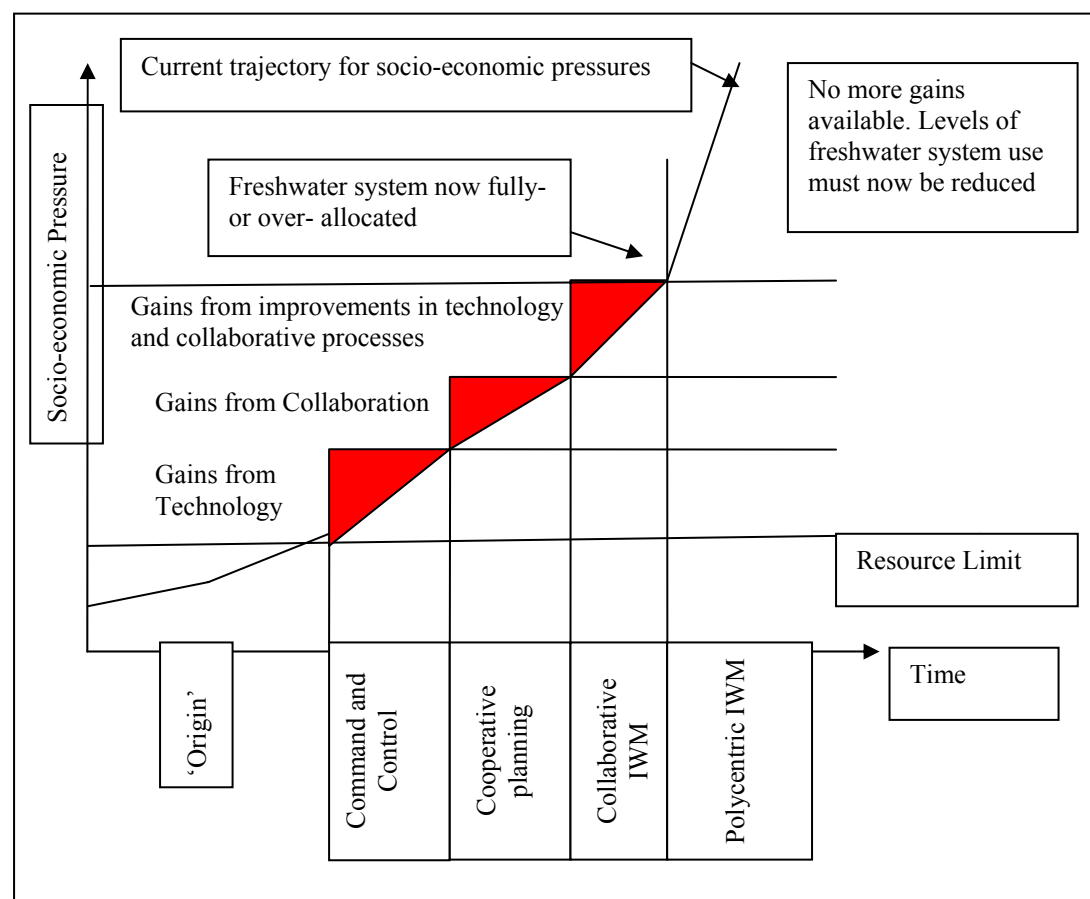


Figure 5: A Broadly Malthusian Perspective of Polycentric IWM Problemshed Development.

Instead, the peculiar confluence of influences in these SESs (context, rules, worldview, technology, freshwater availability, and physical infrastructure for storage and transport), have conspired to generate a series of avoidance tactics at each stage of IWM development instead of sustainable transformation, as discussed by Olsson et

al, (2006). Avoidance tactics are described in this study as comprising symbolic policies, coupled with economies of technology and/or coordination (effectively raising the freshwater system limit through more efficient use).

Successful or preferred tactics for the resolution of collective choice freshwater governance problems (such as the reliable provision of a sufficient quantity of potable freshwater to a given society), endure as ‘institutional sediments’ (Healy, 2005), and become embedded into the institutional arrangements of that society. This gives rise to a series of institutional designs that are crafted to make greater use of fewer per capita resources, rather than questioning why more intensive levels of resource use are needed.

Figure 5 suggests one route by which IWM problemsheds can develop in normative decision-making difficulty over time. From the ‘origin’, or ‘natural’ freshwater system limits, the steady rise in socio-economic pressures of an SES generates a freshwater overshoot. In the first instance, the resource limits can be extended through, for example, ‘command and control’ enforced use of more efficient, or remedial, technologies, with no change in the patterns of use within the SES. The ‘new’ resources are then exploited until the next overshoot occurs, when under a cooperative approach to IWM users may, for example, coordinate the timing of their uses to effectively raise the freshwater system limits once more. Again there is no need to change existing patterns of use, beyond their timing. Finally, even ongoing technological advances and better coordination are unable to contain the effects of overshoot in the freshwater system, and a reduction of socio-economic pressures through a reduction in levels of use must be undergone. Unfortunately, by that stage the SES in question has undergone several reifications of its unsustainable freshwater appreciation, and livelihoods have been built on the availability of water which no longer exists. Furthermore, by this stage the system is so intensively exploited over so many multi-dimensional uses, that any benefit in one area will necessarily mean a ‘loss’ for another, as described in subsection 4.2.1.2.

Because the underlying issues that generate overexploitation are not being addressed, problems of freshwater overshoot repeatedly return to the forefront of policy-making. If they had been sustainably addressed they would be much less likely to re-arise,

despite SES contextual changes over time. And with a socially embedded freshwater sustainability limit, even when questions of overshoot did arise for whatever reason, they would be significantly less challenging, and less contested.

The sustainable governance of freshwater systems, as with any shared, limited resource, can be considered as a continuous battle to prevent individual expressions of human ingenuity from causing a collective harm. Where IWM has ‘failed’ and a collective harm is experienced, the cause is often cited as a lack of political will. But in the meantime, due to the perennial nature of IWM, avoidance tactics have created three main outcomes. Firstly, the sustainability gap is now larger, and therefore more costly to close. Secondly, the unsustainable social appreciation of the freshwater system has been reinforced, and more deeply embedded in the society, making it more difficult to change. Thirdly, the ‘easy’ remedies (the low lying institutional fruit, such as point-source pollution control, physical infrastructure for storage, or economies of coordination) have already been used as avoidance tactics. What remain to be addressed are the difficult, *corrective*, contested measures of *reduction* which are required for sustainable freshwater outcomes. Thus, with every cycle of IWM ‘failure’, the decisions and challenges become more and more normatively wicked.

5.2.2 A Typology of IWM Contexts

Arising from the point of view described above is the following tentative global typology of IWM contexts, presented in Table 4.

Table 4: A Broad Global Typology of IWM Contexts, Developed from Hooper, 2006; Salmon, 2007; Scholz & Stiftel, 2005.

	Scarce freshwater	Plentiful freshwater
Undeveloped	Type 1 Low-tech, local/small scales, e.g., central Africa	Type 2 Low-tech, local/small scales, e.g., upstream Amazon basin, or parts of Indonesia
European Pioneer ‘Western’ jurisdictions	Type 3 High-tech, multiple scales and values, e.g., American West, South-East Australia	Type 4 High-tech, multiple scales and values, e.g., New Zealand, Pacific North-West, American East
Environmentally Mature ‘Western’ jurisdictions	Type 6 Unclear so far.	Type 5 High-tech, multiple scales and values, e.g., Nordic countries

This typology includes: the developed-undeveloped nations divide described by Hooper (2006); the freshwater availability differences in the American East and West as noted by Scholz & Stiftel (2005), and; insights derived through the empirical study of New Zealand in this research. These particularly relate to the Pioneer background of New Zealand in relation to the more ‘mature,’ ecologically conservationist (or, where necessary, preservationist) societies such as those in the Nordic countries (this social difference is also noted by Olsson et al., 2006). These latter jurisdictions are currently much under observation in New Zealand, largely due to the efforts of the Ecologic Foundation, and its publications (Salmon, 2007), and the uptake of their perspective by the currently governing National Party (see, for instance, the Sustainable Land and Water Forum, 2009). I will return to this topic in later chapters.

Type 4 contexts are defined in this research as comprising developed, ‘Western’ societies, with abundant although unevenly distributed freshwater resources, the technological capacity to have secured essential potable supplies, and extant collaborative IWM policies, plans, and programmes (as derived from Hooper, 2006; Scholz & Stiftel, 2005). The focus of this study is on type 4 IWM contexts, because it is argued here that it is in these SESs that the availability of potable water, coupled with technological availability and a pioneer background, have conspired to prevent a sustainability transformation through a series of highly successful avoidance tactics.

Unfortunately, this ongoing avoidance has resulted in a growing sustainability gap, because the underlying necessity for sustainable transformation (i.e., freshwater overshoot), while it may have been articulated, has not yet been embraced, or even fully accepted in type 4 societies. The shift from pioneer (expansion through exploitation) to a conservation-based paradigm is one which has yet to occur, a century and a quarter since the closing of the American Frontier.

Specifically, the theoretical perspective proposed in this subsection, is that SESs in type 4 IWM contexts have not yet come to terms with the closing of their water-resource *quantity* frontier. Particularly in the case study nation, New Zealand, the strategies that have been employed since 1840, through a series of developmental cycles (for instance, small-scale coordination; abstractive and point-source pollution control technologies; larger-scale collaborative integration *and* continuing

technological advancements) have allowed the underlying problem - the unsustainable trajectory of emergent patterns of use in freshwater resource systems - to be consistently avoided.

Following on from the theoretical perspective proposed above, I argue that that the complex adaptive social process of IWM is in fact working relatively well, particularly with reference to the huge improvements in the planning process (decision-makers are ‘failing’ at increasingly wicked problemsheds). However, as already suggested, IWM must operate and be evaluated under a necessary, but usually incorrect, presumption of sufficient SES ‘constitutional will’. ‘Constitutional will’ is defined in this thesis as the product of political will and social capital, with respect to the constitutional-choice level of freshwater appreciation held by that society (e.g., freshwater as an economic, cultural, spiritual or recreational ‘good’). Thus, it is ‘constitutional will’ that enables changes to socially accepted rule-sets of a society to be made *and successfully implemented* with respect to the ways in which that society will approach the attainment and maintenance of sustainable freshwater outcomes. In other words, I argue for the perspective of perverse IWM outcomes as firstly, one necessary part of an ongoing social development, and secondly, indicative of the fact that SES development has not yet attained the necessary level of social appreciation (as the combination of perspectives and understandings) of the freshwater system. In order to ‘succeed’, IWM must first be operating in social contexts that have undergone, or are realistically willing to undergo, a social freshwater sustainability transformation (e.g., Type 5). This raises the key question of how to persuade the SES in question to accept corrective reductions in individual freedoms (permissible types and intensities of freshwater system use) in order to address a collective harm (an identified freshwater overshoot).

From this perspective, and remembering that IWM is an approach used for wicked problems which have already exceeded the capacity of simpler approaches to resolve, the following conceptual explanation for the normative wickedness of polycentric IWM problemsheds is proposed. Polycentric IWM problems are only now emerging in type 4 IWM contexts. Combined with the theoretical perspective that the underlying reason for collaborative IWM failure in type 4 IWM contexts is a lack of SES ‘constitutional will’, this suggests that the reason that polycentric IWM

problemsheds are so normatively wicked is that they must finally address the underlying social tensions within a society, with respect to the use of the freshwater system. These core issues include conflicting worldviews, cosmologies, systems of property rights, or inequity of power or representation, and have been successfully avoided over multiple cycles of institutional change.

In other words, the easier avoidance tactics derived from technological advancement, physical infrastructure for freshwater storage and transport, or the economies of coordination, have already been used. Socially detrimental consequences of freshwater overshoot cannot now be addressed in any way other than through the collaboratively negotiated, but unpalatable reduction of socio-economic pressures on the resource system. Furthermore, because the essential potable supplies have already been secured in these SESs, identification of overshoot in freshwater patterns of use, and of methods to correct it, becomes a very subjective issue. Thus, as the complex adaptive IWM cycles of an SES proceed through time, the unresolved underlying causes of freshwater overshoot become increasingly embedded, contested, and more difficult to change (Healy, 2005). From the above, the reason that polycentric challenges are so wicked is that they are the ‘core’ difficulties: the most difficult, contested aspects that have remained unresolved over long timescales. The normative wickedness of polycentric IWM is thus the accumulation of long histories of avoidance tactics - complex adaptive change, rather than social sustainability transformations.

This section has developed a theoretical perspective of the interdependent polycentric IWM challenge of increasingly normative decision-making, and the wider social sustainability transformation. The theory proposed explains the emergence of polycentric IWM in type 4 IWM contexts, such as New Zealand. In the following section 5.3, I will address the structural difficulties for institutional design present within polycentric IWM problemsheds.

5.3 The Structural Challenges of Polycentric IWM

As already noted, the emergent polycentric IWM problemsheds reported in type 4 IWM contexts, already exceed the capacity of collaborative IWM institutional designs

to address them in ways that are considered to be both effective (efficient and equitable), and legitimate (Hajer, 2003).

This challenge is here addressed in terms of the complex adaptive system characteristic of aggregation. To recap from subsection 4.2.1, aggregation is the tendency of complex adaptive systems to coalesce into constitutional hierarchies. Constitutional hierarchies generate emergent properties and processes at a scale higher than those at which they were generated (Lovell et al., 2002; Ostrom, 1999). The emergence of polycentric IWM problemsheds is therefore here identified as the self-organising product of multiple SESs, interacting over multiple scales and time, to generate a more complex level of decision-making. In this study I term this the emergent aggregate collective-choice level. The difficulty here is that this is a fourth level of decision-making in a process that is typically considered to contain three: the constitutional, the collective-choice, and the operational-choice.

The insights into the underpinning concepts and processes of IWM presented above re-enforce calls for new institutional designs to address this emergent level of freshwater decision-making. Further, the literature as reviewed so far, suggests that the governance of water, particularly in type 4 SESs, is entering a period of “constitutional politics” (Ackerman, 1992, c.f. Hajer, 2003, p175/6). The search for new ways to approach perennially unresolved IWM problems involves “renegotiating the institutional rules of the game” (Ibid). This section introduces the still little-studied phenomenon of polycentric governance structures which may help to resolve multi-scale IWM institutional design difficulties at the emergent aggregate collective-choice level.

Multi-scale governance has proved a significant barrier to the generation and maintenance of sustainable freshwater outcomes from IWM, for two main reasons. Firstly, multi-scale decision-making for freshwater systems requires a complexity thinking perspective to understand its properties and processes (Blomquist & Schlager, 2005; Gunderson & Holling, 2002; Holling, 2004; Janssen & Anderies, 2007; McGinnis, 1999; Olsson et al., 2006; Ostrom, 2001, 2008; Scholz & Stiftel, 2005). This is why multi-scale systems of freshwater governance that demonstrate polycentric decision-making, such as those in the arid American West, have until very

recently been considered as ‘institutional artefacts’. Secondly, a key difficulty for institutional design, recognised in varying degrees by all three convergent management perspectives, is the necessity for a fourth level of decision-making in multi-scale problemsheds. The emergent aggregate collective-choice level of decision-making (Ostrom, 1999, 2001; Steins et al., 2000) is identified in this study as the product of a constitutional hierarchy: a fourth level in a process which has been analysed from the perspective of only three (constitutional-choice, collective-choice, and operational-choice levels). The emergent aggregate-choice level of decision-making is here termed the fourth level, because it is the outcome of complex adaptive aggregation, and therefore by definition will operate at a level, and a scale, higher than that of its constituents. McNeill (2008, p12) suggests that “with this diffusion in multi-level systems there may well be no centre of accumulated authority, but rather variable combinations of governments on multiple layers of authority with relationships built on mutual trust”.

5.3.1 A Theoretical Perspective of Polycentric IWM Problemsheds

Polycentric decision-making systems have been described above in terms of emergent governance practices at a level higher than that of their constituent members. A polycentric system of decision-making in IWM is the product of a constitutional hierarchy, and as such can be considered as an emergent property of inadequate (failed, or absent) institutional arrangements. It is this *emergent* characteristic that differentiates polycentric decision-making from networks in this research. Ostrom (1999, p521) envisions polycentric governance as “a system where citizens are able to organise not just one but multiple governing authorities at differing scales”.

Polycentric decision-making structures address problems of vertical and horizontal integration in multi-scale decision-making through combinations of general purpose and special purpose SESs. These structures also provide civil equity and criminal courts (Blomquist & Schlager, 2005; McNeill, 2008; Ostrom, 1999).

As already noted, polycentric systems of governance are certainly not a new idea. But until very recently, they have been discounted as too costly (especially in terms of redundancy), contested, and uncontrollable to have been considered as viable options,

despite their persistence (Blomquist, 1992; McGinnis, 1999a; Ostrom, 2001).

Importantly, Ostrom (1999, p528) states that

“..., there is no guarantee that such systems will find combinations of rules at diverse levels that are optimal for any particular environment. In fact, one should expect that all governance systems will be operating at less than optimal levels, given the immense difficulty of fine-tuning any very complex, multi-tiered system”.

Accepting that decision-making in IWM will be iterative through time and political jurisdiction, then a more boundedly rational approach is more applicable to the strategic planning process than rationality however defined, (ecological or economic, for instance). A boundedly rational approach to iterative decision-making describes the essence of a polycentric system. The idea of boundedly rational polycentric IWM is also excellently described by the phrase “distributed action by distributed intelligence” (Connick and Innes, 2003, p193).

The tenets of bounded rationality as defined by Jones (2002) and applied in polycentric IWM can be described through four underlying principles:

- The tenet of intended rationality (the implementation gap),
- The principle of adaptation (learning by doing)
- The principle of uncertainty (difficulty in specifying outcomes), and
- The principle of trade-offs (trade-offs between goals is difficult).

In polycentric IWM, the locus of decision-making will be dispersed over multiple levels of intervention. In such cases, “trust suddenly pops up as a key variable” (Hajer, 2003, p184). The reality is that polycentric IWM will require, rather than render redundant, the support of authorities at all levels above and below that at which it operates (Blomquist & Schlager, 2005; Hajer, 2003), and it seems that the role of government agencies as ‘classical-modern’ institutions in the governance of complex adaptive common-pool freshwater resources, and their dependent SESs, is indeed more needed, richer, and more complex than had previously been envisioned (Ryan, 2001; Schlager et al., 1994; Steins & Edwards, 1999).

The wickedness of polycentric IWM is explained above from a complexity thinking perspective of the cycles of development and institutional change in the IWM process. As already noted, from this perspective, ongoing calls for more collaborative capacity,

for clearer definitions and procedural attributes, can be explained in terms of the process of institutional change in IWM (subsection 4.2.1). In light of the insights above, Connick and Innes (2003, p180) note that “collaborative policy dialogue can best be understood as part of a complex evolving system”.

Adopting the perspective that institutional design (planning) is a sub-process of IWM in an evolving system, the following outcomes may still be produced by ‘failed’ collaborative IWM efforts (i.e. those that fail to achieve and maintain sustainable freshwater outcomes). The ‘hidden’ outcomes are: 1) increases in social and political capital, 2) agreed-on information, 3) an end to stalemates, 4) high-quality agreements, 5) learning and change, and 6) innovation and new practices of networks and flexibility (Connick and Innes, 2003). These often disregarded outcomes have quietly contributed to IWM participant capacity to respond to emerging polycentric problemsheds.

The complex adaptive phases of the process of institutional change in IWM are: a shortfall in institutional capacity – the identification of an institutional void, and emerging new political spaces in which stakeholders explore new ways to fill the void (front-loop), and; the re-statement of the changing IWM problemshed, and re-negotiation of rules (back loop) (Hajer, 2003; Olsson et al., 2006). Particularly with reference to the questions addressed through collective-choice level rule-sets in Table 3, there are five challenges to the decision-making status quo (Hajer, 2003) which will need to be re-considered for every stage of IWM procedural development. These challenges are identified in a range of literatures (Abernethy, 2005; Blomquist & Schlager, 2005; Connick & Innes, 2003; Gunderson & Holling, 2002; Hajer, 2003; Healy, 2005; Medema et al., 2008; Ostrom, 2001; Scholz & Stiftel, 2005; Steins & Edwards, 1999; Steins et al., 2000; Valentine et al., 2007; Weber & Khademian, 2005; Yorque et al., 2002). The challenges that must be addressed are reported in various forms of the following five ‘preconditions for a good deliberation’ (Hajer, 2003):

- the new order of decision-making is dispersed (the locus of power has become unclear);
- There is a new spatiality of policy making and politics (where ‘scale jumping’ is the art of putting in each intervention at the appropriate level);

- The standard view of participation and democratic governance might have to be rethought (perhaps the very design of citizen-involvement should be reconsidered);
- The authority of classical (scientific) expertise has been undermined;
- The context of policy-making is expansive.

From a complexity thinking perspective, these polycentric IWM challenges represent back-loop re-organisation as part of social learning and change. They are so challenging because they are the accretions of many cycles of adaptive change (avoidance tactics, rather than sustainable transformation), and all the low-hanging institutional fruit has now been picked. What remains are the issues that have so far remained avoided and unresolved. This back loop happens at every stage of development between coercive, cooperative, collaborative, and polycentric IWM because these questions (who pays? Who benefits? Who decides? How? And how may rules be changed?), are fundamental to institutional change- to the collective-choice re-negotiation of bundles of property rights.

Viewing the development of freshwater governance as a series of ‘steps towards’ a more robust ‘balance’ also underlines the more boundedly rational approach of polycentric structures. As the number of participant SESs grows, so does the range of capacity, experiences, and stages of SES development. Complexity thinking and the perspective of cycles of adaptive change also explains the reiterated calls for capacity in various forms - at the beginning of every new developmental cycle, the parameters are investigated, defined, and then there must be a period of capacity building in order to lift the performance ceiling of IWM institutions to the next level of difficulty. It is not that previous approaches have not worked: it is that they were necessary developmental stages that have been ‘failing’ at successively more difficult and complex tasks. However, development of institutional designs for sustainable freshwater governance from a ‘pure’ property rights perspective is now at a point where if it was subject to evolutionary forces, it would be stuck. But because institutions are a human creation, it is possible, when that point is reached, to go back to the drawing board and re-design, using both long-term experience, and new information that has been collected along the way.

5.3.2 Polycentric IWM and the Aggregate Collective-Choice Level of Decision-Making

The key difficulty for institutional design from multi-scale problems identified by all approaches in the literature is here interpreted as the necessity for a fourth level of decision-making. A complexity thinking perspective can contribute to this interpretation by providing a more realistic appreciation of the systems involved (hydrological, social, ecological, or institutional). Further, it can help by defining polycentric IWM as the outcome of previous cycles of ‘failure’. Polycentric IWM will operate as an emergent, self-organising product of a constitutional hierarchy, at the emergent aggregate collective-choice level. The problems currently defying IWM are the outcomes of a particular kind of SES experience. In order to become polycentric IWM challenges, a problemshed must first of all be addressed by collaborative IWM. Where this fails to close the sustainability gap, but succeeds in developing social capital and all kinds of learning (policy, institutional, social, scientific, etc), then polycentric IWM may emerge.

Hajer (2003) considers that polycentric systems of decision-making are required because classical-modernist institutions are no longer able to cope with the challenges of emerging IWM problemsheds. These challenges are shown in Table 5. Compared with the challenges to adaptive governance from what Scholz & Stiftel (2005) call ‘second order’ collaborative governance, shown alongside, there is a strong correlation, although not a perfect fit. This seems more than reasonable, given the widely varying theoretical perspectives and purposes, and real-world examples from which these characteristics were identified, and employed in the consideration of polycentric implications for institutional design.

Table 5: Two Perspectives of Polycentric Challenges to Decision-Making for Freshwater Systems

Hajer (2003) Five Characteristics of new political spaces that challenge classical-modernist decision-making	Scholz and Stiffler (2005) Characteristics of second order collaboration challenges to adaptive governance
The locus of decision-making power is unclear	Representation (who should be involved?)
There is a new spatiality to decision-making , which requires the art of ‘scale-jumping’	Public Learning (how can resource users and the relevant public develop common understandings as a foundation for consensual policies and policy processes?)
The nature of democratic governance and of citizen participation may have to be re-thought	Decision-process (how can authorities and involved stakeholders reach policy agreements that serve them well?)
Scientific authority has been undermined	Scientific learning (how can policy makers develop and use knowledge effectively?)
The context of policy-making is unclear	Problem responsiveness (how well do decisions achieve natural resource management goals, including sustainability, equity, and efficiency?)

As with the convergent model of collaborative IWM described in Chapter Three, the broad correlation of challenges to both the ‘old’ (classical modernist) paradigm identified by Hajer (2003), and the ‘new’ adaptive governance, as required by ‘second order’ collaboration problems (Scholz & Stiffler, 2005) suggests that these are difficulties inherent to something other than either of the ‘old’ or ‘new’ decision-making paradigms. These characteristics are also noted in various forms from a wide range of sustainable freshwater governance perspectives (Connick & Innes, 2003; Gunderson & Holling, 2002; Gunningham, 2008; Healy, 2005; Olsson et al., 2006; Ostrom, 2008; Steins et al., 2000; Valentine et al., 2007). This suggests that it is the emergent aggregate collective-choice level of decision-making that requires polycentric decision-making structures and processes, not adaptive governance, as suggested by Scholz & Stiffler (2005).

In this study, I propose that the challenges which link the old and the new decision-making paradigms as described above are representative of the emergent aggregate collective-choice level of decision-making. Thus, it is the new political spaces developing from an institutional void in collaborative IWM, which generate polycentric IWM problems (as described by the characteristics above) at the

emergent aggregate collective-choice level of an SES. Further, the emergent aggregate collective-choice level of decision-making can only be identified and understood from the perspective of complex adaptive systems, their process of change, and their characteristics, particularly that of aggregation.

At the emergent aggregate collective-choice level, each SES involved will need to make SES-specific decisions over *all three* (constitutional-choice, collective-choice, and operational-choice) levels of decision-making. What is being considered is a re-negotiation of the five institutional change questions (who pays, benefits, decides, etc) from a range of SES developmental stages (e.g., coercive, cooperative, collaborative). Therefore, collaborative IWM institutions for structure and process at the coupled collective-operational choice levels (Figure 4) are hereby proposed as the decision-making considerations that Giordano (2003) has suggested will need to be made in every SES. To recap, Giordano (2003) has pointed out that for Complex Commons problems, certain decisions will have to be iterated for every scale of authority at which there exist two or more competing or conflicting intersections of property rights domains, with respect to the domain of the resource.

From the above, polycentric IWM is the necessary *structural* response to the emergent aggregate collective-choice level of decision-making, which in turn is the result of a collaborative IWM failure that has triggered a period of institutional change, addressing Hajer's (2003) five 'preconditions for a good deliberation'. Institutional outcomes are dependent upon the outcomes of the other two systems (social and freshwater/ecological). Because IWM rules are difficult, time-consuming, contested, and costly to design and change, this process is typically undertaken in response to a very clear actual or predicted threat of freshwater overshoot and social disadvantage. An IWM outcome of institutional change is therefore a clear indicator of overall IWM 'failure', and marks the progress of the IWM complex adaptive cycle into the back-loop (system disturbance or collapse, and re-organisation) phase. Furthermore, the type of challenges identified as problematic to the re-negotiation of IWM rules will indicate whether the IWM problemshed under analysis has become polycentric, since this will influence the type of institutional change required.

The developmental processes of complex adaptive systems generate emergent properties from decisions that are repeated through time, spatial scale, and sectoral interest of SES (Berkes, 2002; Carter et al., 2005; Connick & Innes, 2003; Gibson et al., 2000; Giordano, 2003; Hajer, 2003; Healy, 2005; Lovell et al., 2002). This iterative element of decision-making invokes a more boundedly rational approach to collaborative IWM than has been apparent in the preceding coercive and cooperative approaches (Janssen & Anderies, 2007; Jones, 2002; Ostrom, 1999, 2008; Owens et al., 2004; Steins et al., 2000). Acknowledgement of the need for iterative, boundedly rational decision-making is a significant shift in the underpinning decision-making perception, which again brings the constitutional-choice level of decision-making (as political will) to the fore across all scales of jurisdiction (Giordano, 2003; Hajer, 2003).

The iterative nature of decision-making at the emergent aggregate collective-choice level means that “it is the *continuity and coherence of the constitution* that has become an empirical question again” (Hajer, 2003, p184). From the foregoing discussions, the following attributes of emergent aggregate collective-choice decision-making, and their relationship with polycentric IWM problemsheds characteristics have been identified:

Firstly, polycentric IWM is an emergent property of a particular type of collaborative IWM failure, which nonetheless has facilitated social learning and leadership.

Polycentric IWM problemsheds are characterised by Hajer’s (2003) five ‘preconditions for a good deliberation’, and are the result of a collaborative IWM institutional void, resulting in the generation of the emergent aggregate collective-choice level of decision-making.

Secondly, the emergent aggregate collective-choice level of decision-making will include multiple decision-making autonomies (SESs) from various jurisdictional scales, and sectoral or social perspectives. As the complex adaptive product of a constitutional hierarchy, the decision-making process at this level will firstly have no single decision-making authority, and secondly, will be prone to change without central direction. Indeed, this level cannot be understood from the perspective of a centrally directed organisation (Ostrom, 1999).

Effective, parsimonious freshwater management paradoxically requires redundancy from imbricated decision-making structures. Polycentric approaches address this through a more boundedly rational approach to iterative decision-making. This system involves much higher levels of redundancy, but this is arguably a pre-requisite for increased SES robustness.

Difficulties with emerging polycentric IWM problems have been identified in this section as the characteristics of emergent aggregate collective-choice level decision-making. How can collaborative IWM institutions be adapted for polycentric IWM (aggregate collective-choice level) problems? The answer lies in the iterative nature of polycentric IWM decision-making. All three levels of governance (constitutional, collective, and operational) must be employed in every SES that is a part of the problemshed. Further, boundedly rational iterative decision-making from multiple SESs reinforces the observed shift from management to governance (i.e., from collective-choice to constitutional-choice processes), highlighting the hitherto under-considered constitutional-choice level as critical to polycentric IWM.

However, it remains important to note that social transformation in freshwater decision-making from collective-choice to constitutional-choice processes will not necessarily ensure sustainable freshwater outcomes. For that, a sustainability transformation, rather than a decision-making one, is required.

5.4 A Synthesis for Polycentric IWM

The foregoing sections of this chapter have identified key challenges of polycentric IWM as being broadly either structural or normative (Table 6). These are underpinned by ongoing failure of an SES to achieve a sustainability transformation with respect to its freshwater systems. Perennial problems, multiple scales, and multiple normative contestations all indicate that IWM is best approached as a boundedly rational, iterative process of property rights re-negotiation over multiple dimensions (Jones, 2002; Margerum & Born, 2000; Margerum & Hooper, 2001; Margerum & Whithall, 2004; Ostrom, 1999, 2008; Ryan, 2001; Singleton, 2002).

Table 6: Challenges and Attributes of Polycentric IWM

Polycentric IWM Challenges	Polycentric IWM Attributes
Elusive sustainable freshwater outcomes	A requirement for a social sustainability transformation
Normative challenges to decision-making	A willingness to address deeper social problems or inequities
Structural challenges of institutional design for multi-scale decision-making	Identifies the emergent aggregate collective-choice level as a fourth level of decision-making Applies a boundedly rational perspective to iterative decision-making

One challenge presented by iterative decision-making in freshwater governance is that because the focus so far has been on the coordination of the collective and operational levels as a coupled system (Anderies et al., 2004), the constitutional level of governance has not been the focus of attention, beyond the observation that legislative rules should support (or at least not undermine) collaborative enterprises (Edwards & Steins, 1998a; Margerum, 1999b; Ostrom, 1999). However, in light of the iterative, and imbricated, nature of decision-making for freshwater as argued for above, the constitutional-choice level emerges as an increasingly important and influential level that must be addressed at every governance scale. This is because it is at the constitutional-choice level that decisions are made about the way that water is viewed (as a public, community, or private good, for instance), and the type of society in which people wish to live. Examples of the latter include the degree of autonomy available for individual decision-making, the kind of responsibilities and duties that go with that autonomy, and the kinds of punishments for rule-breaking (Bakker, 2003; Bruns & Meinzen-Dick, 2005; Giordano, 2003; Margerum & Born, 2000; Ostrom, 1999).

The attributes of polycentric IWM identified in this chapter include:

- an ongoing requirement for social sustainability transformation;
- a willingness to address deeper social problems or inequities;
- Imbricated SESs, generating the emergent aggregate collective-choice level of decision-making through the complex adaptive system characteristic of aggregation, and;
- A boundedly rational perspective to iterative decision-making.

The IWM process is essentially one approach to informing and directing the design and re-design of IWM institutions over time, sectoral interest, and jurisdictional scale.

In Chapter Four, I proposed a re-drawn model of IWM that included:

The **concept** of integration; A **complex adaptive systems** perspective; **Procedural approaches** which may be coercive, cooperative, collaborative, or polycentric; **Complex Adaptive Processes** that include IWM, coupled institutional change/planning sub-processes, and the imbricated social sustainability process.

Collaborative IWM Planning Process and Rules-sets are defined as comprising:

Constitutional-choice level elements of initiation, problemshed definition, and resourcing. These elements are closely associated with the design of structural rule-sets for collective-choice decision-making: scope, membership, and position.

Collective-choice level procedure rules for the coordination of the collaborative planning process: authority, information, and decision/procedure/aggregation.

Coordinated collaborative planning will design **operational-level** rules (the output, or management plan), which are boundary, allocation, input/output, and penalty. The way that these rules are interpreted through the wider SES institutional arrangements, will influence the sustainability of otherwise of the IWM outcome.

The model for IWM thus described in Chapter Four and recapped above, remains unable to address polycentric problemsheds. Therefore, in this chapter, I have proposed a theoretical perspective that extends the model to address key polycentric challenges. This perspective suggests that polycentric IWM is a terminology that refers primarily to structure, rather than process. In polycentric IWM, all other decision-making approaches (coercive, cooperative, and collaborative) are to be expected, reflecting the diverse range of SESs and their degree of sustainability development. This is accommodated by the employment of a more boundedly rational, iterative approach to decision-making, which nonetheless will employ the rule-sets identified above to address the issues pertaining to institutional voids and resulting new political spaces, to re-negotiate individual bundles of property rights.

Finally, Polycentric IWM, as a complex adaptive response to the emergent aggregate collective-choice level of decision-making, will have no single decision-making

authority. It will be self-generating, and self-ordering, and thus demonstrate a capacity to change in unpredictable ways. Further, boundedly rational, iterative decision-making implies a degree of decision-making redundancy which will be costly to maintain, and also implies a degree of decision-making devolution.

5.5 Summary

Polycentric problems challenge institutional design for IWM in two broad areas. Firstly, in their normative, procedural difficulties, and secondly, in the structural requirements of imbricated SESs, operating over more than three levels of decision-making. These two main challenges need to be addressed from a perspective of ongoing social change through iterative, and therefore boundedly rational decision-making (Jones, 2002; Ostrom, 1999). In order for this type of system to be robust, there must also be redundancy of decision-making, authority, and leadership (Janssen & Anderies, 2007; Olsson et al., 2006; Ostrom, 2008). Redundancy is also implied by the necessity of iterative decision-making in complex common-pool resources, as noted by Giordano (2003).

Further, institutional design for IWM must operate within the parameters of the wider institutional arrangements through which they are generated, interpreted, and implemented, to outcomes sustainable or perverse. The vast number of possible institutional permutations drives the need for frameworks and models based on the identification of generic institutional patterns, and patterns of institutional change (Edwards & Steins, 1998, 1998a; Oakerson, 1992; Ostrom, 1999). What are required are sufficiently complex system models for decision-making in freshwater SESs that can accommodate the emergent properties of constitutional hierarchies (Adger, 2000; Anderies et al., 2004; Biswas, 2004; Connick & Innes, 2003; Gibson et al., 2000; Giordano, 2003; Gunderson & Holling, 2002; Janssen & Anderies, 2007; Yorque et al., 2002). As complex adaptive systems, institutional *arrangements* should therefore be expected to demonstrate diversity across scales, non-linear (abrupt) periods of change, or punctuations of constitutional change, and the critical attribute of aggregation, whereby institutional arrangements may generate emergent properties and processes at a scale higher than those from which it emerged. Evaluative frameworks for these attributes in SESs undertaking IWM are urgently needed. The

following Chapter (Six) reports on the development of an evaluative framework for the model of IWM proposed in this study.

6 An Evaluative Framework for a Re-Drawn IWM Process

6.1 Chapter Introduction

The previous two chapters have re-drawn IWM as a complex adaptive process of social change. Integrated water management has developed its procedural attributes through experience of coercive, cooperative, and collaborative approaches to the renegotiation of IWM institutions, with the intention of achieving and maintaining sustainable freshwater outcomes. In type 4 contexts, such as New Zealand, the IWM process must now deal with polycentric decision-making accommodating the emergent aggregate collective-choice level. Further, the role of wider socio-economic, cultural and political institutional arrangements in the achievement or compromise of the IWM sustainability intentions has been suggested as a key, under-considered aspect of IWM outcomes.

As I have argued in the previous chapters, the IWM process should be considered in terms of three interacting or interdependent complex adaptive processes. Besides IWM, prime amongst these is the social sustainability transformation as a wider, imbricated process and a non-substitutable driver for sustainable IWM freshwater system outcomes.

Institutional change is a sub-process of complex adaptive IWM and includes the sub-process of plan development as its back-loop. Plan development, in turn, addresses the employment and/or renegotiation of collective-choice rules for crafting operational-choice rules, which are expressed as property rights. The collaborative IWM planning process is thus the outcome of previously failed attempts at coercion, cooperation, or collaboration. However, in some situations, collaborative failure in one SES can coincide with failures in other SESs. These multiple decision-making authorities, representing a range of scales, stages of IWM development, or sectoral interest then coalesce into a constitutional hierarchy, to address problems beyond their individual capacity to resolve. The outcome is polycentric IWM, operating at the

emergent aggregate collective-choice level of decision-making. The key points of polycentric IWM as proposed above are that it will be an emergent property of (potentially several) collaborative failures; it will be developed in response to decision-making challenges at the emergent, aggregate collective-choice level; it will operate without the presence of a single decision-making or directing authority; it will include SESs at all stages of IWM procedural development, and; polycentric IWM will be largely uncontrollable and prone to self-organising change.

One of the major challenges for analysis of IWM reported in the literature has been the difficulty of developing a method of identifying subjectively important data-sets, collecting normative data, and comparing results across multiple SESs. This is because of the interrelatedness, hidden contexts and contextual dependency of every individual enterprise (Ascher, 2001; Connick & Innes, 2003; Edwards & Steins, 1998a; Ferreyra & Beard, 2007; Healy, 2005; Hedelin, 2007; Steins & Edwards, 1999a; Steins et al., 2000). In order to evaluate the re-drawn IWM, and to undertake the empirical evaluation of institutional arrangements for IMW in New Zealand, an evaluative framework is needed.

The purpose of this chapter is to propose a framework to evaluate the re-drawn IWM process, and to describe the framework development. This is achieved as follows. The evaluative framework developed in this chapter originates from the well-known institutional analysis and design framework published by Oakerson (1992), presented in section 6.2. The Oakerson framework was further developed by Edwards and Steins (1998), specifically in order to analyse multiple-use Commons, and the associated process of institutional change in multiple-use common-pool resources (section 6.3).

In section 6.4, I will adapt the Edwards and Steins framework to the evaluation of re-drawn IWM as cycles of social change and learning, comprised of imbricated and nested processes of complex adaptive change. Section 6.5 provides a summary, including a brief discussion of the strengths and weaknesses of the proposed evaluative framework for re-drawn IWM.

6.2 The Oakerson (1992) Framework

As mentioned above, the framework developed in this chapter has its origins in that of Oakerson's (1992) framework, presented in Figure 6.

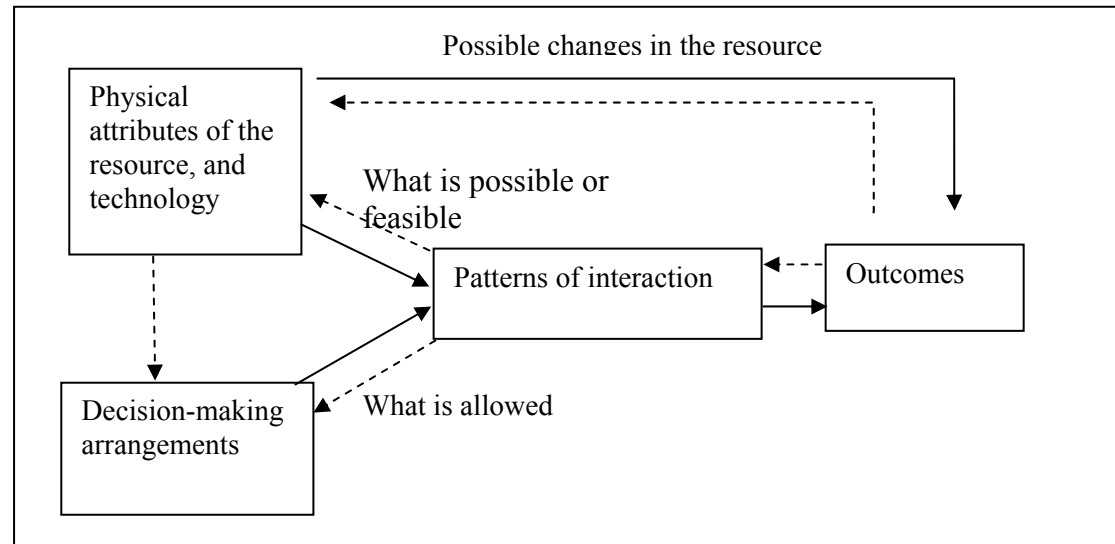


Figure 6: Oakerson's (1992) Framework for Analysis of Institutional Change

The original framework from Oakerson shows how the context - what is possible, and what is allowed, shown on the left of the diagram, will directly influence the use of a resource, resulting in an action or outcome, on the right. This outcome may be directly influenced at any time by changes in the resource, for instance an unexpected or prolonged drought. However, the repeated single use of a renewable resource over time accumulates into patterns of interaction, generating feedback loops (the dashed lines) that influence *future* availability, rules, use, and outcomes. These feedback loops are one of the reasons that IWM is wicked. Another reason, already discussed, is the common-pool-resource nature of water resource systems and their benefits. The next framework has been specifically developed from Oakerson's by Edwards and Steins (1998), to analyse changes in institutional arrangements for *multiple-use* (i.e. single scale and/or single system of property rights) common-pool resources such as water.

6.3 The Edwards and Steins (1998) Framework

The framework for analysis of multiple-use common-pool resources, as presented by Edwards and Steins (1998), is shown in Figure 7. As presented, the framework

comprises: contextual factors external to the system; contextual factors internal to the system (resource characteristics and technological capacity, decision-making rules, and social characteristics of user-groups); the individual selection of action strategy from multiple available choices; emerging cumulative patterns of interaction, and; outcomes (for the resource, the institutions, and the users).

This framework follows the basic process of context, patterns of interaction, and outcome. But common-pool resource governance must include a jurisdictional or resource boundary, represented at the top of the diagram by the presence of external contextual factors. Freshwater governance has generally been considered at the catchment scale, although as I have discussed, this is increasingly contested. The definition of jurisdictional boundaries is necessary in order to distinguish between the influence on outcomes from variables that are external to the SES, and over which the local users may have very little control, and those on the left of the diagram (the natural resource characteristics and available technologies, the institutional arrangements, and the user-groups' characteristics), which are internal to the system and which influence outcomes directly through patterns of interaction with the resource.

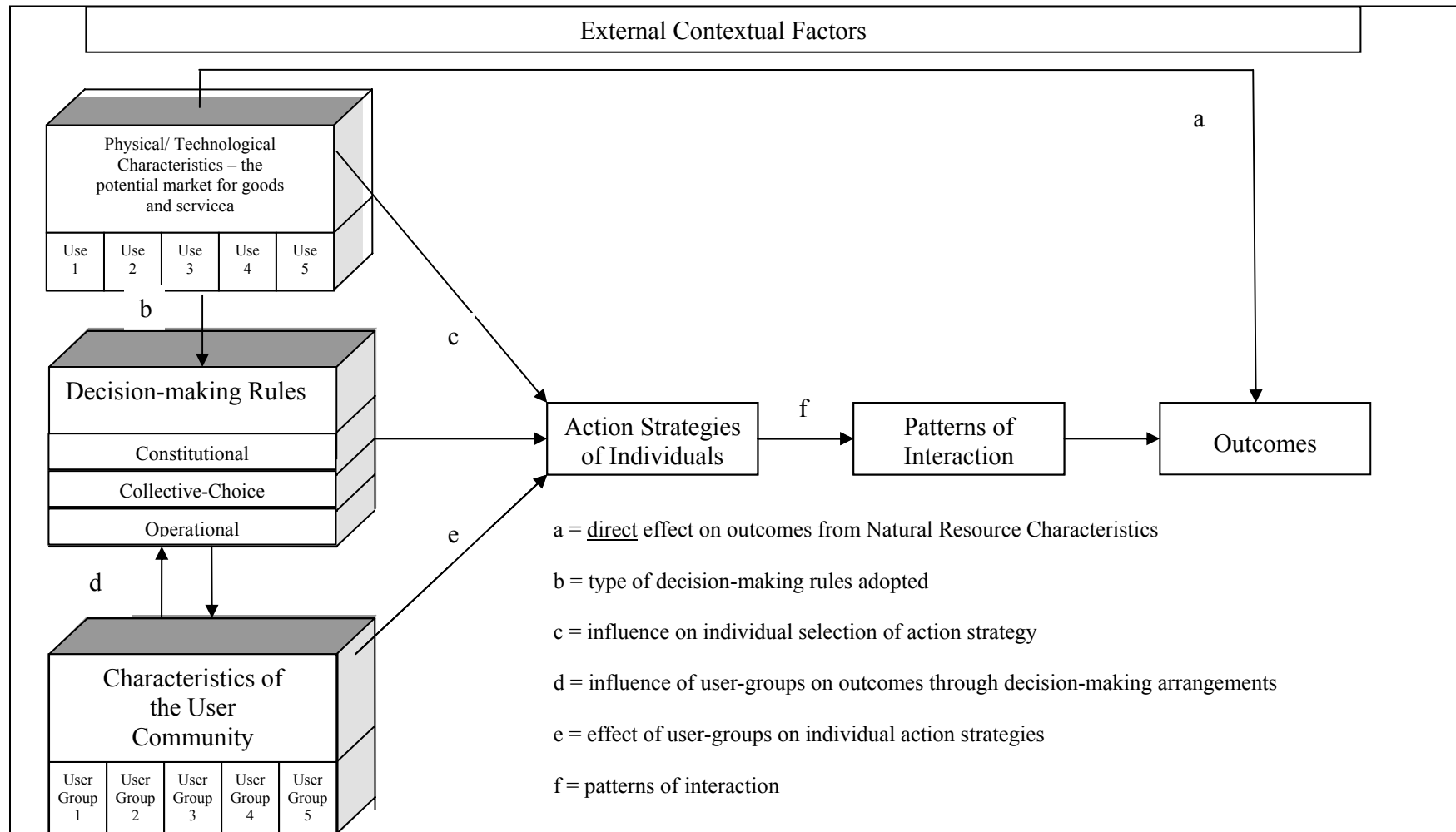


Figure 7: Framework for Analysis of Multiple-Use CPRs, Edwards and Steins, (1998, p368).

Furthermore, it is important that the characteristics of the users themselves are represented, since they influence the decision-making process through their two-way relationship with the decision-making arrangements. The inclusion of user group characteristics also shows how the selection by individuals of one particular action strategy from several available, is influenced in three ways. Firstly, the range of options available to users is influenced by what is practical, in terms of potential costs and benefits of competing water uses and markets. Secondly, it is influenced by what is legal, or permitted, as typically represented by the prevailing freshwater governance institutions and property rights system, and lastly, individual strategy selection is influenced by what is desirable, in term of user-group worldview and preference. Once an action strategy has been selected, patterns of interaction begin to emerge as before, but the subtractability of common-pool resources means that it is critical to address the **cumulative** effects of multiple patterns of interaction, which should result in institutional change if they exceed resource system limits. Lastly, this framework gives a very clear sense of multiple-use common-pool resource governance as a process happening over time.

Institutional change as an IWM outcome is thus demonstrated as the product of interactions between all the contextual variables over time. It is important to note that Margerum (1999) and Edwards and Steins (1998) observe that because of the strongly contextual nature of decision-making in such situations, desired outcomes of the planning process should be identified by the participants from the context of the problemshed. However, this viewpoint does need to be underpinned by a clearly defined set of quantifiable ecological goals, including freshwater system limits to use. As I have argued above, the identification and acceptance of ecological limits to use seems to be more closely associated with social sustainability transformation than IWM.

6.3.1 A Visual Metaphor

Swaffield (1998) reports on the importance of metaphor in integrated management situations, as a method of conveying a great deal of information quickly and reliably, and Gunderson and Holling (2002) encourage the development of new ‘myths’ for the

same purpose. In this study, a great deal of information is conveyed through the visual ‘metaphors’ of figures and tables. In order to properly demonstrate the complex interrelatedness, the multiple scales, and multiple perspectives that may be brought to bear on an IWM problem, the framework above must be reduced to a visual metaphor. This simplified representation, based on Figure 7 from Edwards and Steins (1998), and shown in Figure 8, will be built upon during the following subsections, as the evaluative framework for IWM is developed.

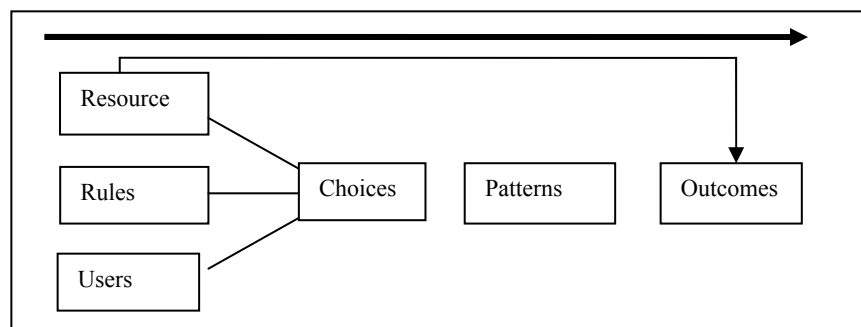


Figure 8: A Visual Metaphor for the IWM Process

This visual metaphor, representing one cycle of single-scale complex adaptive change in IWM from context to outcome, becomes a different kind of building block from that already cited in subsection 4.4.4.3 from the perspective of collaborative institutional design. As with the identification of rule-sets for decision-making, the figure above can be used as a way of “breaking down complex processes into small chunks that can be used in multiple ways and can be combined and recombined repeatedly and at diverse levels” (Ostrom, 1999, p. 523).

6.4 A Proposed Framework for Evaluation of a Re-drawn IWM Process

Because the framework as developed above has been designed to analyse a process, it is particularly suited for use as a basis for evaluation of re-drawn IWM. However, in order to specify the framework to re-drawn IWM, the following main steps were undertaken and are reported in detail in the following subsections.

In subsection 6.4.1, I align the framework above with the stages of the complex adaptive process of IWM procedural development, identifying front and back-loop

IWM processes. Next, in subsection 6.4.2, I specify the multiple-use common-pool resource framework for the evaluation of re-drawn IWM, including the capacity to analyse the role of institutional arrangements, particularly in front-loop IWM processes, as identified in the previous subsection. The focus here is on the transition from collaborative to polycentric IWM, as of particular interest to this study. Lastly, I incorporate the processes of social sustainability transformation and institutional change into the framework (subsection 6.4.3). Subsection 6.4.4 provides a brief overview of how the framework directs lines of enquiry during evaluation of institutional arrangements for IWM.

6.4.1 The Development of Procedural IWM as a Complex Adaptive Process

Accepting the multiple-use framework above as a broadly robust representation of the governance process in multiple-use common-pool resources such as freshwater, the first task was to align the framework with the stages of the complex adaptive process over the developmental cycles of IWM, as one approach to the governance of freshwater systems (Figure 9). Drawing from the framework above, the context and outcome, at either end of each individual cycle, represent the back-loop. Individual strategy selection, and the emerging patterns of interaction thus represent the front-loop processes of IWM which are of particular interest to this study.

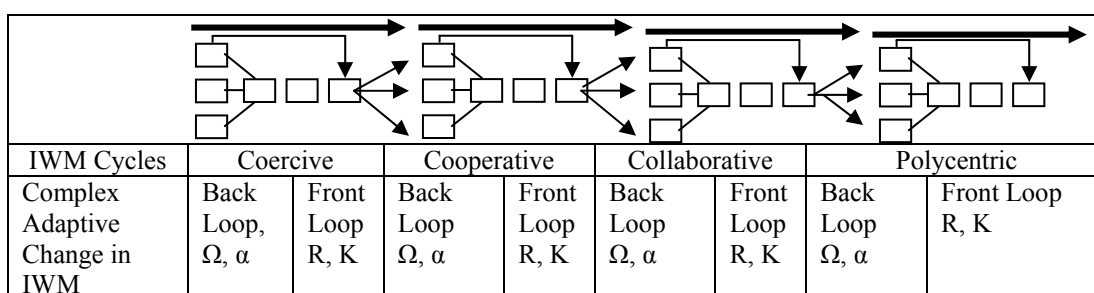


Figure 9: IWM Procedural Development as Cycles of Complex Adaptive Change

The alignment of these two processes also highlights the need to evaluate IWM as an ongoing process whereby the system does *not* re-set to the original starting point (as implied by the feedback loops of the previous frameworks), but generates a ‘new’ context, however deeply rooted in the past, with every cycle. As already noted, the transition of most interest to this study is that between collaborative and polycentric IWM.

6.4.2 Evaluating the Role of Institutional Arrangements in IWM

The next task was to specify the multiple-use common-pool resource framework to the re-drawn model of IWM. In particular, the resulting framework for evaluation will require the capacity to analyse the influence of institutional arrangements, and multiple scales of governance. The framework for the evaluation of the IWM process, as adapted from Edwards and Steins (1998) to accommodate re-drawn IWM, is proposed in Figure 10 and described below. Subsection 6.4.3 then incorporates the associated complex adaptive processes.

The key framework elements are now: contextual factors (external, historical, and internal); institutional arrangements; operational rules in use that influence individual action strategies; patterns of interaction; sustainability range; triggers for institutional change, and; resource, institutional, and social outcomes. The processes and elemental interactions represented by framework in Fig 10 show that as before, the external context continues to influence IWM outcomes. However, so does the historical perspective, the ‘institutional sediments’, now included as background to in the internal context. Considerations of technologically and economically practical uses (markets), existing IWM rules (that which is legal), and user-group appreciations of the resource (what are considered desirable uses) are now filtered through the wider social systems of institutional arrangements, creating a group of socially accepted ‘rules in use’, which influence individual decisions as to whether and how individual bundles of property rights will be exercised. Social characteristics and world-views of user-groups can now also influence the outcomes of IWM directly, reflecting this capacity in the resource system itself.

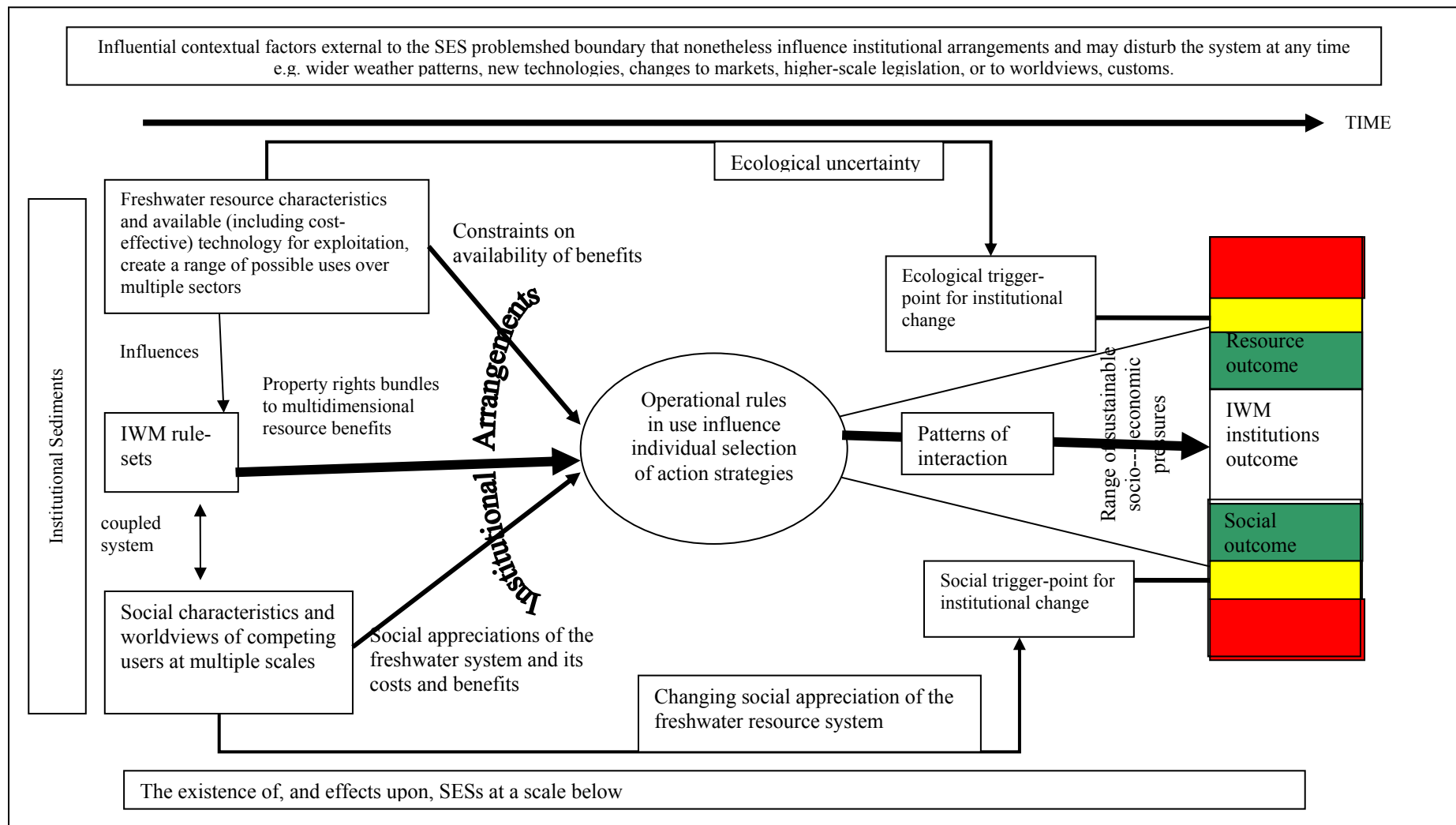


Figure 10: A Framework for Analysis of Re-Drawn IWM

Once decisions regarding the execution or otherwise of individual bundles of property rights have been made, these then generate cumulative patterns of interaction over time. The cumulative patterns of interaction generate cumulative levels of multi-dimensional resource use. The sustainability ‘triangles’ shown in Fig 10 reflect two key concepts embedded within this framework. The first is that institutional arrangements, through their influence on the operational rules in use of an SES, can direct, or ‘aim’ cumulative levels of use to within sustainable limits, or to a sustainability overshoot. This is represented by the extent to which the sustainability triangles intersect with the ‘traffic lights’ of the social and resource outcomes. Institutional outcomes do not have traffic lights, since institutional change is expensive and contested, and triggered by cumulative levels of use (socio-economic pressures, or sustainability triangles) exceeding sustainability levels in the social or resource outcomes. In either social or resource outcomes, sustainability triangles that intersect with green portions will not trigger institutional re-design. Where they intersect at yellow portions, institutional change should be considered, as indicated by the trigger points. Where red portions are breached, overshoot and unsustainable outcomes have occurred.

The main changes made to the Edwards and Steins (1998) framework in order to evaluate the re-drawn IWM process as proposed above are:

- the explicitly multi-scale nature of the framework;
- the inclusion of the element of institutional sediments (although the authors do suggest the possibility of evaluating historical contexts);
- the inclusion of a direct line of influence on outcomes from changing social appreciations of the freshwater system;
- institutional arrangements arising from the external, historical, and internal contextual factors, which filter IWM institutions and create a set of ‘operational rules in use’;
- a variable element for patterns of interaction;
- a range of sustainable socio-economic pressures on the resource, as identified by the social and ecological trigger-points, which when crossed will initiate the back-loop processes of institutional change (the sub-process of plan development), and;

- An ‘onward’ cycles perspective, rather than a feedback loop.

Thus, the elements and interactions of the framework proposed in Figure 10 are as follows.

Contextual factors external to the SES are external to the SES problemshed, but nonetheless can influence the institutional arrangements of that SES, and may disturb the system at any time. Examples of external contextual factors include, *inter alia*, wider weather patterns (inducing drought or floods, for example), new technologies, changes to markets, higher-scale legislation, or wider world-views of water. Further, there may be several scales of SES operating above that being evaluated, as well as below. Multi-scale SESs and decision-making are therefore added to the visual metaphor (Figure 11), shown in bold as multiple lines above and below.

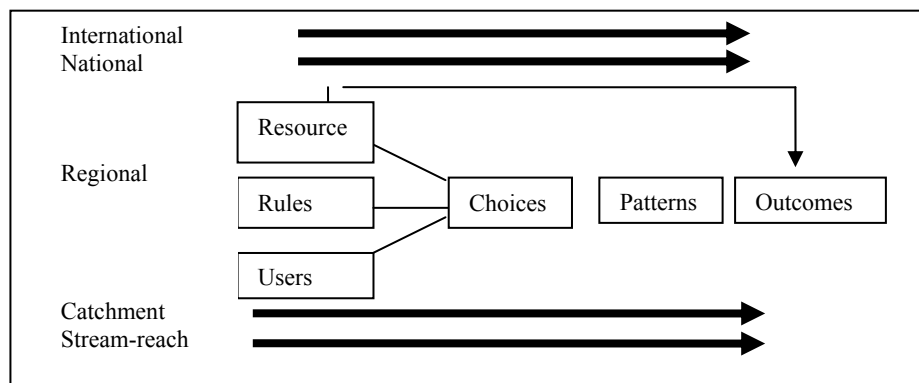


Figure 11: Representing Contextual Factors External to the SES in Multi-Scale IWM

This may, for instance, represent a New Zealand regional SES, with national and international SESs at scales above, and catchment or sub-catchment-scale SESs, and SESs associated with individual stream-reaches or even an individual property, below.

Institutional sediments are the historical underpinnings of enduring formal and informal decision-making outcomes (typically avoidance tactics), that have accreted over the society’s long-term (intergenerational) relationship with the resource. As suggested in previous chapters, these can be an important source of strongly influential institutional arrangements that are difficult to change. Therefore, understanding the historical embeddedness of current challenges to sustainable freshwater outcomes is critical to their resolution. This element is added to the metaphor in bold, and feeds into the current internal context to give Figure 12.

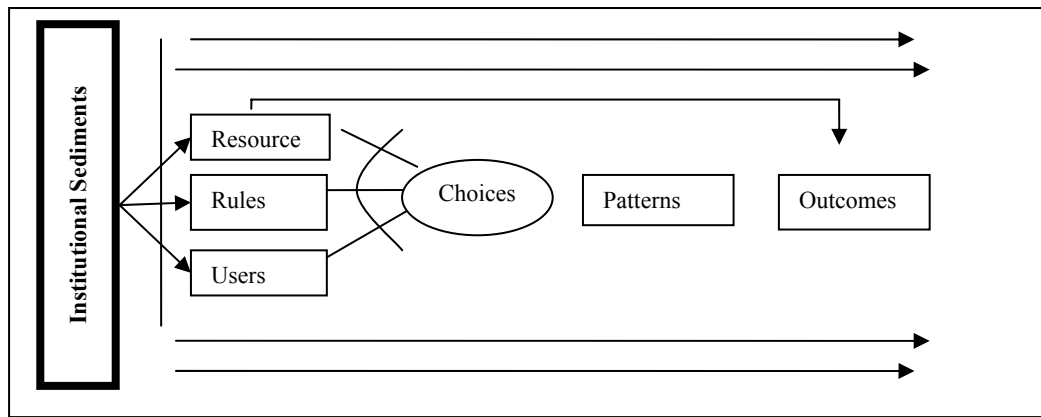


Figure 12: Representing Institutional Sediments in IWM

Internal contextual factors: As in the previous framework, there are three main factors to the internal problemshesh context. These are:

- 1) The **multi-scale freshwater resource characteristics and the available (including cost-effective) technology for exploitation**. In effect, these generate *probable* uses over multiple sectors, through physical and cost constraints on the availability of multi-dimensional benefits. Constraints on availability also directly influence the institutional design. As with the original framework, the possibility of system disruption from unpredictable environmental systems (droughts, flood, or earthquakes, for example), means that the freshwater system may directly influence the SES and trigger institutional change at any time. In the framework (Figure 10) this is shown as ‘ecological uncertainty’.
- 2) The **IWM institutions** are the outputs of the IWM planning process, and are designed to adjust cumulative socio-economic pressure on the resource through systems of property rights to multi-dimensional resource benefits. The framework considers the institutions and the users to be a coupled system, as recommended by Anderies et al (2004). Further, there is the double dynamic of governance to be considered, reinforcing the need to view these two elements as a coupled system, since the users are now directly involved in designing rules for future decision-making.
- 3) The **social characteristics and worldviews of competing individuals, or individual user-groups at multiple scales**. In addition to the (potentially unequal) influence that various groups may exert within the collaborative planning process, the social characteristics of the users will influence types and levels of resource use through their social appreciation of the freshwater system and its benefits. Further, changing social appreciation of the freshwater system benefits

and costs through experience and learning, or in response to external change, can, like the freshwater system, affect the SES outcomes at any time. In the framework, this is labelled as the ‘changing social appreciation of the freshwater system’.

Institutional arrangements are key elements of the framework, and are represented by the curved bold line in Figure 13. Institutional arrangements derive from the external, historical, and internal contexts to the IWM problemsheds. It is here argued that it is institutional arrangements (as wider complex adaptive systems of formal and informal rules, market forces, cultures, customs, etc) that are used by individuals to interpret, judge legitimate, or reject the letter and the intention of the IWM institutions. Therefore, it is this element that can be considered to be the strongest influence on the social selection of formal and informal rules, which comprise the ‘operational rules-in-use’.

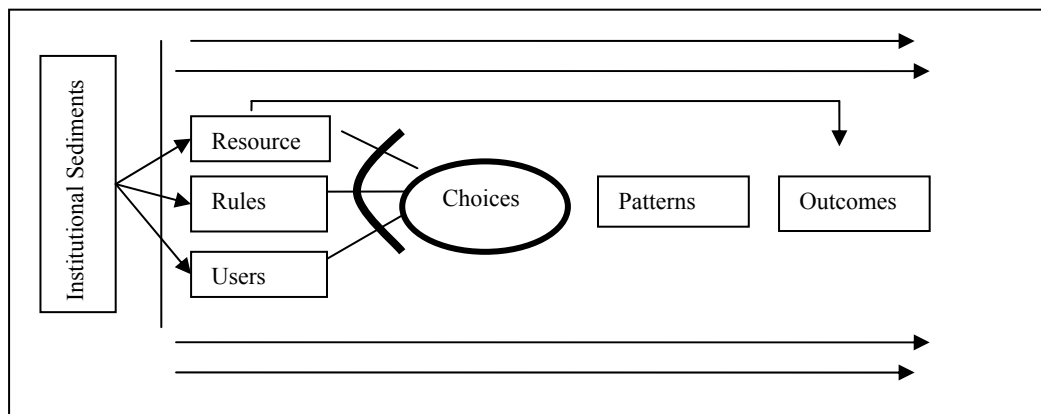


Figure 13: Representing Institutional Arrangements and Operational Rules-in-Use That Frame Individual Choices

From the IWM process framework (Figure 10), in the analysis of institutional arrangements what is under scrutiny is the way that the internal contextual factors, (the specific combinations of market forces, property rights, and social appreciations of the resource system, for example) affect IWM outcomes through their influence on individual (operational-choice level) decision-making, with respect to the intention of IWM institutions. Application of IWM institutions is considered to be the combination of the implementation style (coercive, cooperative, or collaborative),

implementation efficiency (how well were the rules implemented?), and the degree of legitimacy awarded to the IWM rules by the users.

Emergent operational rules in use and individual selection of action strategy

The term ‘operational rules in use’ is thus used in this framework to represent not just the IWM institutions, but the IWM institutions as they have been filtered through the wider institutional arrangements. This is represented by the oval element in Figure 13 above. Operational rules in use are therefore a socially selected combination of IWM rules, and wider customs, worldviews, market forces, or systems of property rights, etc. This is a key area of interest for this study, since it is this element that influences the individual selection of action strategies with respect to whether, and how, an individual user, or user group, will choose to make use of their property rights, and thus generate emergent patterns of interaction or use.

Operational rules in use that derive from markets, worldviews, institutional sediments, property rights, and IWM institutions, for example, will together influence the trajectory of emergent patterns of use. This happens through the interpretation, legitimisation, and implementation of the sustainability *intent* of IWM institutions by individuals, or individual groups. If the relative weighting of markets and demand generates patterns of use that remain in the ‘safe’ zone, then there is no reason to change the rules in use. If the social demand is not kept in check by the rules, however, then overshoot occurs, and triggers a period of institutional change. Since the institutional arrangements are derived from the internal, external, and historical contexts under which IWM is operating, these are reinforced as critical to a sufficiently complex and realistic understanding of IWM problemsheds.

The **emergent patterns of interaction** are the cumulative outcome of individual action strategies, or socio-economic pressure on the resource. Operational rules in use, individual selection of action strategies, and patterns of interaction together comprise the front-loop of an IWM cycle. The variable extent of the emergent patterns of interaction is represented in the visual metaphor as the triangle which links the operational rules in use to the outcomes, as shown in bold in Figure 14.

The **sustainability range** makes explicit the need for limits to be identified, or recognised, and is bounded at either side by the ecological and social trigger points for institutional change (also Figure 14, in bold).

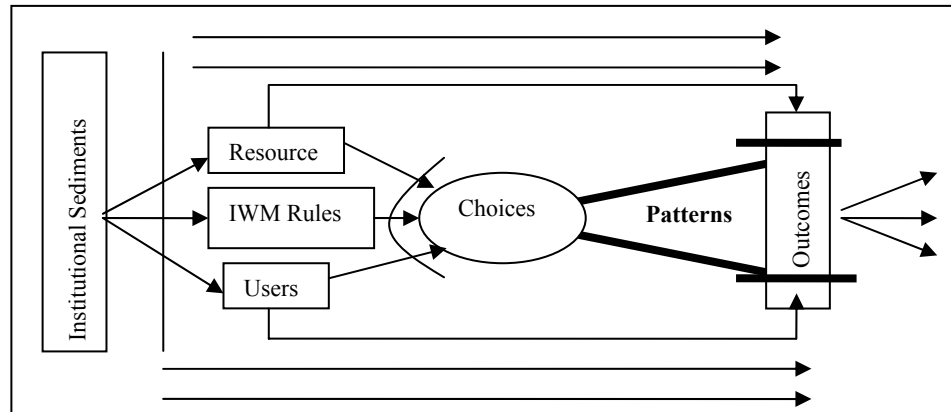


Figure 14: The Visual Metaphor for IWM

Outcomes are recognised more explicitly than in the original framework as ecological, social (including cultural and economic) and institutional, and sustainability ranges for the ecological and social systems are graded from green (sustainable ecological or social system costs), through yellow (nearing limits of sustainable ecological or social system costs), to red (unsustainable ecological or social system costs that trigger institutional change).³

Interestingly, the completed visual metaphor for IWM shown above (Figure 14) clearly highlights institutional arrangements and operational rules in use as the pivot point of the IWM process whole. However, as I have argued, the IWM process does not operate alone. It remains to incorporate the associated processes of complex adaptive change into the framework. This is the task addressed in the following subsection.

³ This grading in Figure 10 has been adopted from the Environment Canterbury (Canterbury's Regional Council) approach to allocation from groundwater systems, where a red zone is over-allocated, a yellow zone is allocated to 80%, and a white zone, in their case, represents a groundwater system which is less than 80% allocated (www.ecan.govt.nz accessed 13th Nov, 2009).

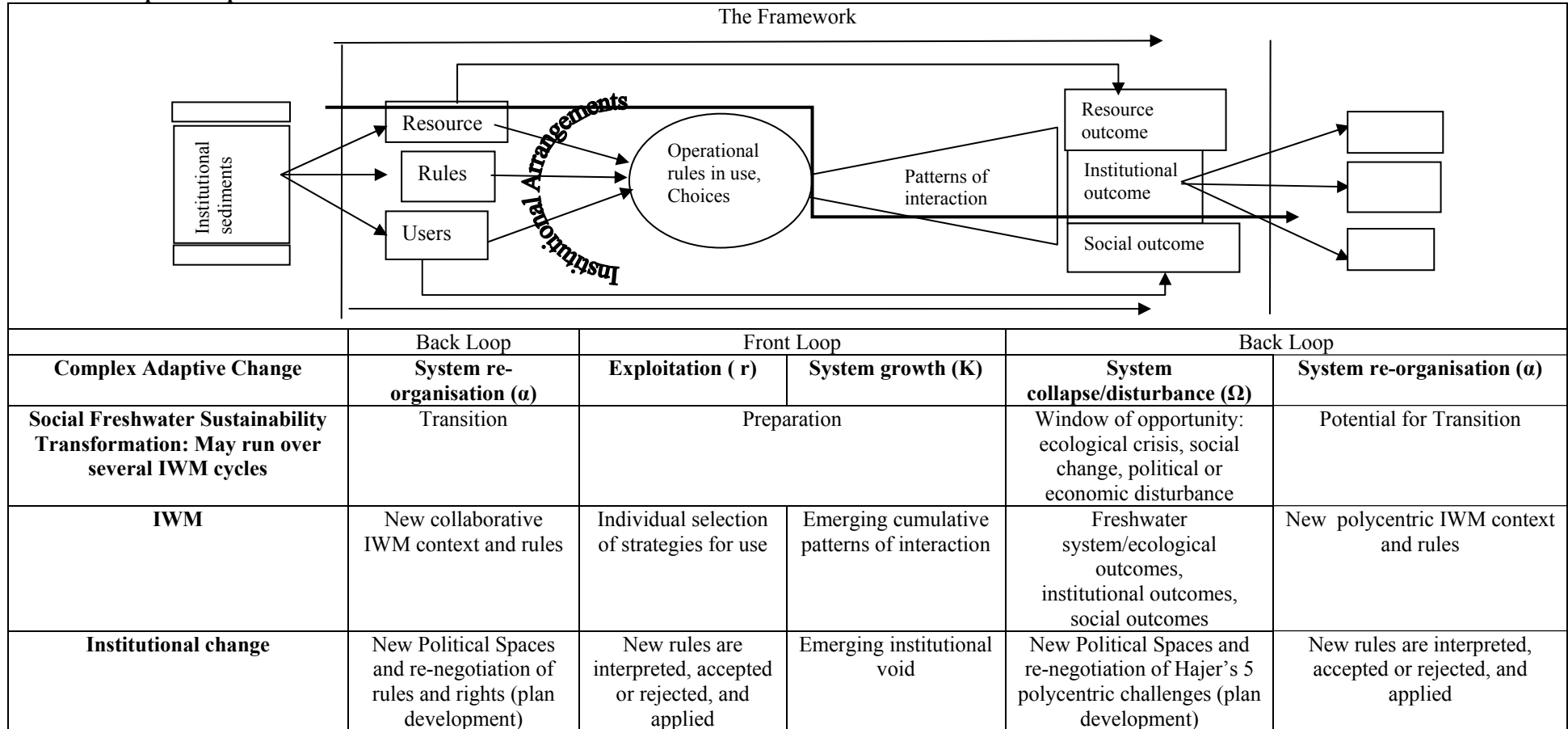
6.4.3 Incorporating Associated Processes of Complex Adaptive Change

The process of IWM has already been identified as comprising many different complex adaptive systems and their processes of change. As already noted, the underpinning objective of the framework is to evaluate process. The framework is therefore adaptable to any IWM processes, including those of institutional change and sustainability transformation, of particular interest to this research, as shown Table 7.

In Table 7 the focus is on the collaborative/polycentric IWM transition, as being of greatest interest to this study. However, the framework can be applied to any IWM enterprise; coercive, cooperative, collaborative, or polycentric.

From Table 7, it can be seen that cycles of IWM and institutional change run concurrently. This is to be expected, given that institutional change is a sub-process of IWM. However, the important point here is that the type of institutional change required, i.e., the IWM challenges to be addressed, will indicate which cycle of IWM procedural development is being evaluated. However, as argued in Chapter Five, it may require several IWM/institutional change cycles to generate a social sustainability transformation. Therefore, although a single transformation process is shown above, it is also noted that this process will only generate the *potential* for transition.

Table 7: Complex Adaptive Phases of IWM and Associated Processes



The main area of interest to this study is the role of institutional arrangements in front-loop IWM processes which shape IWM outcomes, particularly as they relate to the collaborative/polycentric IWM transition. The idea of coordinating multiple IWM processes towards a ‘tipping point’ where positive transformation may occur in an SES is thus demonstrated as a hugely complex and problematical task, relying heavily on chance to bring all the necessary elements together in the right place at the right time for the right problem. Chance, of course, can be helped along considerably by preparation. IWM is concerned with bringing together different key perspectives about an SES, so that sustainability trade-offs to enhance the robustness of the whole can be identified, and addressed (made). This is a supremely normative social process, although as decision-makers converge on unanimity it can often be perceived as more objective than it actually is. Even the overarching sustainability driver is, finally, a matter of choice. Societies, whose decision-makers wish to avoid the tragedy of open access, think that sustainable governance is the ‘right’ thing to do. Therefore, they use the elements and strategies that are most widely recommended as a point of departure (e.g., collaborative planning for IWM). But this is still a choice. However, having made that choice, further decisions need to be made. As already stated, these decisions will relate to five questions, regardless of context (who benefits? Who pays? etc.). It is the answers to these questions that are so inextricably context-dependent and normative.

6.4.4 Employing the Framework

The multi-scale, multi-process, evaluative framework for re-drawn IWM developed above directs the evaluation of institutional arrangements for IWM as follows.

First, the IWM framework is applied to the selected SES to collect data on outcomes for the resource, IWM institutions, and society. As a sub-process, where the institutional outcome is change, then the type of institutional re-design questions or issues being addressed will indicate which IWM procedural development transition is being analysed. Then, working backwards through the framework, analysis considers how the patterns of interaction have generated cumulative effects, triggering institutional change. Returning to the process of institutional change, the framework directs lines of enquiry to consider the ways in which the institutional void has failed to contain cumulative levels of system use(s).

Having characterised the institutional void, the next step is to identify the problematic institutional *arrangements* implicated, and the mechanisms by which they have compromised or supported the sustainability intentions of the IWM institutions.

Central to the theoretical perspective of polycentric IWM as an adaptive outcome of the emerging aggregate collective-choice level of decision-making, is the argument that polycentric IWM in type 4 contexts is the product of many, many, reifications of unsustainable social appreciations of freshwater systems. Therefore, the final step in the evaluation is to trace the historical origins of the implicated problematic institutional arrangements. This is a vital part of understanding how polycentric IWM in an SES has come about, and thus how to most beneficially address it through re-negotiation of collective-choice decision-making rules and operational-choice level rules, expressed as individual bundles of property rights.

6.5 Summary

In this chapter, I have addressed the need for new frameworks for analysis of IWM reported in the literature, and cited in section 6.1. I have developed a framework for the evaluation of institutional arrangements in re-drawn IWM from the work of Oakerson (1992), and Edwards and Steins (1998). The main developments and adaptations made to the framework since its inception are summarised in Table 8.

Table 8: The Development of an Evaluative Framework for IWM

Oakerson, 1992	Edwards and Steins, 1998	This Study, 2010
Single Scale	Single scale	Multiple scales
Single process	Single process	Multiple complex adaptive processes; IWM; social sustainability transformation, and; institutional change/planning
	External Contextual Factors	External Contextual Factors, including institutional sediments
	Internal Contextual Factors, Including:	<p>These internal contextual factors are now considered in terms of broader institutional arrangements that filter IWM institutions to generate a set of rules-in-use.</p> <p>Further, a direct line of influence representing changing social appreciation of freshwater is now included</p>
Physical attributes of the resource, and technology	Physical attributes of the resource, and technology: the available markets for benefits	
Decision-making arrangements	Decision-making rules over three levels, defining which actions are legal	
	User-group Characteristics that define desired resource benefit uses	
	Selection by individuals of one action strategy from many possibilities	This element now shows how the rules in use can influence the trajectory of patterns of interaction
Patterns of interaction	Patterns of interaction	Patterns of interaction now shows variable trajectories for cumulative levels of use
		Sustainability limits for the resource and the society, that will trigger institutional re-design
Outcomes	Resource outcomes Institutional outcomes Social outcomes	The particular type of decision-making challenges for which IWM institutions need to be re-designed, indicates the type of transition being undergone (e.g., collaborative to polycentric)
Feedback Loop	Feedback Loop	Onward Cycle

To recap, the elements of the IWM process evaluative framework as proposed are: external contextual factors; institutional sediments; internal contextual factors (comprised of natural resource characteristics and technological availability; IWM institutions, and; user-group characteristics); institutional arrangements arising, which shape operational rules-in-use and thus influence individual strategy selection; emergent patterns of interaction; system limits, and; ecological, social (including cultural and economic), and institutional outcomes.

This IWM process framework also includes the complex adaptive stages of associated cycles of institutional change/planning, and social sustainability transformation, to more richly inform the IWM evaluation.

6.5.1 Strengths and Weaknesses of the Proposed Evaluative Framework

Any framework for evaluation of such a complex and challenging process as IWM will be more robust in some areas than in others. Furthermore, this is a novel development, which is yet to be tested in the field. From the above, it is expected that the empirical results will show that the main strengths and weaknesses of the framework that I have developed in the preceding sections are as follows. The underpinnings of an evaluative framework for IWM as re-drawn, like the foundations of a house, need to be sturdy. Although the framework as developed above incorporates many new ideas and evaluative perspectives, Oakerson's (1992) original framework is now well known, well regarded, and widely cited. The framework for analysis of multiple-use common-pool resources from Edwards and Steins (1998) has been recommended by Agrawal (2002) for its identification of key elements and processes, facilitating cross-case comparative analysis in the search for a 'unified theory' of sustainable Commons Governance. It has also been noted by Laerhoven & Ostrom (2007) as a useful approach to the analysis of complexity and complex adaptive change in SESs. This lends support to the supposition that the basis of the framework as developed is robust.

The strengths of the framework developed here are considered to include its ability to be relatively easily re-focused over multiple scales of governance. Further, as demonstrated above, the framework is very flexible and may be broken down or combined and recombined in various ways to provide both a big picture perspective, and a rich and complex overall analysis, with the capacity to narrow the focus of enquiry to further investigate a wide number of possible elements and processes. In particular, the ability to identify problematic institutional arrangements, their origins and their mechanisms of influence in front-loop IWM processes through Agrawal's (2002) 'causal chains', offers the potential for a more realistic and robust analysis and understanding of IWM problemsheds. Lastly, the identification of the characteristics of new political spaces associated with the collaborative/polycentric IWM transition, and thus the ability to identify emergent polycentric problemsheds, is potentially a useful advancement to the field.

However, as with other frameworks, this one should not be expected to provide 'answers' to IWM challenges. What it *can* do is direct various lines of enquiry to consider key interdependencies within complex adaptive IWM processes, and highlight areas of shortfall or merit in a given IWM enterprise. It will not be able to reveal hidden motives or agendas, or necessarily gain access to sensitive higher-level (e.g., Cabinet or ministerial) decisions in their

entirety. However, the framework does at least identify the presence of such obscurities or gaps. Neither will it necessarily reduce the level of normative difficulty inherent within emergent polycentric problems. These, almost by definition, will always be difficult, passionately contested decisions. Nonetheless, the framework can highlight which decisions or rules need to be re-negotiated, and provide a more realistic and robust context to inform deliberation. Further potential weaknesses of this framework are that it is complex, information-dense, may suffer from the semantic confusion in the literature, and may be conceptually challenging. Lastly, the need to ‘work backwards’ through the analysis from outcomes to contexts may become confusing during empirical analysis.

This concludes the theoretical portion of this thesis, in fulfilment of the first two objectives of this study, which were:

- To seek more realistic and conceptually robust theoretical underpinnings for IWM.
- Based on this, the development of an evaluative framework for the re-drawn IWM process.

The next chapter begins the empirical portion of this research, addressing the third research objective in this study, which is the employment of the evaluative framework in the multi-scale case study analysis of the role of institutional arrangements in IWM outcomes in New Zealand. Chapter Seven (following) applies the evaluative framework to a national-scale analysis of the role of institutional arrangements in IWM outcomes in New Zealand under the RMA, during the period 1991-2009.

7 An Evaluation of the Role of Institutional Arrangements in IWM Outcomes: The New Zealand National-Scale SES under the Resource Management Act (1991)

7.1 Introduction and Chapter Overview

The aim of this chapter is to contribute to the understanding of how and why the RMA, from a national-scale Social-Ecological-System perspective, has failed to deliver its sustainability intentions for freshwater systems. This will be achieved by analysing how and why the current freshwater governance difficulties have arisen in the New Zealand national-scale SES. Analysis is based on the application of the framework developed in Chapter Six, focusing in this chapter on the complex adaptive processes of IWM and institutional change. The chapter aim is achieved through the identification of key national-scale institutional arrangements, and the analysis of their roles in front-loop IWM processes. As explained in the previous chapter, these processes are: the emergence of operational rules in use and their influence on individual decisions, and; the resulting trajectory of cumulative patterns of interaction.

Hence, to recap from section 6.4.2, emergent operational rules in use for an SES represent not only the intentionally designed IWM institutions, but the IWM institutions as they have been filtered through, and potentially amended or supplemented by, wider, socially constructed institutional arrangements over time. In other words, they are the ‘socially accepted’ group of rules, including but not limited to specifically designed IWM institutions, which frame individual decisions. These individual decisions then aggregate into cumulative patterns of interaction, constrained or otherwise by the IWM institutions. The front-loop elements of the re-drawn IWM process which are of particular interest in this chapter are shown in bold in Figure 15.

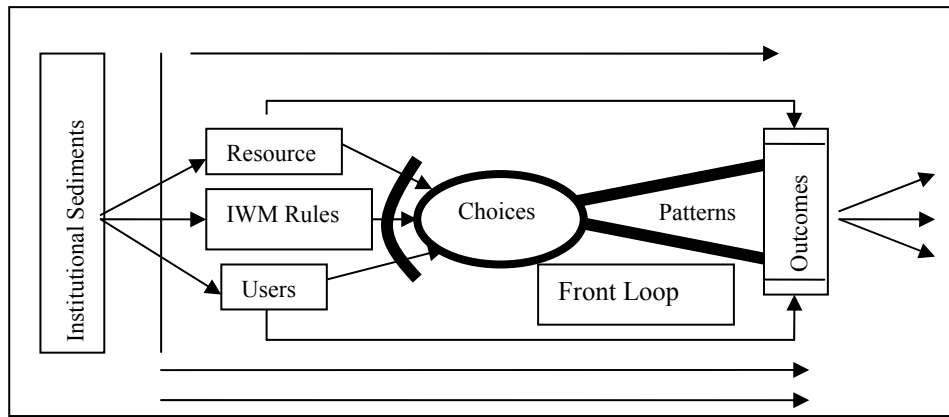


Figure 15: Representing Front-Loop National-Scale RMA Processes for Evaluation

This chapter addresses two main questions in the attainment of its aim:

- 1) Which (if any) of the broader institutional arrangements (customs, worldviews, markets, or systems of property rights, for example) in New Zealand, are identified as having influenced the outcomes of the RMA?
- 2) In particular, what has been the influence of any broader institutional arrangements identified, on the front-loop elements of IWM and institutional change processes? In other words, what have been the mechanics of their role in the compromise or support of the RMA's intentions, with respect to freshwater?

The results of this evaluation are reported in the remaining chapter sections as follows. In section 7.2 I will begin reporting the evaluation results. In that section, I will characterise the internal contextual factors to the national-scale RMA cycle: the nation's freshwater resources; the intentions of the RMA, and; the competing cosmologies and worldviews present in New Zealand society, as they pertain to this study. Then, in section 7.3, I will describe the outcomes of the national-scale RMA cycle. These are reported in order as the freshwater system outcomes, the social outcomes, and the institutional outcomes. The institutional outcome is of particular interest in this section, for two reasons already discussed. Firstly, because the study is concerned with the question of why rules for IWM, explicitly and expensively crafted with the intention, *inter alia*, of generating and maintaining sustainable freshwater outcomes, have not done so to the extent expected. Secondly, analysis of the institutional void and resulting new political space in the national SES can contribute to a more robust understanding in the wider literature of the emergence of a polycentric IWM problemshd at this scale of freshwater governance.

Having thus identified the intentions and the outcomes of the RMA at the national scale, the question becomes: how did one lead to the other? And more specifically, what may have been the role of institutional arrangements in what Agrawal (2002) has called a ‘causal chain’? In subsection 7.4, I will first describe the key problematic institutional arrangements identified for this scale of SES. Broadly, these relate to: market forces under a neoliberal agenda with very limited national policy guidance; tensions, overlaps, and misalignments across multiple systems of property rights, and; the bicultural cosmologies, and competing worldviews present within New Zealand society. I will consider the influence of these three broad areas of New Zealand’s complex adaptive system of institutional arrangements on the emerging operational rules in use, and thus on national-scale decision-making, in subsection 7.4.2. The resulting trajectory of cumulative patterns of use, and the coupled institutional void, will be discussed in 7.4.3. In section 7.5 I will reflect upon the extent to which the study findings fit with the theoretical expectations as discussed in the foregoing chapters, and will consider the implications of these findings for the current freshwater governance challenges in New Zealand. Lastly, in this section I will present some concluding comments on the role of institutional arrangements in the national-scale outcomes of the RMA.

7.2 Evaluation Results: Internal Contextual Factors

The evaluative frameworks employed in this chapter are shown in Figures 16 and 17. Figure 16 reports the findings of the RMA process as analysed, while Figure 17 reports on all three associated complex adaptive processes of interest to this study.

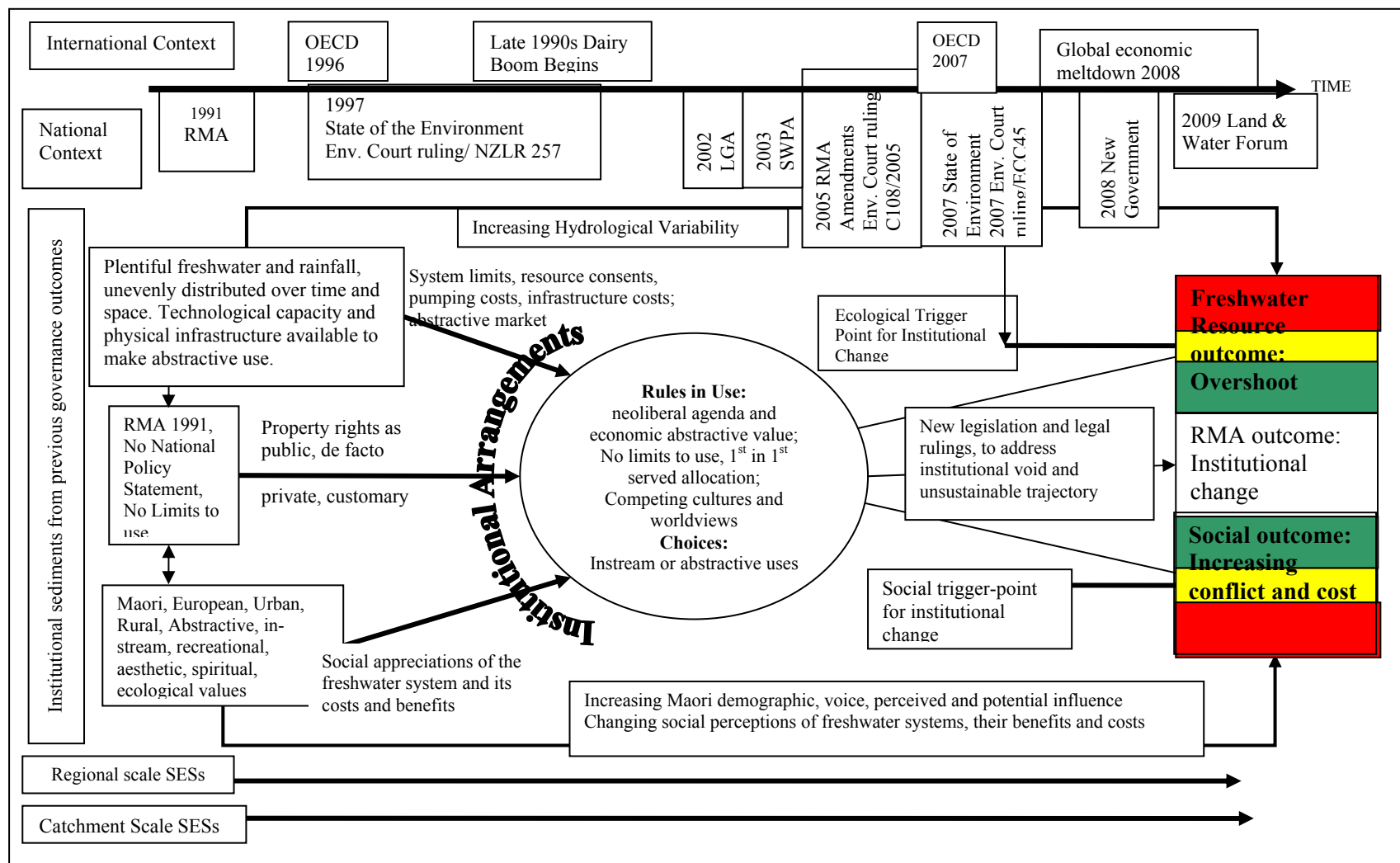


Figure 16: Evaluating the Role of Institutional Arrangements in National-Scale RMA Outcomes

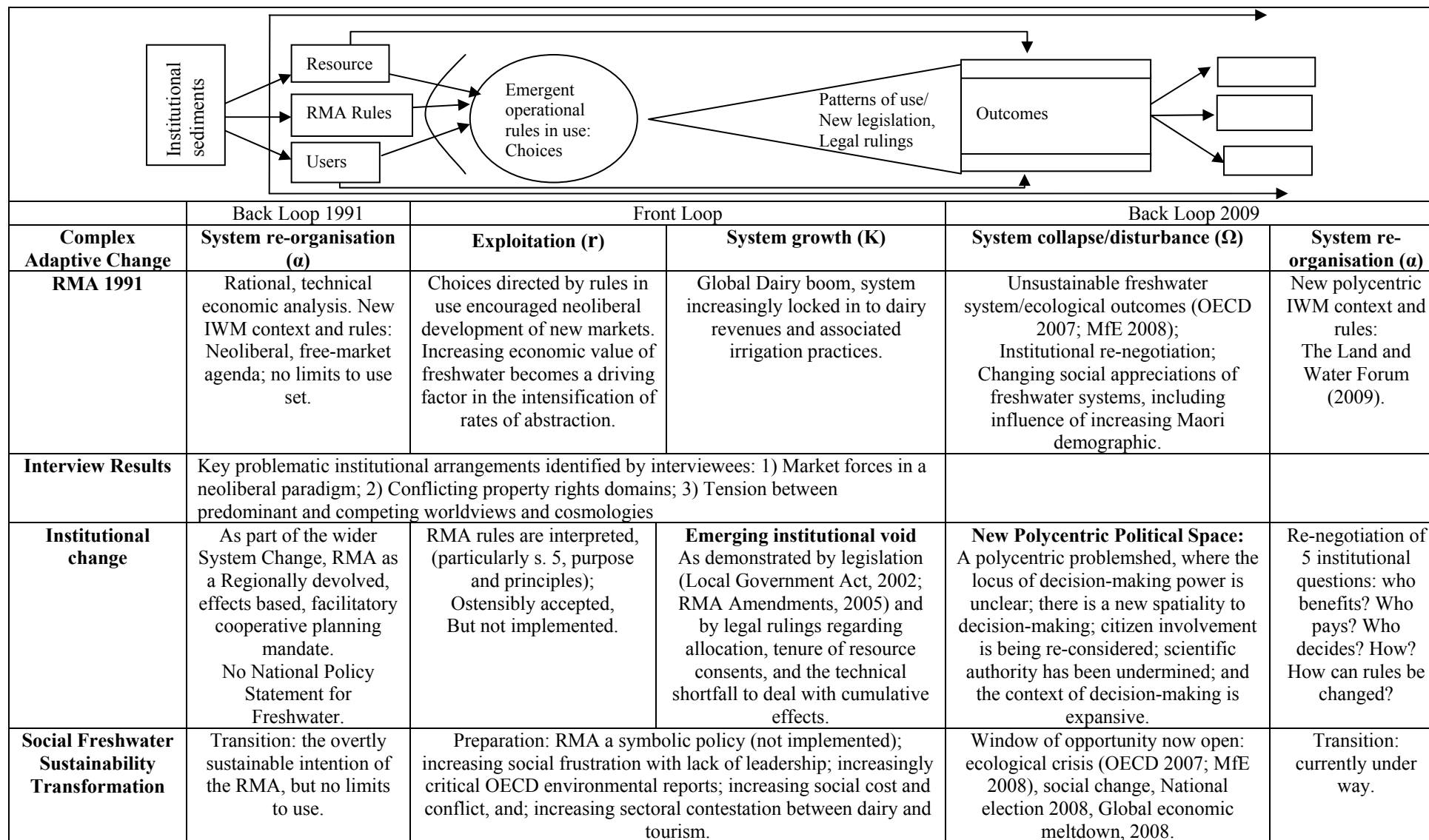


Figure 17: IWM Processes at the National-Scale New Zealand SES, RMA Cycle

The purpose of this section is to provide a characterisation of the three broad internal contextual factors to the RMA cycle, as it began in 1991. These are shown in bold in Figure 18.

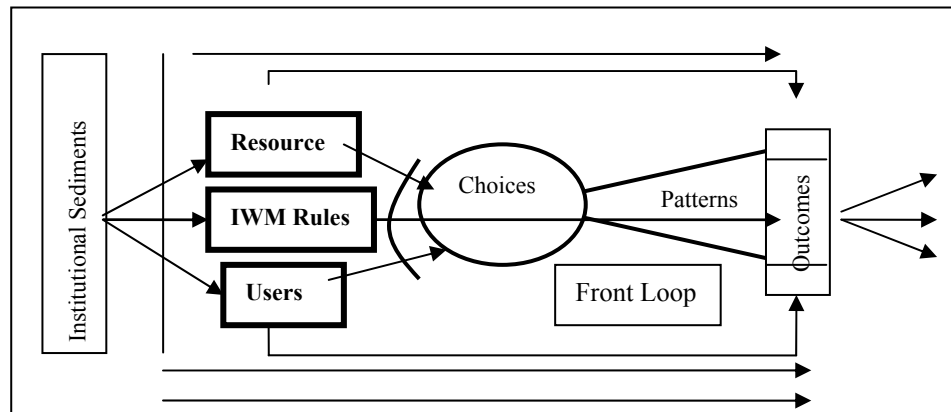


Figure 18: Representing Internal Contextual Factors for Evaluation

7.2.1 The Resource Characteristics and Uses

As already mentioned in Chapter One, New Zealand as a whole enjoys plentiful rainfall, although this is unevenly distributed across the country and over annual cycles. New Zealand is ranked 12th out of 193 countries for its abundance of freshwater (MfE, Aug 2009). Freshwater in New Zealand is subject to a wide range of uses. Beyond the provision of domestic and municipal drinking water supplies and waste disposal, the most important of these include: the generation of hydroelectricity; irrigation of crops; the support of fisheries; as a resource input to primary production such as forestry or dairy; and Maori spiritual and cultural values (Jenkins, 2006; MfE, 2008; OECD, 2007; Park, 1995; M. Williams, 2004).

7.2.2 The Intentions of the RMA

In this subsection, I will characterise the main intentions behind the RMA rule-sets, as they pertain to this study. This is represented in Figure 19 as the IWM rules, and the bold arrow running through the whole cycle to the intended outcomes. The intended outcomes are represented as aiming to generate ‘balanced’ patterns of interaction, within the sustainable range of socio-economic pressures on the resource. However, as already noted, this explicit intention to ‘promote sustainable management’, has not

been fulfilled in the national scale SES. The remainder of this chapter seeks to analyse the role of institutional arrangements in this outcome.

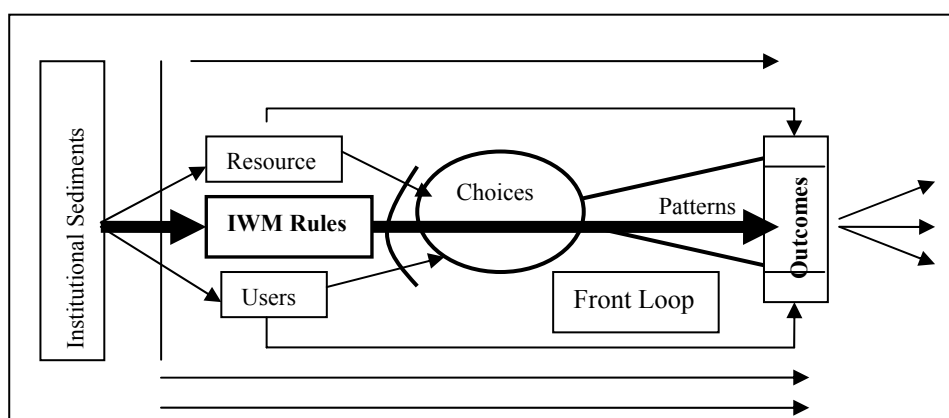


Figure 19: Representing the Sustainability Intentions of the RMA for Evaluation

The Resource Management Act, as part of a wider national-scale re-structuring of central and local government in New Zealand in the 1980s, brought together many of the scattered and often conflicting natural resource legislation and institutions. It simplified and clarified the statutory framework for natural resource management, and reduced over seventy pieces of legislation into a single Act (Memon, 1993; Wheen, 1997). The substance of the RMA, and its origins in the New Zealand System Change of 1984-1991, and the wider neoliberal agenda, are well documented and have been extensively discussed from a range of scholarly and practical perspectives (Barton, 2007; Berke et al., 1999; Bührs & Bartlett, 1993; Cocklin & Furuseth, 1994; Crawford, 2007; Davis & Threlfall, 2006; Deans, 2004; Ericksen, 1990; Ericksen et al., 2003; Frieder, 1997; Guerin, 2007; Gunningham, 2008; Harris, 2004; Heitzmann, 2007; Hooper, 2006; Jackson & Dixon, 2007; King, 2003; Lange et al., 2008; Memon, 1996, 2000; Memon & Gleeson, 1995; Memon & Skelton, 2007; Oram, 2007; Resource Management (Simplify and Streamline) Amendment Bill ", 2009; Selsky & Memon, 1995; Skelton & Memon, 2002; Wheen, 2002; D. Williams, 1997). The main points of the Act nowadays require little introduction, beyond the identification of key aspects particularly relevant to this study, presented below.

Under the mandate of the RMA, Regional Councils in New Zealand are publicly elected bodies, whose duties include “the establishment, implementation, and review of objectives, policies, and methods to achieve integrated management of the natural and physical resources of the region” (“Resource Management Act,” 1991 Part 4, s.

30 1(a)). The development of Regional Policy Statements is mandatory, but the preparation of regional plans for water and other natural resources is voluntary, with the exception of Coastal Plans which are also mandatory. It is important to note that the RMA is not concerned solely with freshwater, but is a wider mandate for the integrated management of natural and physical resources, as stated above. It is also important to note that the RMA was "... derived from a rational technical approach to resource management" (Memon, 1997, p309) in the face of impending national bankruptcy. Further, that in spite of its (then) novel public consultation process during development, the Act is "as much a product of a conventional, theoretical economic analysis of resource management issues as of political direction and negotiation" (Memon and Gleeson, 1995, p115). On the other hand, Wheen (2002, p271) notes that "...by adopting sustainability as its core purpose, the Act broke new ground".

The RMA replaced the 1967 Water & Soil Conservation Act system of water rights (the 1967 Act and its key points will be discussed in greater detail in Chapter Nine), with three types of 'consents' (water permits) which must be obtained for: the diversion and use of waters; the discharge of effluents into surface waters, and; any water quantity or quality alterations affecting the coastal zone. The exceptions to this are: firstly, any use that is expressly permitted in a Regional Plan, or; secondly, the 'reasonable' use of water for domestic use, stock watering, or fire-fighting ("Resource Management Act," 1991 s. 14). In spite of the Resource Management Law Reform Brief of 1984, which specifically considered issues relating to the ownership of and rights to a range of natural and physical resources, including freshwater (for in-depth discussion of this, see Bromley, 1988 ; Memon & Gleeson, 1995), the Act makes it very clear (s.122 (1)) that resource consents are "neither real nor personal property". However, this is changing through Environment Court decisions, as will be discussed below.

Underpinned as it is by a wider neoliberal agenda, it is not surprising to find a requirement in the legislation ("Resource Management Act," 1991 Section 24 (h)), that the Minister for the Environment give consideration to, and investigate, "the use of economic instruments including charges, levies, other fiscal measures, and incentives to achieve the purpose of the Act". However, concern has been voiced by many commentators, including Wheen (2002, p261), that despite this provision, the Act

“...fails to provide any real checks against development and resource exploitation”. And as already stated, the RMA has not succeeded in its sustainability intentions, particularly with respect to freshwater systems (Creech et al., 2010; MfE, 2008; OECD, 2007; Resource Management (Simplify and Streamline) Amendment Bill ", 2009).

On the other hand, as I will discuss in section 7.5, the wider neoliberal intentions regarding economic development that are embodied in the RMA, have arguably been amply fulfilled. Arising from this tension is a period of institutional change, even ‘constitutional politics’ (Ackerman, c.f. Hajer, 2003) regarding freshwater governance in New Zealand. Thus, the intentions of the RMA can be summarised as relating to two competing agendas: the promotion of devolved, regional-scale sustainable management of natural and physical resources, and; the neoliberal facilitation of market development for those same resources.

7.2.3 Competing Cosmologies and Worldviews

Social appreciations or worldviews of freshwater in New Zealand, as in other places worldwide, lie along a continuum from exploitation, through conservation (‘wise use’), to preservation. However, in New Zealand, there are two main cultures to be considered: indigenous Maori, and European ‘settlers’ (Pakeha). The key areas of difference between Maori and ‘Western’/European perspectives on the use and governance of freshwater that are of relevance at this point in the study, have their origins in the conflicting and/or competing cosmologies. While the Pakeha, ‘Western’ perspective is widely recognised and needs no characterisation here, the competing cosmological basis for Maori customary society in New Zealand gives rise to tensions between environmental worldviews and appreciations of freshwater systems, and systems of property rights, as reported below.

7.2.3.1 Maori Cosmology and Worldview

Maori cosmology and worldview links humans to the natural world around them, as well as their ancestors (the eldest and most important of which were gods). All Tangata Whenua (People of the Land, or Maori) trace their whakapapa (ancestral

lineage) back to their deities (atua), from whence are derived all forms of living and inanimate entities. One's whakapapa was, and remains, a strong source of mana (power, or standing): a rooting to one's history, and a source of comfort and security (Ballara, 1998; Patterson, 1994; Stokes, 2002; J. Williams, 2006). Maori society remains structured around a kinship regime of three tiers: the Iwi, (tribe or clan); the Hapu (a largely autonomous satellite community based on kinship ties); and whanau, or extended family group (Ballara, 1998). The customary (pre-European contact in the 1700s) society was based almost exclusively on kinship ties, but with reference to the group in which one lived, choices were available. Ballara (Ibid, p30) rather grandly characterises the societal framework as based around "...optative, cognatic bilateral descent (descent reckoned by choice through either or both males and females)". Land and resources were held conditional to one's kinship ties, and, perhaps more importantly, then as now, to the ability to defend them (Marsden, 1989; Stokes, 2002).

But there is a fundamental tension between the current 'Western' right of management (the right to regulate internal patterns of use, and to transform the resource by making improvements), and the Maori environmental ethic which states that the essential nature of the resource must remain intact (Patterson, 1994; Pyle, 1992; J. Williams, 2006). The Maori worldview identifies several states of water. As shown in Table 9, water may be fresh, brackish (estuarine) or sea-water. Within that, Mauri (life force) is the defining 'element', and Williams (2006) thinks of Mauri as the 'moods' of water. The Mauri of water dictated whether it was considered pure, ordinary, or dead. The categories for water are "*Waiora, Waimaori, Waikino, Waimate, Waitai*" as shown. One of the major issues arising from the Mauri (life-force) of freshwater systems is the Maori resistance to the mixing of waters. This clearly holds potential for conflict in current management approaches (Tipa & Welch, 2006).

Table 9: States and Mauri of Freshwater, to Tangata Whenua (Adapted from Ward and Scarf, 1993; Williams, 2006)

	Freshwater	Estuarine/ Brackish	Ocean/Seawater
	Waimaori - Water that has come into contact with human beings. It has become ordinary and has no particularly sacred associations.	Waimataiatai - This class of water is not given a wider description in the literature.	Waitai - The term for the sea, the surf and the tide. It represents the end of the water cycle from its inception through all states to the sea. From the sea, it is lifted back into the heavens and is purified again to fall as Waioara.
Mauri	Waioara (water of life) - The purest form of water, like the rain. It has the potential to give life, to sustain the wellbeing of all things and counteract evil. Waioara is used in scared rituals to purify and to sanctify. It can remain pure only if contact with humans is protected by appropriate ritual prayers.		
	Waikino (bad water) - This can be potentially harmful in that it conceals its intention and deceives a user by its habit. This category of water may hide boulders or snags that can cause damage. In a spiritual sense, this is water that has been polluted, debased, spoiled or corrupted.		
	Waimate (dead water) - Water that has lost its mauri or life force. The power to rejuvenate itself or any living thing has gone; it is so damaged as to be considered dead.		

However, as with so much else in Maori society, there was, and remains, a large degree of expediency involved in the designation of water resources as one or other of these types (J. Williams, 2006). Lest the picture of customary Maori resource use be painted too rosily, O'Regan (1984, p. 9) "...shudder[s] to think what my own tupuna would have done had they had bulldozers...If our old people had had the skills and greater power to destroy the landscape they would have played a full and vigorous part in doing it in proportion to their numbers". It is worth while remembering that there are tensions within both the Maori and Pakeha (Western) cosmologies: the constitutional-choice level decisions over in-stream or abstractive uses pose exactly the same questions to decision-making from either cultural perspective.

7.3 National-Scale RMA Outcomes

This subsection will report the IWM outcomes of the RMA cycle in the national-scale New Zealand SES, as shown in Figure 16 and Figure 17. These figures are

summarised for this section by the following Figure 20, indicating RMA outcomes for the national-scale resource, society and institutions, in bold.

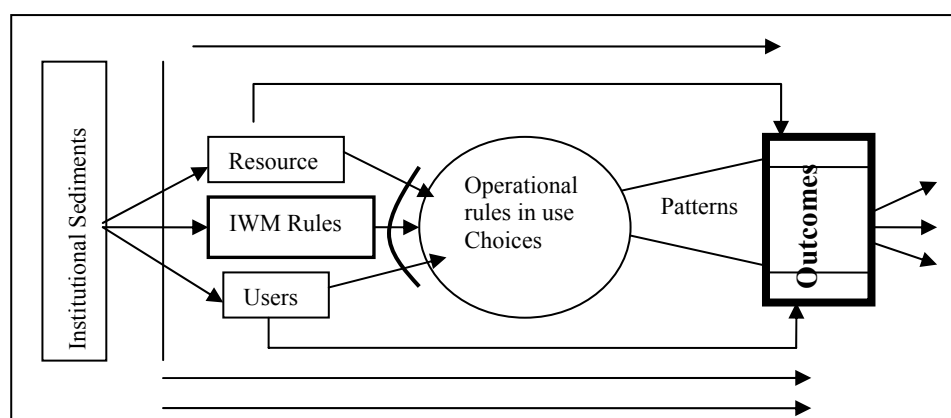


Figure 20: Reporting National-Scale RMA Outcomes for Evaluation

7.3.1.1 Freshwater System Outcomes

As already stated, the RMA has not succeeded in its sustainability intentions with respect to freshwater systems (Creech et al., 2010; MfE, 2008; OECD, 2007; Resource Management (Simplify and Streamline) Amendment Bill ", 2009), and per capita water demand is now 2-3 times higher in New Zealand than other OECD countries (MfE, Aug 2009). At the time of writing, the latest data on freshwater available from New Zealand's central government agencies remains the 2004 Physical Stock Accounts for Freshwater (Statistics New Zealand, 2004). This document states, on p13, that "the degree to which actual abstraction is monitored varies greatly between regional councils and there is insufficient coverage for compilation of national aggregates". As may have been expected, therefore, the 1996 and 2007 OECD Environmental reports for New Zealand (OECD, 1996 & 2007) were increasingly critical, especially of environmental reporting and freshwater governance respectively. The central government's State of the Environment reporting did not begin until 1997, and was eventually followed-up in 2007 with a report that omitted the conclusions chapter. This was controversial, particularly as the chapter is now available from the Ministry for the Environment website, and is heavily critical of agricultural intensification of land-uses, particularly in the nationally economically vital dairy industry (MfE, 2007).

The increasingly extreme climate and micro-climates in New Zealand (National Institute for Water and Atmosphere (NIWA) NIWA, 2008) are an example of an external contextual factor for IWM, over which the SES or its members have very little control. That said, the question of water storage becomes of key concern, and this is currently a topic of particularly intense debate in parts of New Zealand, as I will discuss in later sections and chapters. Critical issues identified for New Zealand's freshwater systems particularly include the quality and flow regimes of lowland waters, as a result of up-catchment over-allocation (MfE, 2007, 2008; OECD, 2007). The incoming National government of 2008 has been progressing the development of a national policy statement, and states that amongst other things,

“The decline in fresh water quality needs to be addressed through improvements in land-use development planning and management, particularly for urban development and intensive farming practices. There is also a need to:

- better protect outstanding freshwater resources and ecosystems
- improve efficiencies in the use of water
- increase resilience against future effects of a changing climate
- enhance the involvement of tangata whenua in RMA decision-making
- rectify the present underinvestment in infrastructure for supplying, storing and distributing fresh water” (MfE, 2008).

These objectives, un-specified as they are, with the possible exception of the ‘swimmability’ of systems, are to be achieved by 2035. Swimmability means suitable for contact recreation (MfE, 2008). Realistically, of all the above aims, this may be the most likely to gain agreement on specific limits, because of the obvious and tangible potential for public harm. It should be noted, however, that issues with freshwater quality have yet to be fully resolved in the forty years since the introduction of the 1967 Water and Soil Conservation Act, which I will discuss in greater depth in Chapter Nine. A Proposed National Freshwater Policy Statement has now been notified, submissions have been requested and made, and the Board of Inquiry reported its findings to the Minister of the Environment at the end of January 2010 (MfE, 2008). It remains to be seen what the result will be.

7.3.1.2 Social Outcomes

The RMA is renowned for its experiment with a devolved, integrated mandate, and the attempt to address natural resources planning through regional expressions of individuality, and explicit inclusion of Maori (Burton & Cocklin, 1996; Memon, 1997; Memon & Gleeson, 1995). Burton and Cocklin (1996, p91) state that “One of the RMA’s important underlying principles is that decisions relating to the use of resources should be placed in the hands of the communities most directly affected by those decisions”. What, then, have been the social outcomes of the RMA?

Questions of increasing freshwater scarcity, and greater intensity of competition for these resources, have led not just to increasing legal costs and social contestation, but have also inevitably given rise to considerations of storage and physical infrastructure, as noted above. Questions of storage have in turn focused attention on property rights, and the misalignment of, and tensions between, different types of existing rights, considered in greater detail in subsection 7.4.1.2. This is particularly as they relate to the current situation, whereby private economic gain is legally available from the individual use of subtractable public benefits (and indeed, until very recently has been strongly encouraged) (Lange et al., 2008; Memon & Weber, 2008; MfE, 2009c).

However, this situation is changing rapidly, and the public perception of New Zealand’s freshwater systems, and the role of agriculture (particularly dairy and associated irrigation practices) has changed dramatically since the Millennium, as has been demonstrated by the ‘Environmental Perceptions’ series of biennial surveys, undertaken since 2000 (Hughey et al., 2008). This change in social appreciation of freshwater and other natural resources has fuelled national-scale contestation of the status quo. It also reinforces the perception of the IWM process as one of fostering the potential for social learning and change.

As with most ex-Colonial countries around the world, the indigenous population of New Zealand were effectively displaced in the 1800s by the flood of new settlers, diseases, extractive technologies, and social systems, including alien perspectives on property rights. The RMA, for the first time in one hundred and fifty years (the Treaty of Waitangi was signed in 1840), openly acknowledged the indigenous relationship

between Tangata Whenua ('People of the Land', or Maori) as a matter of national importance (s.6 (e)). Further, the Act has integrated many of the Maori concepts of stewardship into its principles. There are five substantive provisions within the RMA related to Maori rights which must be addressed in plans, in the following descending order of influence:

- Plans 'shall recognise and provide for' the relationship of Maori and their culture and traditions with ancestral lands, water, sites, wahi tapu and other taonga (treasures) as matters of national importance (s. 6(e));
- Plans are to 'have particular regard to' local Maori responsibility in the guardianship and stewardship of the land and resources (s. 7(a));
- Principles of the Treaty of Waitangi shall be 'taken into account' (s. 8);
- Councils shall have regard to any 'relevant planning document recognised by an iwi authority' affected by a regional policy statement, regional or district plan (s. 61, 66 and 74); and
- Councils shall consult with original people of the land (or Tangata Whenua) during plan preparation (Clause 3, First Schedule).

Unfortunately, many Maori feel that these provisions have not been adhered to in the spirit with which they were intended, and there is an apparently increasing Maori/Pakeha (European New Zealander) divide (Burton & Cocklin, 1996; Cocklin & Blunden, 1998; Prystupa, 1998; Stokes, 2002; Tipa & Welch, 2006; J. Williams, 2007). Particularly post the 1970s, the continued rise in neo-Polynesian (J. Williams, 2007) population levels and the focus on land, language, and culture, has become increasingly recognised and influential in freshwater policymaking in New Zealand. This is particularly so in the current problemshed, where debates are now intensifying over suggestions of 'parallel', culturally distinct (Maori and European) management systems (Tipa & Tierney, 2003; Tipa & Welch, 2006; J. Williams, 2006, 2007). Thus, the cosmology, worldview, and customary practices of Tangata Whenua are an important thread in the fabric of past, present, and future freshwater decision-making in New Zealand. I will consider this critical facet of the IWM process in New Zealand in greater detail in later sections and chapters.

7.3.1.3 Institutional Outcome: An Emergent Polycentric IWM Problemshed

The national-scale IWM institutional outcome of the RMA cycle is identified in this section as a polycentric IWM problemshed. The country is experiencing a period of

constitutional politics, including the potential for the collaborative re-negotiation of core rights to freshwater, and their distribution in the face of increasing scarcity (see, for example, the Proposed National Policy Statement, quoted in 7.3.1.1 above). The polycentric IWM challenges that have been identified in the New Zealand national-scale SES are summarised below.

The locus of decision-making power is unclear: Over the last two decades, the locus of decision-making power in New Zealand has become increasingly unclear, and social movements' strategies have become more diverse. Questions persist, regarding who should decide on freshwater governance and allocation issues. A current example of this is the central government 'call-in'⁴ by the Environment Minister, Nick Smith, of the decision facing Environment Canterbury (ECan), the Regional Council, over granting permits for effluent disposal from three large dairy units proposed for the Mackenzie Basin, in South Canterbury. The Minister stated that he had "called in these discharge consents as they are nationally significant due to their scale, the fragile and iconic nature of the Mackenzie Basin environment, the importance of freshwater quality to the Government and the high level of public interest" (ECan, 2010c; Smith, 2010).

In addition to this national/regional decision-making tension, as I will demonstrate, legal rulings can contradict Regional Council decisions (see, for example, section 7.2.2 below), and local communities challenge developers (see, for example, the hearings on the proposed Central Plains Water scheme in Central Canterbury, (ECan, 2010b)). Central Government, Regional Councils, lawyers and Judges, developers, scientists, anglers, export industry sectors, Maori, and the general public all enjoy the capacity to influence different pieces of the decision-making whole in different ways, to different extents, and from different perspectives. However, whether or not the current de facto distribution of decision-making power is the most appropriate, remains debatable.

Lastly, and critically both for this evaluation, and for the future of New Zealand's freshwater systems, is the Creech Report (Creech et al., 2010). This report was

⁴ "Call in" is an example of national government assuming decision-making responsibility from the relevant local authority, in this case Canterbury Regional Council.

published on the 19th of February 2010, and is an outstanding example of how a devolved collaborative decision-making approach can be undermined (indeed, potentially devastated). The Creech report, and its unfortunate implications for freshwater decision-making in New Zealand at all scales of decision-making, will be discussed in greater detail throughout the remainder of this thesis.

There is a new spatiality of policy-making and politics: This is evident on the one hand at the international scale, where international influence weighs heavily on the vital export earnings of tourism and the dairy industry in particular ("Statistics New Zealand: National Accounts, Sustainable Development," 2010). In the other direction, there is an increasing groundswell of 'flax-roots' (grassroots) collaborative approaches to decision-making, and the importance of the collaborative approach was ostensibly recognised in the approach adopted by the Land and Water Forum 2009 (MfE, 2009b). Unfortunately, this is another area where Creech et al., (2010) undermine decision-making innovation and progress. This report makes explicit the extent to which central government is willing to disregard developing social capital, in favour of the short-term need for the furtherance of economic development.

The standard view of participation and democratic governance may have to be re-thought: Although advisory boards for decision-making are not new notions, either in the literature or in New Zealand, the Land and Water Forum, as mentioned above, has been welcomed as a new national-scale approach to this role. This is a multi-scale collaborative process for IWM in New Zealand, asked to "recommend reforms for freshwater management in New Zealand". However, not unexpectedly, the Land and Water Forum recommendations will be "non-binding on the Government" (MfE, 2009b). Further, the current willingness of central government to undermine the potentially successful collaborative IWM initiative in Canterbury Region, through the "removal of regulatory roadblocks" (Key, 2010b) to further freshwater storage and irrigation, and to implement key institutional change recommendations from the Creech et al. (2010) report, must also seriously undermine the potential influence of this national-scale Forum. Moreover, key questions remain over potential Maori claims to freshwater, arising from ongoing Treaty of Waitangi settlement processes.

The authority of classical scientific expertise has been undermined: Again, Creech et al. (2010, p26, 27) demonstrate that conflicting views of decision-making as science *led* (bad) or science *informed* (good), from the perspective of ‘timely’ consent processing remain an issue in New Zealand, particularly where the ‘science’ remains contested. The challenge has now become one of identifying, generating, acknowledging and integrating different or competing information, or ways of knowing, effectively. This is particularly with respect to changing scientific understandings (as evidenced by, for example, the emergence of the perspective of complex adaptive cycles of change), inadequate applied science and/or technology for legal rulings (see subsection 7.4.3.2 below), and the Maori cosmological conflict with Pakeha (Western) science. As already noted, this issue is especially acute where the clashes involve the Maori perspective on the mixing of waters, and the Maori interpretation of management responsibilities which demands that the ‘essential character’ or essence (Mauri) of a place be retained (Patterson, 1994; Polack, 1840; Tipa & Tierney, 2003; J. Williams, 2006). This is in direct contradiction to the Pakeha perspective of management which includes the right to change the resource by making ‘improvements’ (subsection 4.3.2), which may include storage dams, for example.

The context of policy-making is expansive: Climate change, carbon credits, tourism and export markets, environmental and ecological overshoot, public property and private economic gain, and the potential for economically crippling Maori, dairy and irrigation compensation claims: there is little in the current round of policy renegotiations that does not impact upon a wide range of underpinning social issues (CAB min 09 10/4; CAB min 10 20/12).

From the examples given above, it is clear that the current IWM problemshield facing the national-scale New Zealand SES is polycentric. How did this come about? The following subsection identifies key problematic institutional arrangements in New Zealand, and considers their role in the front-loop elements of the national-scale RMA cycle.

7.4 Institutional Arrangements and Front-Loop Elements of IWM

The foregoing two sections have characterised the internal contextual factors to the national-scale RMA cycle, and its outcomes. Arguably, while the wider neoliberal aspirations of the ‘System Change’ of the 1980s have been well met, the sustainability intentions as specified in the RMA have not. In this section, I will first identify key problematic institutional arrangements. Then, I will analyse their role in: the social selection of the emerging operational rules in use, and the individual decisions arising, and; the resulting cumulative patterns of interaction, and coupled institutional void.

7.4.1 Institutional Arrangements

The focus of this subsection is on the identification of key institutional arrangements, as shown in bold in Figure 21.

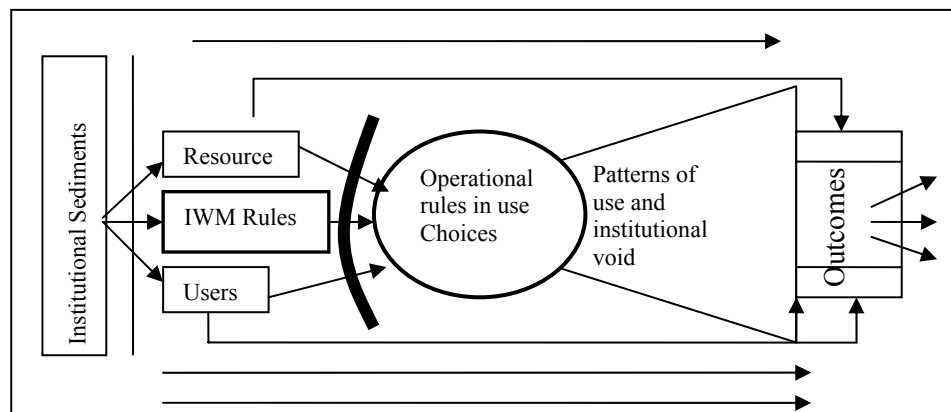


Figure 21: Representing Key Institutional Arrangement in the National-Scale RMA Cycle for Evaluation

Institutional arrangements identified in this study as particularly problematic to the sustainability intentions of the RMA follow three broad themes, described in the subsections below. In the order addressed, these are:

- 1) The freshwater resource availability, and the wider neo-liberal agenda under which the RMA was designed, and (not) implemented (Berke et al., 1999; Cullen et al., 2006; Davies et al., 2007; Ericksen et al., 2003; Jay & Morad, 2007; MfE, 1997, 2007; OECD, 2007; M. Williams, 2004);

2) Issues with competing and conflicting (or potentially conflicting) systems of property rights, and the question of allocation and economic instruments, which is one that is looming large in New Zealand (and particularly in Canterbury, as will be discussed in the following Chapter Eight) at the time of writing (Jenkins, 2006; Lange et al., 2008; Memon & Weber, 2008);

3) Competing and conflicting world-views and cosmologies, identified in this study as presenting significant present and future challenges to successful IWM in New Zealand (MfE, 2008; Prystupa, 1998; Tipa & Welch, 2006; J. Williams, 2006). Central amongst these is the enduring pioneer perspective of ‘plenty’ where freshwater systems are concerned.

7.4.1.1 The Neoliberal Agenda and Market Development

As already stated, the RMA was designed with the intention of achieving two broad goals. The first was to promote sustainable management of natural and physical resources. The second was to facilitate the development of those natural and physical resources for the national-scale economic advancement, through that of the individual. The neoliberal paradigm was adopted at the time of System Change, and wholeheartedly applied in the two decades following. Unfortunately, while this was the dominant perspective of the time, there is an increasing amount of criticism of the neoliberal ecological modernisation paradigm as a management approach internationally, and in New Zealand (Barton, 2007; Connick & Innes, 2003; Healy, 2005; Higgins & Lockie, 2002; Jackson & Dixon, 2007; Jay & Morad, 2007; Valentine et al., 2007).

The restructuring of all levels of government during the 1984-1991 System Change was focused on the aim of “getting government out of business, and business into government” (Ericksen, 1990, p78). Given national-level government’s appalling record in environmental protection (culminating in the Lake Manapouri/Clyde Dam debacle of the early 1980s which almost brought down the Muldoon Government), and the impending national bankruptcy (Bührs & Bartlett, 1993; Memon, 1993), this attitude is certainly understandable, even a laudable ideal. Unfortunately, integration

of business considerations (as essentially the furtherance of individual rights and benefits) with governments whose remit is the furtherance of public rights and benefits, does not typically enable sustainable outcomes (see, for example, Scrase & Sheate, 2002). It seems clear from the outcomes that neither the Labour nor the National governments involved in the development of the RMA properly understood the implications of 'getting business into government' from a sustainable management perspective. This is particularly in relation to the worldviews or decision-making perspectives, limitations, requirements (particularly including 'up front' investment in research, development, and capacity-building), and mechanics of entrepreneurial market development. All of these, along with leadership, have been conspicuous by their absence over the last two decades.

That said, two markets in particular have been highly successful, but are now beginning to encroach upon each other's future development. In 2007, tourism, based on the 'Clean, Green New Zealand' branding, accounted for almost 20% of New Zealand's export earnings, ("New Zealand Tourism Strategy, 2015," 2010). Meanwhile, research from Statistics New Zealand, commissioned by Fonterra, the country's largest dairy cooperative, who also trade on the "Clean, Green New Zealand' brand, claims that this cooperative contributes 25% of the country's export earnings (Fonterra, 2008). These outcomes are testament to the natural resource base, as well as the human ingenuity and imagination in the development of these market sectors, and technological advancements (such as large-scale centre-pivot irrigation), which have been involved. However, particularly in the matter of freshwater quality and quantity, these two industries can now arguably be viewed as holding diametrically opposed positions as to the more beneficial use of water at the national scale. It will be most interesting to observe the responses of these two key New Zealand industries to the Creech report (Creech et al., 2010).

It is important to remember that notwithstanding technological advancements in storage and transport, freshwater remains a limited, if renewable, complex common pool resource, and the perceptions of 'plenty' on which some markets appear to have been developed, may not in fact be accurate. This has become particularly apparent as the growth in dairy in New Zealand continues, hand in hand with the growing realisation that whilst the first in first served approach to freshwater allocation may be

cheap and straightforward where supply is no issue, more sophisticated approaches are required during actual or expected scarcity. Paramount to all of these is the growing realisation and acceptance by the New Zealand public of the fact that there *are* limits to use, and to expansion and intensification, and that these urgently need to be identified. Unfortunately, central government currently appears determined to side-step the necessary debate regarding the clarification and re-negotiation of freshwater property rights, in favour of its plans to ensure that “less of the water that currently pours out to sea does so” (Key, 2010a).

7.4.1.2 Property Rights

The situation in New Zealand with respect to water allocation and water rights has become progressively more complex and contested over the last two decades of the RMA. Water, and the benefits of freshwater systems including instream, cultural, social, and economic values, are now ‘owned’ in several different ways over several different dimensions. Under the RMA, water remains a publicly (Crown) owned resource. Barton (2007, p. 240/241) suggests that:

“The Act was drafted to stay out of ownership questions – it tries to ignore ownership, property, and distribution of wealth... On the more specific question of property rights emerging from the RMA in the form of water permits... we find a set of questions that the RMA never addressed in 1991. The nature of these rights, their allocation, and their transferability, present themselves as the agenda for change that the RMA clearly needs”.

Did the RMA ‘studiously avoid’ the issue of property rights? It was very clear in the reports from the Resource Management Law Reform (1987-1989) (RMLR), during the drafting of the Act, that consideration was being given to various governmental options relating to ownership and rights to use water amongst other natural and physical resources, specifically:

- “the characteristics of the resource and its markets
- the implications of these characteristics for defining rights to the resources and the options for ownership or management of the resource
- the costs and benefits of the different ownership or management options identified and the costs of altering existing rights
- the role of the government with respect to
 - third party spill-over effects and
 - public goods

- the appropriate level (that is, national, regional, or local) of government involvement where a role for government is identified” (RMLR, 1988, c.f. Memon and Gleeson, 1995, Note 3, p115).

Yet the RMA *has* left unresolved the Commons question of, and tension between, individual property rights and community benefits, and some commentators observe that “this unresolved conflict lies at the heart of the legislation” (Oram, 2007, p. 12). This conflict has been avoided by successive governments through two main avenues. The first is the ongoing absence of any national-level leadership in the freshwater field, as evidenced by the lack of National Freshwater Policy Statements or guidance (a National Policy Statement was finally proposed in 2008, but has yet to be confirmed, MfE, 2008). The second is the ongoing national-scale failure to ensure capacity (as capability and commitment) at the regional scale, or provide funding to develop capacity where it is lacking (Ericksen et al., 2003; Memon & Skelton, 2007). Finally, it should be remembered that as already stated, the dominant first-in-first-served approach to the allocation of freshwater and its benefits, particularly with regard to abstractive use, is not mandatory, merely inherited from previous governance regimes.

7.4.1.3 Competing Cosmologies and Worldviews

As already noted, Maori enjoy a cosmology completely independent of the dominant Pakeha one. Maori environmental perspectives to freshwater governance in New Zealand are arguably becoming increasingly influential, and the projected Maori demographic certainly suggests that the Maori culture may have re-established social dominance by the middle of this century (J. Williams, 2007). This of course holds significant challenges for the current institutional re-design and property rights re-negotiation processes (Tipa & Welch, 2006). Further, as I have already noted, there is a full spectrum of worldviews and appreciations present in New Zealand society, from conservation perspectives through to the apparently dominant perspective that every drop of water reaching the sea is ‘wasted’ (see subsection 7.4.1.1 above).

This subsection has briefly described the key problematic institutional arrangements in the national-scale SES. How have they influenced the social selection of emergent

operational rules in use, and thus framed decision-making at this scale? This question is addressed in the following subsection.

7.4.2 Emergent Operational Rules in Use that Frame Choices

The purpose of this subsection is to identify the key emergent operational rules in use which have been socially selected (or, as in the case of allocation approaches, merely inherited and accepted), as an SES-specific ‘frame of reference’ (Swaffield, 1998). The operational rules in use, as already described, are the socially selected outcome from the way that IWM institutions have been filtered through, and/or supplemented by, key institutional arrangements as identified above. It is the emergent operational rules in use which will thus influence the factors considered by individuals in the selection of their action strategies, with respect to use of multi-dimensional freshwater system benefits. This is shown in bold in Figure 22.

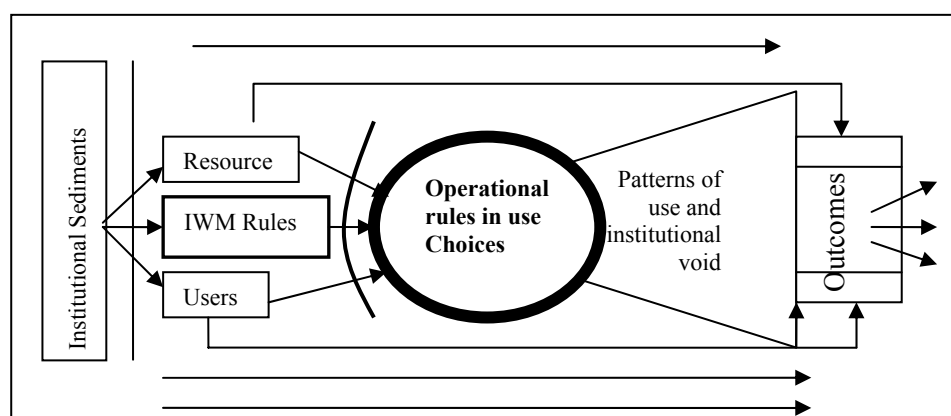


Figure 22: Representing the RMA Cycle's National-Scale Operational Rules in Use for Evaluation

While there exists capacity for the generation and maintenance of sustainable freshwater outcomes within the design of the RMA rule-sets, the emergent operational rules in use are few and far between. In particular, the lack of political and social will to accept and implement the intention, or spirit, of the passionately debated section 5 provision of the RMA for:

“managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and committees to provide for their social, economic, and cultural wellbeing and for their health and safety while-

- a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations, and;
- b) safeguarding the life-supporting capacity of air, water, soil, and ecosystems, and;

- c) avoiding, remedying, or mitigating any adverse effects of activities on the environment” (“Resource Management Act,” 1991, s.5 (2)),

has remained an ongoing area of sometimes heated and *ad hominem* debate (Skelton & Memon, 2002; Upton et al., 2002). The widespread resistance to curtailment of individual freedoms to use and develop freshwater for economic wellbeing (as selectively interpreted from RMA s. 5), has been coupled with the ‘cognitive blindness’ (Memon, 2008b) of decision-makers, the lack of data and monitoring of abstractive use, and the rapidly increasing economic value of freshwater. This has meant that there have been, as Wheen (2002, p261) predicted, few “...real checks against development and resource exploitation” (as already noted in section 7.2). This has particularly been the case in dry-land areas considered ‘suitable’ for the expansion of the dairy industry and associated irrigation practices. These industries have been very successfully developed in response to the free-market opportunities, arising from the wider neo-liberal agenda.

In the face of the effective abandonment of Regional and District Councils by central government in the 1990s (Ericksen et al., 2003), the status quo allocation approach of first in first served was perpetuated, along with the unsustainable perception of plentiful freshwater. This situation was particularly noticeable in regions which had not already developed their freshwater system use to its limits, such as Canterbury, and remained broadly the case up until the Millennium. Further, the effects-based facilitatory mandate of the RMA, coupled with the lack of measurement technologies, available abstractive use data, and monitoring, has meant that in effect, those of New Zealand’s freshwater systems not protected by Water Conservation Orders have remained ‘fair game’ to those who wish to appropriate them, under the free-market economy. Water Conservation Orders were inherited from the 1981 ‘Wild and Scenic Rivers’ amendment to the 1967 Water and Soil Conservation Act. Their purpose is to:

“Recognise and sustain-

- a) Outstanding amenity or intrinsic values which are afforded by waters in their natural state:
- b) Where waters are no longer in their natural state, the amenity of intrinsic values of those waters which in themselves warrant protection because they are considered outstanding” (“Resource Management Act,” 1991 Part 9 s. 199 (1) (a, b)).

These institutions have proved themselves robust and enduring, and offer the advantage of having already identified limits to use, and/or parameters for management. Unfortunately, these critical and generally well-regarded IWM institutions in New Zealand are currently under threat from the ongoing RMA 'streamlining', and approach to economic maximisation. This was instigated by the incoming National Party in 2008, and further implied by Prime Minister John Key in a speech given on the 18th of January, 2010, where he stated that the government was seeking ways to remove "regulatory roadblocks to water storage and irrigation", particularly in Canterbury Region (Key, 2010a).

7.4.3 Unsustainable Patterns of Use and the Institutional Void

This subsection characterises the emerging IWM institutional void in New Zealand over the last two decades - the 'policy lacuna' (Skelton & Memon, 2002), as demonstrated by the unsustainable trajectory of patterns of interaction, the adverse effects of over-abstraction, and the new rules crafted to redirect or constrain the trajectory. These new rules were designed between 1991 and 2009, in order to address the RMA's main perceived or actual shortcomings as it began to 'play out on the ground' (Memon & Selsky, 2001), and emergent problems were identified.

The IWM and institutional change processes must at this point be considered as a coupled system. This is because it is by analysing the intention of new rules or legislative accretions, that the nature of the institutional void, and thus the patterns of interaction which have outstripped the institutional capacity, may be identified. Similarly, in a complex and subtle world of political negotiation, with commercial sensitivities, hidden agendas, and political expedience implicit, it can be just as informative to consider which institutional gaps have remained open, and why. The focus of this subsection is shown in bold in Figure 23.

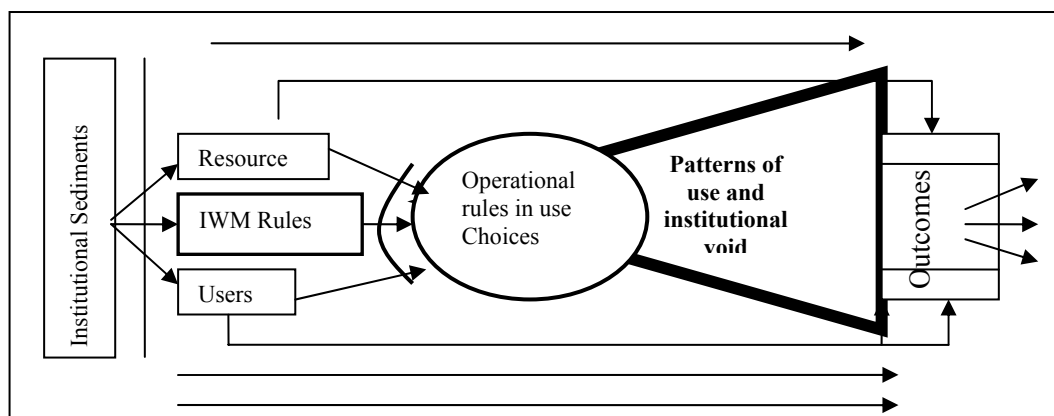


Figure 23: Emerging Patterns of Use and Institutional Void in the National-Scale RMA Cycle

How have the key, problematic institutional arrangements identified in 7.4.1 directed emerging patterns of freshwater system use into unsustainable trajectories? The following subsections will consider the way that the remarkably few constraints on individual freedoms, and the resistance to those constraints by a predominantly rural and strongly influential section of the population, have generated the ongoing gap in implementation capacity and national leadership, reported above, and in Figures 16 and 17. Three main strands of action are considered: national-scale legislation and amendments, legal rulings, and informal social actions to address the emerging institutional void and associated freshwater overshoot.

7.4.3.1 Key Legislation, 1991-2009

Because there has been little or no central vision, leadership, or guidance from central government (Crawford, 2007; Ericksen et al., 2003; Memon & Skelton, 2007; MfE, 2008; OECD, 2007), decisions have been made as issues have come to a head in various arenas. Several key pieces of legislation of particular interest to this study have been introduced to supplement the perceived or real deficiencies of the RMA 1991. These are the Local Government Act 2002, and the RMA amendments of 2003 and 2005, briefly reviewed below.

Local Government Act, 2002: The RMA divided ‘local’ governance between land-use at the district scale and freshwater (and other natural resources, including soils) at the regional scale. However, this proved to be a significant barrier to integrated freshwater decision-making in regions across the country. This was addressed through

efforts of the Local Government Act (2002) to bind these two levels of decision-making more tightly together. Part 1, section 3: Purpose of the Act, states that:

“The purpose of this Act is to provide for democratic and effective local government that recognises the diversity of New Zealand communities; and, to that end, this Act-

- (a) states the purpose of local government; and
- (b) provides a framework and powers for local authorities to decide which activities they undertake and the manner in which they will undertake them; and
- (c) promotes the accountability of local authorities to their communities; and
- (d) provides for local authorities to play a broad role in promoting the social, economic, environmental, and cultural well-being of their communities, taking a sustainable development approach.”

The key issue here is the provision for a sustainable *development* approach (as compared to the promotion of sustainable management in the RMA), and the explicit inclusion of four ‘well-beings’: social, economic, environmental, and cultural.

Balancing ‘well-beings’ is of course central to the trade-offs inherent in IWM, as already discussed. Further, the inclusion of economic or business interests does not typically enhance the sustainability of freshwater outcomes (Scrase & Sheate, 2002). However, the Local Government Act 2002, and its required structures and time-frames for policy and/or plan development between District and Regional Councils for the development and reporting of Long-Term Community Council Plans ("Local Government Act," 2002 Part 6, s. 93) has achieved some potentially significant changes to perspectives and processes. Key amongst these are the unavoidable need to coordinate district and regional planning, and the potential for Regional Councils to contribute to the shaping of future land uses and intensities, as identified in the District Plans. Indeed, it has been lately noted that "the drive to tie the Regional Policy Statements more tightly in to local plans and management could have far-reaching consequences, perhaps even to the point of enabling the RMA to deliver fully integrated resource management" (Beyond the RMA, *Beyond the RMA*, 2007, p. 18). However, it is also interesting to note that Local Government Act (2002) retains the use of the term ‘consultation’, rather than ‘collaboration’.

The RMA amendments, 2003: The principle of subsidiarity, and the precautionary principle, are both provided for in the RMA and its amendments of 2003. The application of the precautionary principle has, however, been remarkably slow in the area of freshwater. One reason for this is the effects-based approach, coupled with inadequate data and monitoring (MfE, 2007; OECD, 2007). As I will show in the

following subsection, this means that even where an attempt to set limits is made, the effects cannot be measured accurately enough to support the refusal of a water resource application. This is not addressing cumulative effects.

The RMA amendments, 2005: In the face of increasing conflict, and calls to central government for guidance, the perception that allocation between uses was not a function of the regional councils was corrected with the RMA amendments of 2005. These were aimed at improving freshwater governance practices in New Zealand in several ways, but particularly with reference to the authority of Regional Councils to allocate freshwater benefits between uses, and with respect to the dire need for leadership. The 2005 amendments, (30 (i), (fa), (fb), subsection 30 (4)) state that “rules in Regional Plans may allocate the resource among competing types of ‘activities’”.

For the purposes of this evaluation, these are the key legislative changes introduced to New Zealand during the RMA cycle to address the emerging institutional void. They have dealt with issues of: leadership; local (regional and district) development of medium and long-term visions, and; Regional Council authority to allocate freshwater benefits, particularly between competing ‘activities’. As I have already noted in section 7.2, the Environment Minister is tasked with the investigation of methods of allocation, including the use of economic instruments. It is therefore important to remember that the prevalent allocation approach of first in first served, as I will discuss in the following section, is not mandatory. It is merely inherited, and reflective of the institutional inertia that has surrounded the implementation of the RMA.

7.4.3.2 Key Legal Rulings

The ‘Balancing Act’ (the RMA1991) followed the ‘wise use’ approach of the preceding 1967/81 legislation. Judicial feathers were ruffled at the idea of subservience to an environmental ‘dictator’ (Skelton, 2008; Research interviews), many of whose properties, processes, and principles of management were (and in some cases remain) poorly understood or hotly debated, or both (see, for example, Creech et al., 2010). The cases reviewed below are key examples of this decision-

making confusion. In the already noted absence of any direction from central government, the absent or poor quality regional plans, and the lack of political will to remedy this, it was inevitable that the 'policy and political lacuna' (Skelton & Memon, 2002) present under the RMA would be filled by the courts. There are three legal rulings that have been particularly detrimental to the sustainability intentions of the RMA. These have re-enforced perverse IWM outcomes in various facets of the problem of allocation of costs and benefits between competing uses and users. They relate specifically to: firstly, the process of allocation as 'first in first served'; secondly, security of tenure in water resource permits that brings them closer to de facto property rights, and; thirdly, the failure to invoke the precautionary principle as provided for in the Act's 2003 amendments, due to technical shortcomings in the demonstration of cumulative effects. These are briefly introduced in order below.

The first is the ruling in the case of *Fleetwing Farms v Marlborough District Council* in 1997⁵. This was the ruling that opened the 'floodgates' to the 'gold-rush' of freshwater resource consent applications, and reified the 'first-in-first-served' approach to allocation, albeit in terms of the first correctly completed application received. Unfortunately, while arguably a socially equitable approach since anyone may apply as their need arises, first-in-line-first-in-right is also arguably neither economically effective, nor an allocation method that works well under scarcity, or under strategic planning constraints for cumulative effects ("Canterbury Water Management Strategy," 2009; Creech et al., 2010; MfE, 2009b).

Tenure of freshwater consents as de facto private property rights is highlighted by the case of *Aoraki Water Trust vs Meridian Energy Ltd*, heard in the High Court in 2005. Here, the ruling states that consent holders have the right to expect that their allocation will be durable enough to justify capital investment for long-term pay-back, for instance. Essentially, this ruling exacerbates the conflict between the public property designation of freshwater as part of what is called in New Zealand the Crown Estate, and the private property nature of the consents to use, and generate private economic benefit from, water. The issue here is not that tenure of consents should not be supported. Indeed, tenure is critical to capital investment. However, this ruling

⁵ ("*Fleetwing Farms v Marlborough District Council* (3 NZLR 257 (CA)), 1997)

gives support to the increasing misalignment between extant rights (particularly with respect to Maori customary rights, for instance), and emerging, increasingly *de facto* private ones. This remains to be properly addressed, and is central to the current problemshed.

The final legal ruling of particular relevance to this study comes from the Environment Court decision regarding the Lynton Dairies appeal over its unsuccessful application for water from Environment Canterbury ("Lynton Dairies v Canterbury Regional Council, Decision No. C108/2005," 2005). This case considered the issue of cumulative effects. The Regional Council had declined Lynton's application for water on the grounds that the resource was already fully allocated. However, the Court ruled that the Council could not prove cumulative effects, because of a measurement issue. The problem was that the Court required proof to within 2% of total flow, and the management data cannot discern below 5%. Cumulative effects in these contexts cannot, therefore, currently be legally proved in New Zealand. Unfortunate as this decision was for the freshwater resource systems, it was pivotal in bringing the long-ignored issues of definition of cumulative effects, and strategic planning for them, to the forefront of the freshwater policy debate.

7.4.3.3 Informal Social Action to Address the Institutional Void

It is important to remember that while formal legislation is critical to IWM, so are informal actions, contestations, and/or agreements, which can sometimes wield more influence than formal approaches. One prime example of informal, non-government organisation attempts to highlight and rectify the growing institutional void in New Zealand's freshwater governance, is the Fish and Game New Zealand 'Dirty Dairy' campaign that was run in 2001 (Dirty Dairying, 2001). This campaign addressed the levels of pollution in streams from livestock. This was followed two years later by the Dairy and Clean Streams Accord (MfE, 2003), and agreements on the exclusion of stock from surface waters, and the fencing of riparian strips. Outcomes of this effort were arguably mixed. Certainly, there is greater public awareness of the issue now, and better riparian fencing and stock control, but the campaign was seen by many farmers as unhelpful and created a significant amount of resentment against Fish and Game (Fish and Game Respondent, Research Interviews, 2008; Davies et al., 2007).

This subsection has described key examples of legislation, legal rulings, and informal action, which reflect the unsustainable trajectory of cumulative patterns of use through identification of the perceived areas of institutional shortfall. The remaining sections discuss the role of the identified institutional arrangements in RMA outcomes at the national scale, and draw some conclusions regarding the fulfilment or otherwise of the RMA's intentions.

7.5 Discussion and Concluding Comments

This chapter has interrogated the key intentions of the RMA, and the IWM outcomes of the RMA cycle at the national-scale (including an emergent polycentric IWM problemshed). It has examined the main aspects of the coupled institutional void and emerging patterns of unsustainable interaction, through consideration of selected legislation and legal rulings. These were used as indicators of real or perceived weaknesses within the RMA's performance 'on the ground', with respect to freshwater. Based on the above analysis, this section will now consider the extent to which the study findings support or contradict the theoretical expectations described in Chapters Four and Five.

The institutional gaps and unsustainable trajectory of patterns of freshwater use described above could have been adequately addressed under the RMA, and indeed, arguably some regions, such as Otago and Manawatu-Wanganui (Horizons), may have done so (Davis & Threlfall, 2006; Hooper, 2006). Why was the Act not implemented more widely with respect to its sustainability intention? In this chapter, I have argued that the ongoing central government reluctance to involve itself with decision-making in respect to setting limits to freshwater use and freshwater allocation, combined with increasing economic value and competition for resources, has generated a 'gold-rush' for consents. Freshwater resource consents have come to represent an opportunity for private financial gain from increasingly scarce, and therefore correspondingly valuable, public property.

The specified purpose of the RMA is to promote sustainable management. It could have done this on the national scale, but the combination of relatively generous

system limits at the national level, a neo-liberal agenda, and a remarkable absence of ‘constitutional will’ has meant that what it has promoted instead is a trajectory of freshwater overshoot. From Jones (2002), this is the tenet of intended rationality, or implementation gap. In particular, unsustainable IWM freshwater outcomes from the RMA have been largely driven by the combination of a neoliberal agenda and a heavy national-scale dependence upon primary production: agriculture, particularly irrigation and dairy farming which has been intensified, and extended into dry-land areas, such as the Canterbury Plains. The increased generation of hydroelectricity is also high on the agenda, with hydroelectricity already contributing 56% of New Zealand’s electricity. New Zealand must finally close its freshwater quantity frontier: the quality frontier was arguably reached with the 1967 Water & Soil Conservation Act, discussed in greater detail in Chapter Nine. However, as already noted, over forty years later the ‘swimmability’, or suitability for contact recreation, remains a central concern (MfE, 2008). The Manawatu River in North Island, for example, was cited as one of the most heavily polluted rivers in the Western World in November 2009, rating 107 on a scale where 0-4 is regarded as ‘healthy’. A national-scale vision, and national-scale limits to freshwater system use are long overdue, the Water Conservation Orders notwithstanding, and the freshwater sustainability overshoot that has occurred in the meantime will be difficult and expensive to remediate.

Current contestations are based on issues of property rights to freshwater system benefits. This was a clear issue in the brief to the RMLR group in 1984, and therefore it is arguable that this approach to allocation was ignored in the perspective of plenty, along with the economic approaches to allocation that are available but have remained largely unused. However, current debates are not about the reliable provision of potable supplies as such. Given the per capita availability of freshwater and the physical infrastructure available for its storage and transport, this issue has essentially been settled. Debates are now about how to spend the country’s ‘disposable freshwater income’, and have become a contestation between and across a wide continuum of Maori and Pakeha environmental perspectives: intensive agriculture (especially dairy and associated irrigation); rural and urban values; hydro-electricity generation; ecological values, and in-stream uses including, inter alia, spiritual, aesthetic and biodiversity values, fisheries, tourism, and recreation. This is now an extremely wicked constitutional-choice level contestation between cultures,

worldviews, markets, abstractive and in-stream property rights, and ultimately, conflicting social appreciations.

On the other hand, some IWM institutions in New Zealand have proved themselves both robust, enduring, and a route to informal collaborative progress in decision-making (I will discuss this aspect in greater detail in the following Chapter Eight). As already noted, Water Conservation Orders were inherited from the 1981 'Wild and Scenic Rivers' amendment to the 1967 Water and Soil Conservation Act. However, also as already noted, these are now under threat from the 'streamlining' of the RMA, and the governing National Party coalition's determination to enable further economically-driven freshwater systems development through water storage and irrigation (Key, 2010b).

There is also an argument for the further devolution of decision-making authority as part of a more boundedly rational approach to freshwater governance, particularly in emerging polycentric situations. Further devolution to Maori management under s. 33 of the RMA is possible, although this has not been widely employed. On the other hand, as already noted, the 'neo-Polynesian' (J. Williams, 2007) demographic in New Zealand is showing very rapid growth, and the Tainui (local Iwi) co-management of the Waikato River, and the implications of their claims to the river as summarised in their submission to the Proposed National Water Policy Statement (MfE, 2008), may become much more common-place in the future. Alternatively, degrees of self-governance may be awarded to designated community groups, as is happening in South Canterbury, with the Opuha Water Partnership (www.scfis.co.nz) (Gunningham, 2008; Lange et al., 2008), and with the catchment-based Canterbury Water Management Strategy announced in 2009 (www.canterburywater.org.nz), now potentially undermined by the Creech report (Creech et al., 2010), and current central government ambitions. These will be discussed in greater detail in the following chapters.

The RMA is thus identified in this chapter as a symbolic policy in terms of freshwater. It has not been implemented as intended with respect to its sustainability intentions for freshwater, and this has led to an institutional void Figure 17. The new political space associated with this void has been identified as a polycentric IWM

problemshd. The problematic institutional arrangements were identified as relating to the interacting and interdependent social aspects of: markets in the form of the neoliberal agenda and global dairy boom; property rights tensions, and judicial decisions on matters of cumulative effects, allocation, and tenure and; competing and/or conflicting world-views and cosmologies, dominant amongst which remains the 'pioneer' perspective of plenty for exploitation. Yet in spite of the ongoing accretion of institutions, vital national policy statements or guidelines to limits of use have remained absent, although these are finally being discussed.

This is clearly a hugely complex issue with no 'right' answers, approaches, or scales for governance, although plenty of 'wrong' ones, and a great many very wicked challenges to be worked through. These will have to include firstly, methods of allocation. These will always be less important than the setting of allocation limits. Setting of limits is ostensibly an objective exercise, but is in reality the most difficult, normative, constitutional-choice level choice level challenge, yet to be faced by New Zealand's central government decision-makers. Once limits are set *and accepted*, methods of allocation will eventually resolve themselves. However, the fact that these limits remain to be drawn supports the theory that in spite of the RMA sustainability intentions, New Zealand has yet to make its social sustainability transformation with respect to its freshwater systems. I will return to this subject in Chapter Nine.

Secondly, issues of compensation will need to be addressed. Maori and the Treaty Settlement Process are still working through the Maori reparation negotiations, and until these can be settled with respect to freshwater, little real progress is likely to be made in the crafting of property rights or allocation methods. Further, while eminently understandable, increasingly vocal Maori calls for separate systems of self-governance of their customary resources usage (Tipa & Welch, 2006; J. Williams, 2006, 2007) would appear to present significant challenges for implementation alone, never mind social cohesion. Along with issues of freshwater property rights and compensation being negotiated by Maori, the question of potential compensation for dairy and associated irrigation agriculture also arises. These industries are ultimately no more to blame for the extant freshwater allocation approaches, or the allocation overshoot, than anyone else. Moreover, memories in farming are as long as those of any other 'injured' party, and the way in which the industry and its individual

members were exposed to economic hardship during and immediately after the free-market neoliberal shift, is still resented by many. Further, it appears highly unlikely that the dairy industry, in its current position of strength in the country's export ratings (as noted, generating 25% of national export earnings, as of 2008), would be willing to accept uncompensated reductions of freshwater allocation (particularly through review of live permits), without a passionate and vociferous struggle.

Arising from the current national-scale legislative reform process instigated by the incoming National government, is the Land and Water Forum as noted above, which has now been critically undermined by the Creech et al., (2010) report on Environment Canterbury. As I have discussed, the Land and Water Forum is a collaborative system of decision-making at the national scale. It has emerged from a policy vacuum, a political change, an economic crisis, and changing social appreciations of the nation's freshwater systems: in other words, all three of the precursors to a potential sustainability transformation. This is as well as the increasing levels of costly, legally 'settled' contestation and conflict, failure of 'simple' collaborations to attain their goals, an increasing Tangata Whenua influence and potential for future influence, and new and emerging leadership.

New Zealand is effectively exporting its freshwater resources. In fact, New Zealand is currently surviving on the export income derived from its freshwater resources. From this analysis, it seems that the RMA has done almost everything that it was designed to do, except to promote sustainable management of the nation's freshwater systems. The fault for this can hardly be said to lie with the RMA, but one conclusion I have reached in this chapter is in agreement with Wheen (1997): the RMA may have done a great deal for environmental legislation in New Zealand; it has done very little for water management legislation. Meanwhile the threatened Water Conservation Orders remain the more effective, robust, and enduring legislative approach by virtue of their willingness to identify and enforce limits to use.

I will now present some conclusions regarding the role of institutional arrangements in the fulfilment or otherwise of the RMA intentions at the national scale. As discussed above, the particular focus for this analysis has been on the role of institutional arrangements in the individual selection of action strategies for resource

benefit use (i.e., the dominant perspectives/social appreciation of freshwater systems), and the emerging unsustainable trajectory of cumulative patterns of use that have triggered the current period of institutional renegotiation. This is particularly focused on the necessary renegotiation of property rights, and the reconsideration of constitutional-choice level perspectives.

7.5.1 Key Chapter Findings

The evaluation as reported above has generated the following key findings:

- As predicted in Chapter Five, the RMA is here identified as a symbolic policy - ‘a good Act not implemented’.
- Arising from a cognitive blindness of freshwater system limitations (the pioneer perspective of plenty), New Zealand has become increasingly locked in to agriculture and export markets for primary produce, particularly milk powder.
- Successive central Governments have been unwilling to be seen as restricting personal freedoms: sustainable management has not been ‘politically expedient’.
- This situation has been exacerbated by damaging, or contrary, Environment Court rulings, whereby the mechanisms through which the unsustainable freshwater trajectory has emerged were reified instead of corrected.
- The first in first served allocation approach is no longer appropriate for the New Zealand conditions, while the ongoing accumulation of new, corrective legislation and rulings arguably demonstrates increasing system brittleness. However, major re-structuring will be hampered by remaining uncertainty over the outcomes of ongoing Treaty of Waitangi settlement processes.

In summary, it is clear that the wider institutional arrangements present in New Zealand have exerted a strongly detrimental influence in relation to the sustainability intentions of the RMA. As I have discussed, this has been as much through sins of omission as it has been through sins of commission, although this situation may now change very rapidly. This chapter has particularly highlighted the role of institutional arrangements related to the broad themes of social freshwater appreciations (particularly in respect of the perspective of plenty and the unwillingness to define limits to use), competing cosmologies, and increasingly misaligned systems of property rights. Further, it has indicated some areas where the recent report on

Canterbury freshwater management (Creech et al., 2010) will undermine what might have been a genuine opportunity for a social sustainability transformation, and real decision-making progress, in the shape of the Land and Water Forum.

One reason for the RMA failure is clearly the combination of the wider neoliberal agenda, coupled with the absence of national-scale vision, and clear limits to freshwater system use. Another is that there was no political will (or recognition of need) to draw limits over the next two decades. But why did the country choose the free market neoliberal approach? Why were there no limits already drawn? And why, given the stated purpose of the Act, was there still no will to draw them? I will return to these questions in Chapter Nine, where I will analyse the origins of the problematic institutional arrangements identified in this chapter. Before that, the following Chapter Eight refocuses the evaluative framework to consider the regional/local scale exemplar, Canterbury Region, and Lake Ellesmere/Te Waihora.

8 An Evaluation of the Role of Institutional Arrangements in IWM Outcomes for Canterbury Region and Te Waihora/Lake Ellesmere, 1991-2009

8.1 Introduction and Chapter Overview

In the previous chapter, I have argued that through the detrimental influence of problematic institutional arrangements on national-scale front-loop IWM processes in New Zealand, the RMA has become a symbolic policy with respect to its sustainability intentions.

The aim of this chapter is to build upon the findings of Chapter Seven, through evaluation of the role of these problematic institutional arrangements in IWM outcomes of coupled regional and local scale IWM processes. The purposively selected region for this study is Canterbury, on the east coast of South Island, (Figure 24). The local-scale IWM exemplar, also purposively selected, is Te Waihora/Lake Ellesmere. This is a lowland lake at the foot of the Canterbury Plains, and the Selwyn River catchment (Figure 25). The Banks Peninsula ‘bump’ that protrudes from the east coast of Canterbury, makes a useful point of reference across the two geographical scales represented.



Figure 24: North and South Islands, and Canterbury Region, New Zealand (DeptofConservation, 2010)

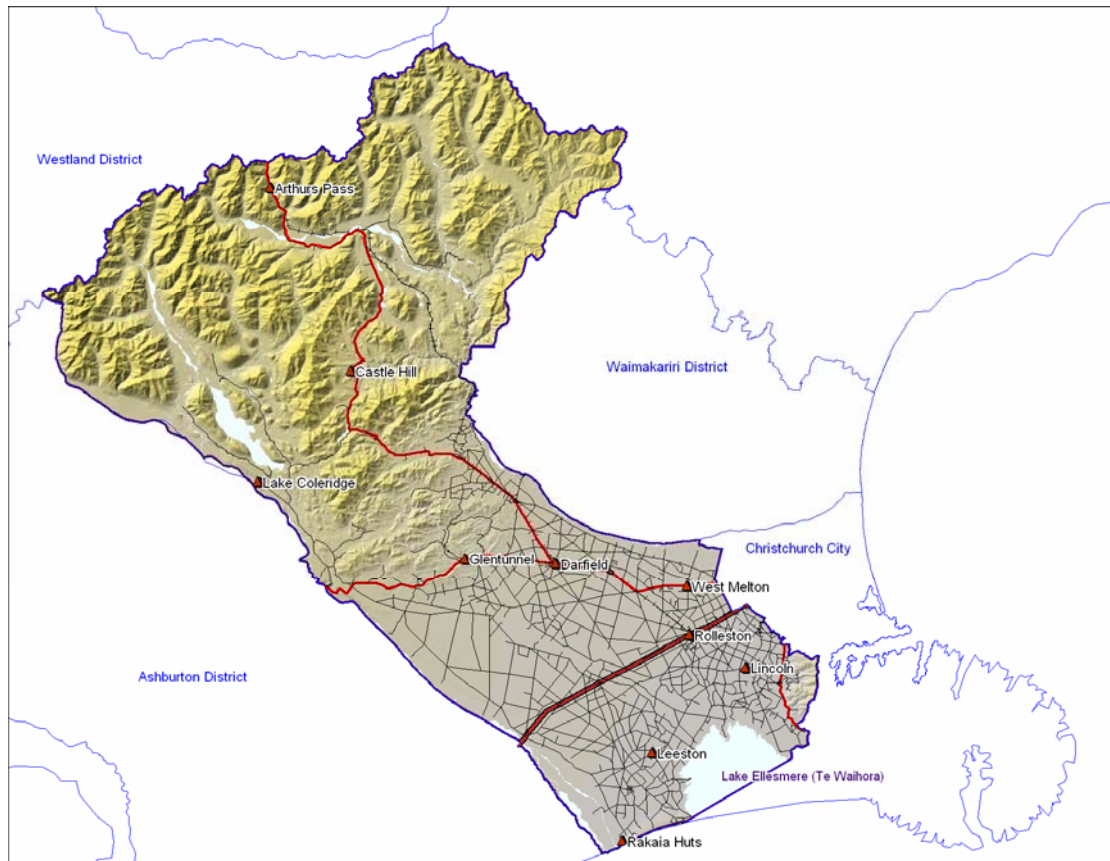


Figure 25: Positioning Te Waihora/Lake Ellesmere within Selwyn District Council boundaries.
Source: Selwyn District Council website, (www.selwyn.govt.nz accessed 26th Feb 2010).

Because the focus of this chapter is on the role of broader institutional arrangements in the coupled regional and local front-loop elements of IWM processes, the evaluative framework metaphor for this chapter includes both scales of IWM process, as shown in bold in Figure 26.

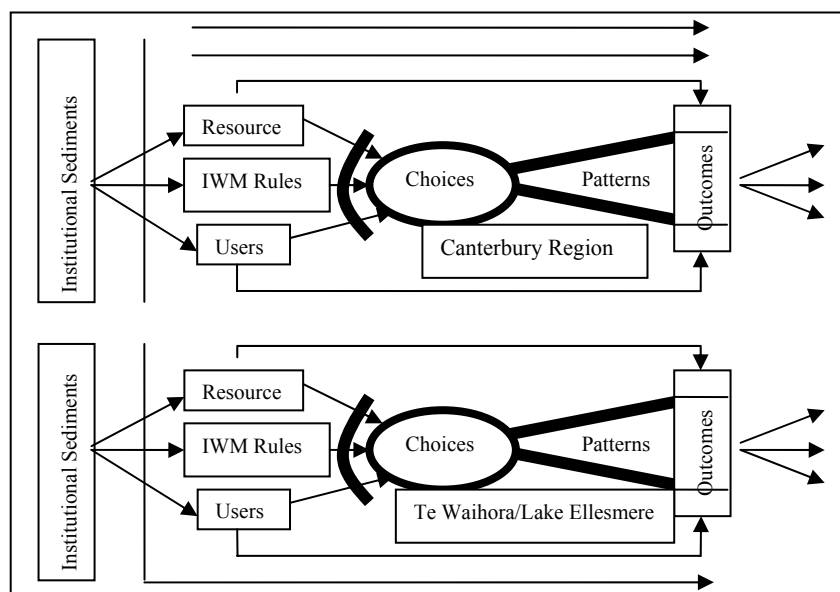


Figure 26: Representing Front-Loop Regional/Local-Scale RMA Processes for Evaluation

As in Chapter Seven, this chapter addresses two main questions in the attainment of its aim:

- 1) Which (if any), of the broader institutional arrangements discussed in the previous chapter, are identified by the study respondents, and supported by secondary data, as having influenced the outcomes of the RMA for Canterbury, and Te Waihora/Lake Ellesmere?
- 2) In particular, how have any broader institutional arrangements identified, influenced the front-loop elements of IWM and institutional change processes in these SESs? In other words, what have been the mechanics of their role in the compromise or support of the RMA's intentions, with respect to freshwater?

In the remainder of this chapter, I will address the two research questions as follows. The national-scale contextual factors having already been analysed in the foregoing chapter, in section 8.2.1 I will characterise in broad terms the key internal contextual factors to IWM under the RMA in Canterbury Region, and for Te Waihora/Lake Ellesmere. These are: the freshwater resources and their markets; the regional and local-scale devolution of decision-making authority and sustainability intentions of the RMA, and; prominent user-group appreciations of the resource. Then, in subsection 8.3 I will consider the IWM outcomes of the RMA for these two SESs.

Following this, in subsection 8.4 I will consider the regional and local expressions of the problematic institutional arrangements identified in the previous chapter, and their roles in the multi-scale front-loop elements of the IWM processes. Thus, in subsection 8.4.2 I will analyse their role in shaping the emergent, multi-scale operational rules in use; and in subsection 8.4.3, I will address the emerging patterns of use and institutional voids. In section 8.5, I will reflect upon the extent to which the study findings support or contradict the theoretical perspective of IWM and institutional processes of complex adaptive change, as explained in Chapters Four and Five. In this section, I will also present some concluding comments on the role of institutional arrangements in RMA outcomes for the coupled Canterbury, and Te Waihora/Lake Ellesmere, SESs.

8.2 Evaluation Results: Multi-Scale Internal Contextual Factors

The evaluative frameworks employed in this chapter are shown in Figures 27, 28, and 29 following. Figure 27 outlines the key findings of the RMA process as analysed for Canterbury. Figure 28 outlines the key findings of the RMA process as analysed for Te Waihora/Lake Ellesmere, and Figure 29 reports on all three associated complex adaptive processes of interest to this study, in both scales of SES.

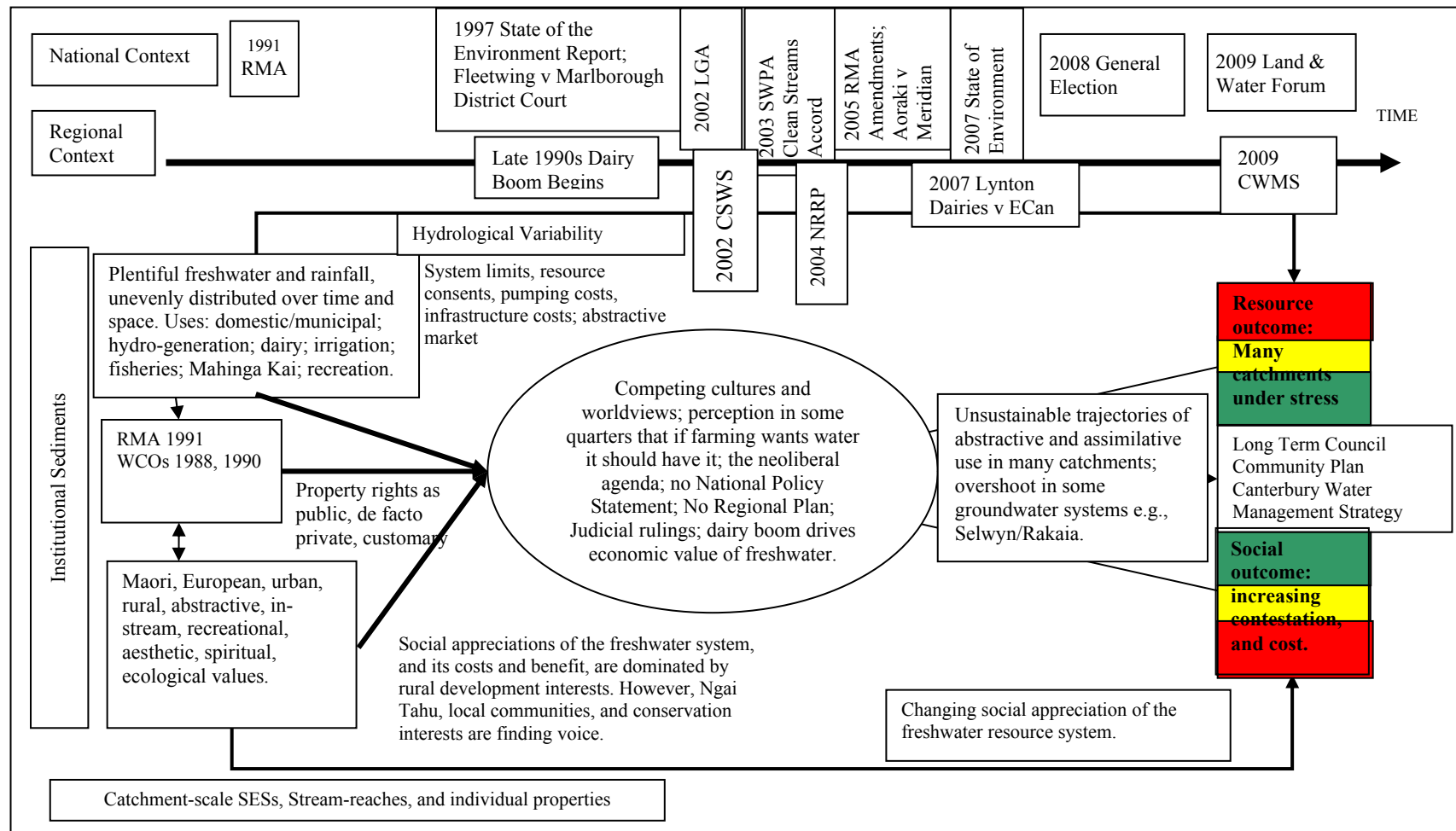


Figure 27: Evaluating the Role of Institutional Arrangements in IWM Outcomes in Canterbury 1991-2009

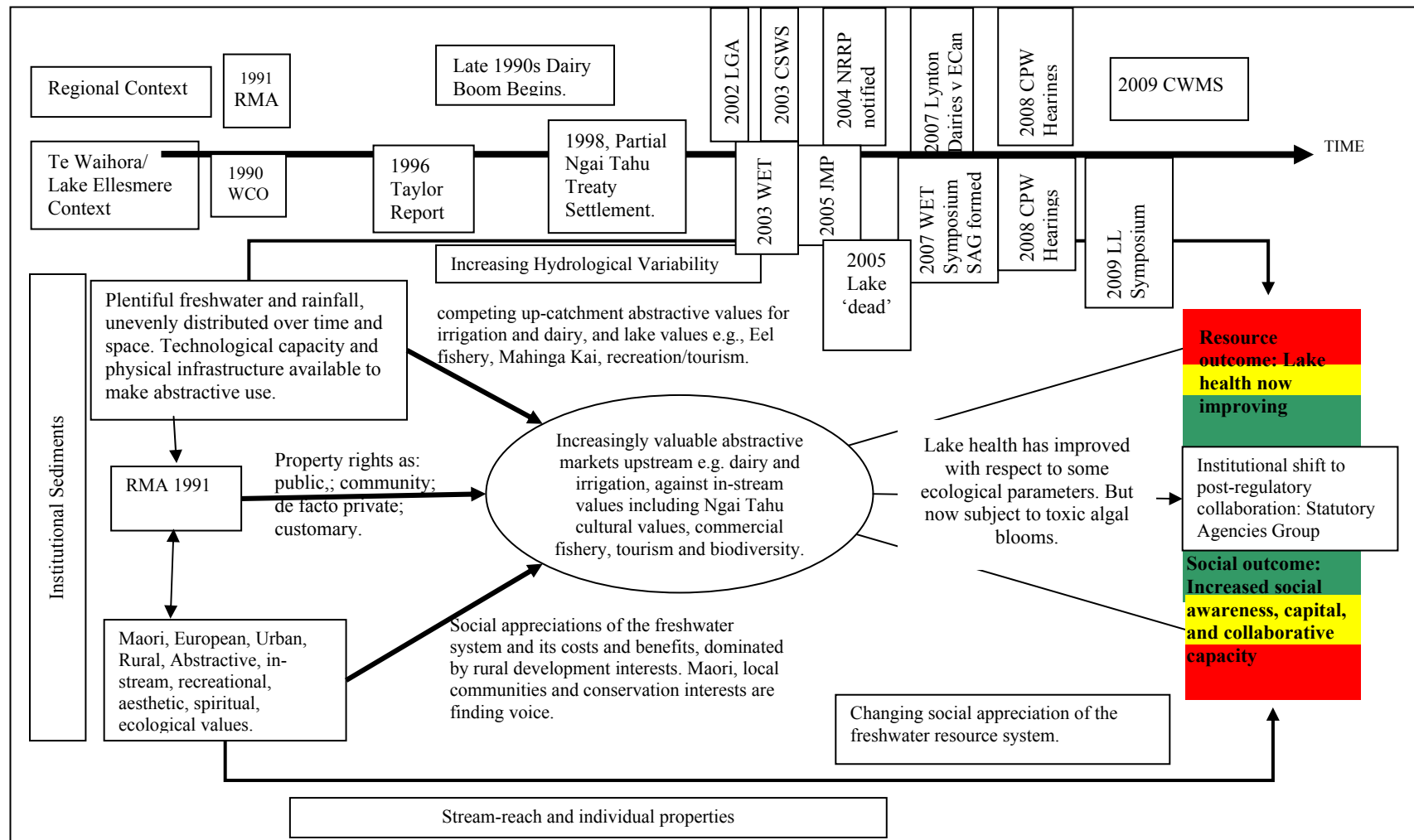


Figure 28: Evaluating the Role of Institutional Arrangements in IWM Outcomes for Te Waihora/Lake Ellesmere 1991-2009

	Back Loop 1991	Front Loop		Back Loop 2009	
Complex Adaptive Change	System re-organisation (α)	Exploitation (r)	System growth (K)	System collapse/disturbance (Ω)	System re-organisation (α)
Canterbury IWM	<p>No capacity building from central government during RMA roll-out.</p> <p>Inherited bad feeling between ECan and Territorial Authorities.</p> <p>Cognitive blindness of the need for freshwater planning.</p> <p>Perception of 'plenty', poor resource consent decisions regarding volume and duration in the 1990s.</p>	<p>Key Problematic Institutional Arrangements identified:</p> <p>Tension between predominant and competing worldviews and cosmologies; Conflicting property rights domains; Market forces in a neoliberal paradigm; first in first served allocation; Legal decisions.</p> <p>National dairy boom, 'cheap' land, and 'available' water drives overshoot. Increased social resistance to progressive loss of public benefits for private gain.</p>	<p>Increasing abstractive and assimilative pressures on the resource from urban and rural land-use intensification.</p> <p>Dairy herd expanded by 60% 2002 -2008.</p> <p>Impressive performance by ECan after 2003, but undermined by the Environment Court.</p>	<p>The Mayoral Forum complaints to central government, Sept 2009;</p> <p>The launch of the CWMS in Nov 2009;</p> <p>Investigation into ECan performance, Nov 2009;</p> <p>Prime Minister speaks of 'removing regulatory roadblocks' to increased water storage, irrigation and dairy in Canterbury, 18th Feb 2010;</p> <p>Creech report (Creech et al., 19th Feb 2010).</p>	<p>Proposed 'sacking' of the Regional Council, to be replaced with an appointed Canterbury Regional Water Authority.</p>
Te Waihora/Lake Ellesmere IWM	<p>The lake has been in 'crisis' for at least four decades, since the Wahine Storm. However, lake water quality and quantity declined sharply during late 1990s, as inflows were reduced.</p>	<p>Lake increasingly valued for multiple uses, including Mahinga Kkai, biodiversity commercial fishery, recreation.</p>	<p>Increasing public support for better lake management, through WET; Living Streams programme.</p>	<p>Here the system disturbance may be linked to improved outcomes for the lake.</p>	<p>Unknown.</p>

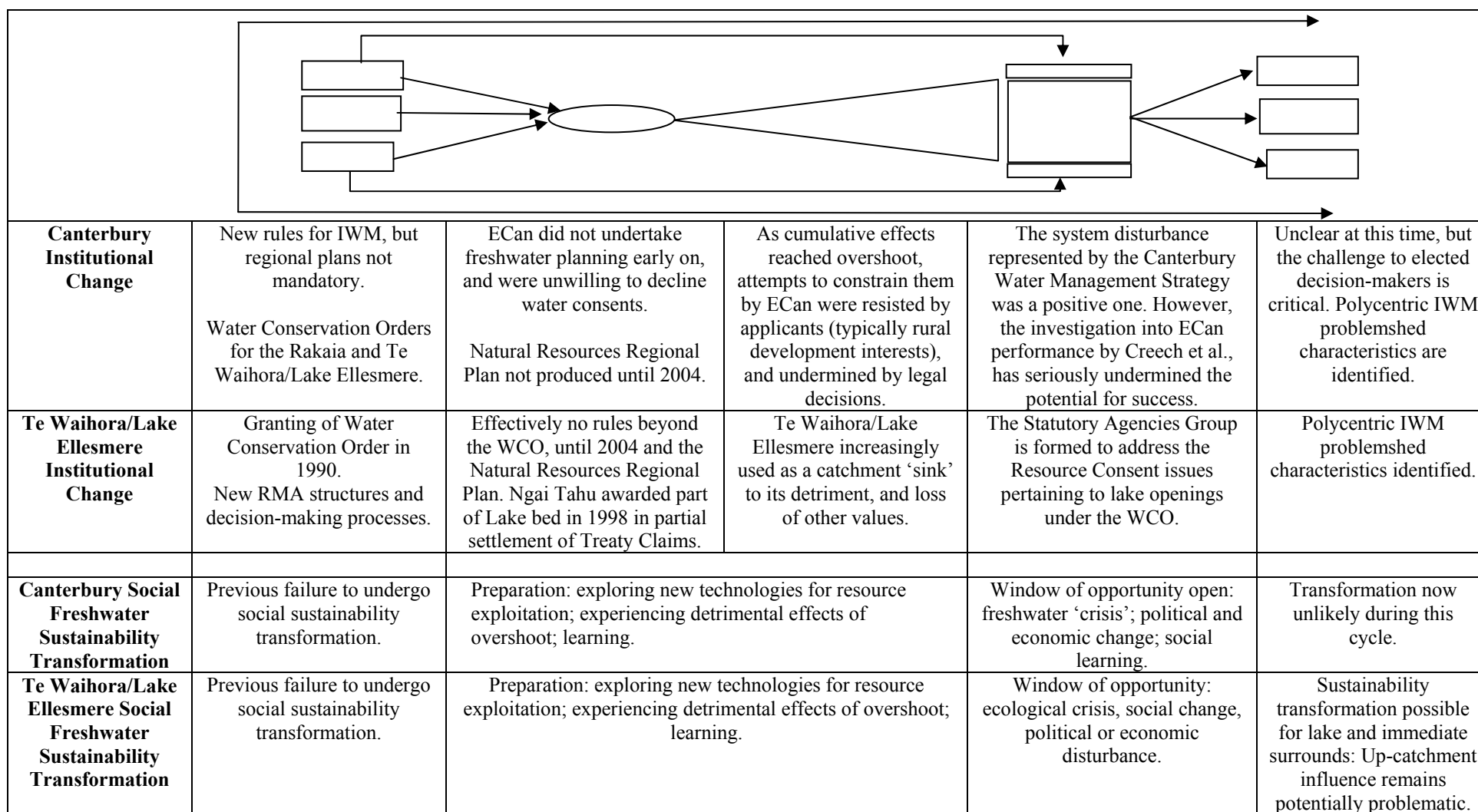


Figure 29: IWM Processes of Complex Adaptive Change in Canterbury and for Te Waihora/Lake Ellesmere, 1991-2009

8.2.1 Characteristics of Freshwater Resources in Canterbury

Chapter Seven has provided the national-scale analysis of the role of institutional arrangements in RMA outcomes. Thus, the previous chapter has also described the external contextual factors for this evaluation in terms of cosmologies, worldviews, markets, higher-scale legislation etc. In this section, I will briefly describe the internal SES contextual factors to IWM in Canterbury, and for Te Waihora/Lake Ellesmere. These are shown in bold in Figure 30. As is already widely understood in environmental management, land and water resources should be primarily considered as a coupled system. Therefore, in this section I will briefly characterise the main freshwater systems in Canterbury, along with their environments and uses.

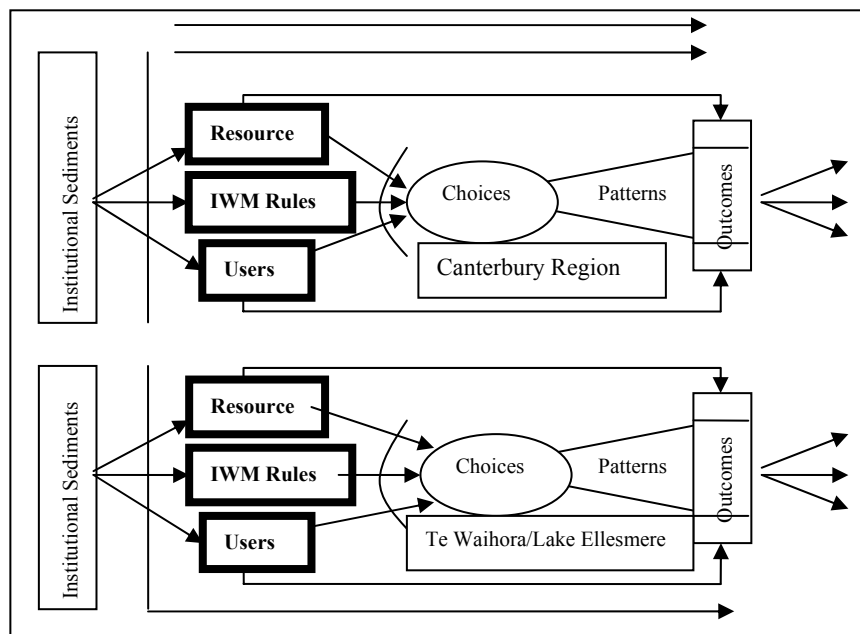


Figure 30: Representing Multi-Scale Internal Contextual Factors for Evaluation

Canterbury is New Zealand's largest region. It covers 45,239km², encompassing a wide range of landscapes and freshwater systems. The region is hydrologically complex as it drains from 'Mountains to Sea', with a large number of identified catchment groups (Figure 31).

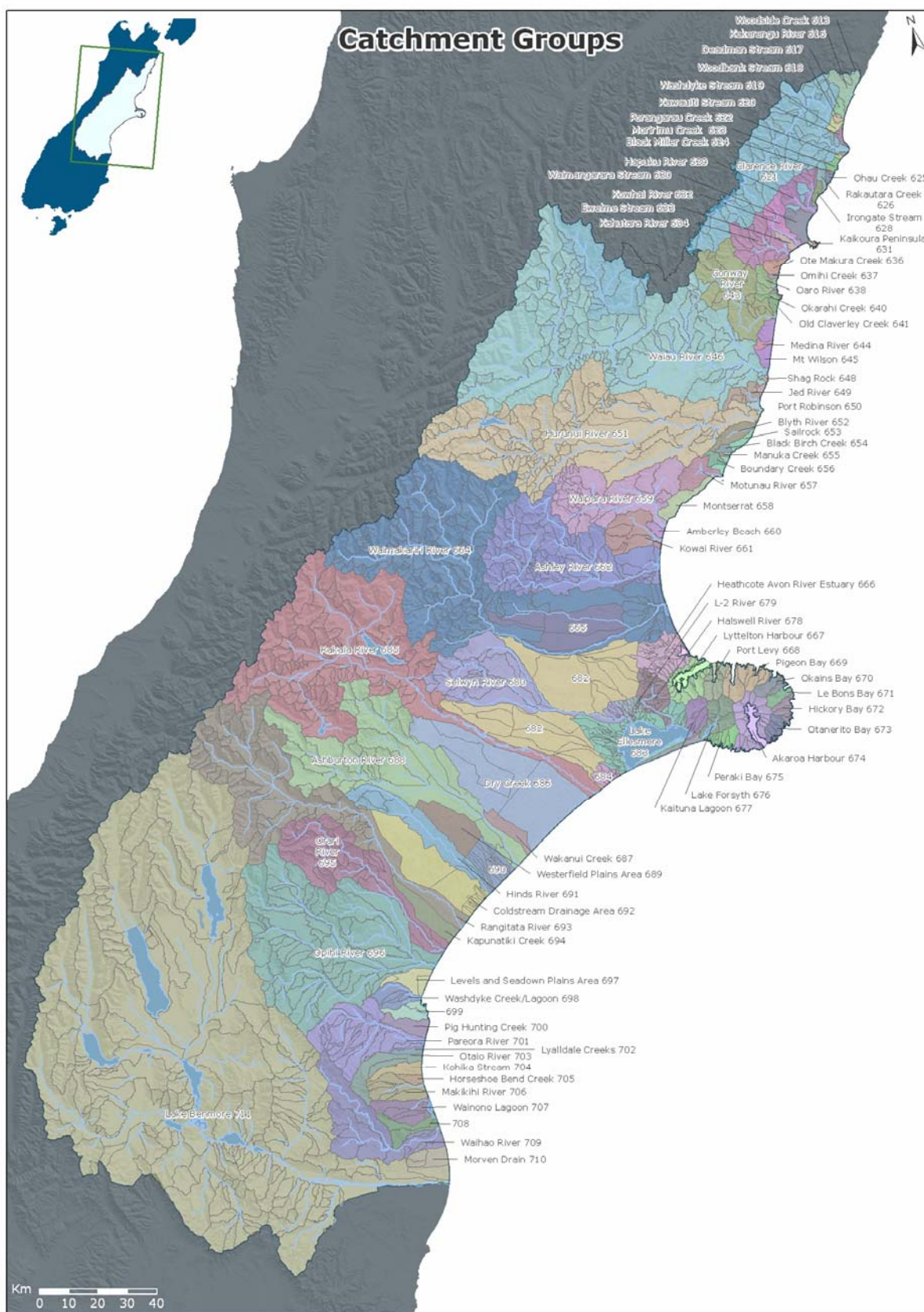


Figure 31: Catchment Groups in Canterbury Region (ECan, 2010a)

Landscapes in Canterbury range from the iconic Aoraki Mount Cook, Lakes Tekapo and Pukaki, and the Mackenzie Basin High Country in the South; the Canterbury Plains, Te Waihora/lake Ellesmere and the City of Christchurch in Central Canterbury; and; the geothermal hot springs at Hanmer, and the Kaikoura Coastline to the North (ECan, 2009a). The region includes approximately 70% of New Zealand's irrigated land area (with the potential to double that) consuming approximately 55% of the country's total allocated freshwater: Canterbury's dairy herd is now the second largest of any region in the country, having increased by 60% between 2002 and 2008. The region also provides 65% of the nation's hydro storage, generating almost 25% of the country's hydro-electricity, and has a burgeoning wine industry. These factors obviously make the region highly significant from a national economic perspective (Creech et al., 2010; Dalziel & Saunders, 2009; Jenkins, 2006; Sage, 2008).

New Zealand's weather is famously unpredictable, but over the last two decades, the disparities between dry and wet areas have increased significantly (NIWA, 2008). This is of particular concern to the dry-land areas such as the Canterbury Plains, where the climate has become drier. Yet during the same period, the dairy industry and associated hectares of irrigated land have generated a 'quantum' (Memon & Weber, 2008) rate of increase in abstractive freshwater use, leading to over allocation of some groundwater resources and depleted lowland stream-flows and quality ("Canterbury Water Management Strategy," 2009; Creech et al., 2010; Hughey & Taylor, 2009; Jenkins, 2006).

8.2.1.1 *Te Waihora/Lake Ellesmere*

Te Waihora has been selected for this case study for several reasons. As a lowland lake at the coast of a highly modified catchment, it contains many of the wicked challenges to, and trade-offs inherent within, IWM, as described in the foregoing chapters. Declared 'dead' by Jeantette Fitzimmons of the Green Party in 2005, Te Waihora/Lake Ellesmere and the Selwyn catchment are excellent examples of IWM challenges. The Te Waihora/Lake Ellesmere catchment is approximately a quarter of a million hectares in area, and because of the hydrogeology and unconfined aquifers present beneath the Canterbury Plains, it runs from the Waimakariri in the north to the Rakaia in the south. These are two internationally recognised examples of braided river systems, with the Selwyn as the main lowland river in between (Department of Conservation, www.doc.govt.nz; ECan, www.ecan.govt.nz both accessed 27th

Feb 2010). Te Waihora/Lake Ellesmere itself is New Zealand's fifth largest lake by area, being a brackish 'bar lagoon' of roughly 20,000 – 30,000 ha depending on depth. Depth is managed at between 1.1 – 1.3m depending on the time of year. When given depth triggers are reached, the lake is opened to the sea at Taumutu in order to prevent flooding. This is a remarkable sight. Since the early 2000s, lake openings have dropped in number from five to two or three openings annually, and it is suggested that this is related in particular to the combination of reduced rainfall on the Plains in recent years, and over allocation of the Selwyn-Rakaia groundwater zones up-catchment (Hughey & Taylor, 2009).

From a conservation perspective, Te Waihora/Lake Ellesmere is of "outstanding national and international importance for wildlife. Over 150 species of birds have been recorded here, including 133 indigenous species" (Department of Conservation, www.doc.govt.nz accessed 2nd March 2010). Further, it is one of New Zealand's "most important wetland systems and one of Canterbury's most treasured biodiversity sites" (ibid). Although lake health, and the wellbeing of many dependent ecological communities, has improved significantly since 1995, the lake water quality remains low, and the lake is now also subject to potentially lethal algal blooms (ECan, www.ecan.govt.nz accessed 24th Feb 2010).

8.2.2 The Intentions of the RMA for Regional Freshwater Governance

The RMA has been characterised as an environmental effects-based, cooperative, facilitative planning mandate for regional-scale integrated environmental management (Ericksen et al., 2003; Memon, 1993; Memon & Gleeson, 1995). The Regional Policy Statement is "...one of the most important instruments for achieving the Act's purpose...an important vehicle for articulating the regional interpretation of the legislation" (Burton and Cocklin, 1996, p89), and "...highlights the significance of policy formulation as a means for making decisions within the public sector" (Memon and Gleeson, 1995, p114). In New Zealand, Regional Councils were neither envisaged, nor authorised, as regulatory bodies that implement nationally developed IWM policy and plans, as in the USA, for example. Indeed, as already noted, after two decades under the RMA there are none yet to implement, although a National Policy Statement has been proposed (MfE, 2008), and the Board of Enquiry's recommendations on this document have very recently been made to the Minister (Jan 2010).

Nonetheless, the RMA acknowledged that there would be resource management issues arising in the future, which because of their national implications, might require central government decision-making to address. Thus, the Minister for the Environment holds the right to ‘call in’ any such resource management issue for further consideration at the national scale, e.g., the current ‘call in’ of three large dairy proposals for the Mackenzie Basin in Canterbury. This has already been noted in Chapter Seven, and will be considered greater depth in following sections.

The RMA’s regional and district intentions as they pertain to this study were to create a hierarchy of locally elected regional- and district-scale councils, which would promote sustainable management of natural and physical resources through integrated management. Section 30 of the RMA lays out the functions, powers and duties of regional authorities. Regional authorities are required to give effect to the purpose of the Act by “the establishment, implementation, and review of objectives, policies, and methods to achieve integrated management of the natural and physical resources of the region” (RMA 1991, s1(a)). As noted above, the key to this system is the regional plan. Unfortunately, while Regional Policy Statements and Coastal Plans are mandatory, the RMA chose to leave the Regional Natural Resources Plans as voluntary. Public representation in Regional Councils is through locally elected council members from constituencies within the region, which do not necessarily coincide with other (e.g., district) boundaries. In Canterbury, there are eight constituencies (four representing Christchurch), electing fourteen councillors on a three-year electoral cycle (ECan, 2007). Regional Council constituencies for Canterbury are shown in Figure 32, as re-drawn in 2007 under the Local Government Act (2002) requirements for equitable levels of public representation. Almost inevitably, these changes were strongly contested by some District Councils who felt that they had lost ‘turf’ (“Minutes of the Ordinary Meeting of the Waimate District Council, 15th August,” 2006; *Waimakiriri District Council Agenda*, 5th Nov 2006).

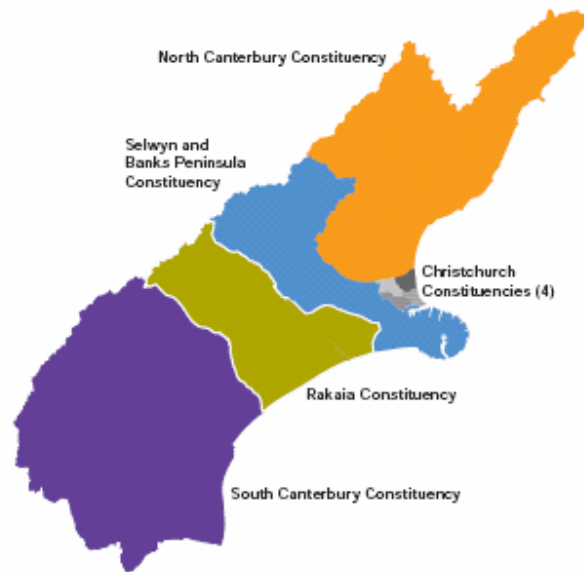


Figure 32: Regional Council Constituencies, Canterbury 2007 (ECan, 2007).

The RMA also divided the focus of ‘local’ governance between the Regional and District Councils. The intention was that the District Councils, being more closely involved with economic development, would make decisions regarding land-use, while the regional councils would address the potential environmental effects of that land-use. However, two main issues arise. The first is that district boundaries were not always drawn to coincide with catchment boundaries (e.g., Selwyn District in Canterbury which only contains part of the Rakaia catchment), and districts often retained their historical river boundaries. This makes good social sense, but is contra-indicated in IWM, and inevitably complicates management issues considerably. Secondly, ongoing District Council resentment of Regional Councils, and resistance to regulation and resulting constraints on ‘individual’ freedoms from many District Councils (also called Territorial Authorities), has proved a significant institutional gap in the RMA. This has been a particularly problematic barrier to sustainable freshwater outcomes in New Zealand generally, but particularly in Canterbury, as I will discuss in later sections. There are ten districts in Canterbury, as shown in Figure 33.

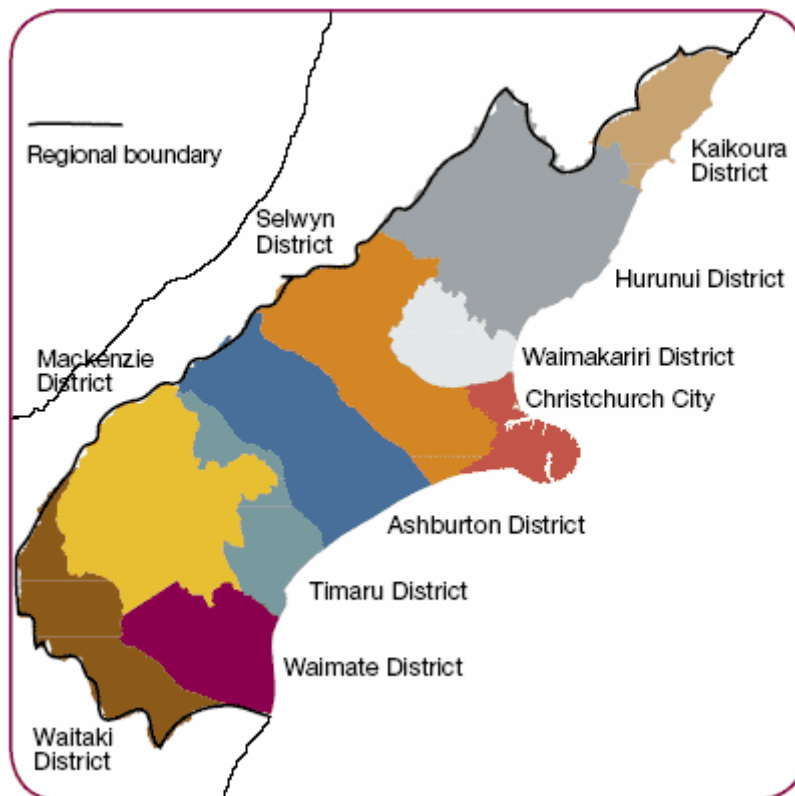


Figure 33: District Councils within Canterbury Region (ECan www.ecan.govt.nz accessed 26th Feb 2010).

These, then, were the broad sustainability intentions of the RMA as they applied to the hierarchical structure of decision-making in regions and districts. Unfortunately, this integrated decision-making intention has not yet been realised in Canterbury, to the general detriment of the freshwater resources.

8.2.3 Competing Cosmologies and Worldviews

As noted in Chapter Seven, there is a fundamental difference between the Maori and Pakeha cosmologies. Beyond this, there is also increasing competition between urban and rural appreciations of freshwater systems, and between hydro-electricity, dairy and agribusiness, biodiversity, and recreational perspectives, broadly representing the range of worldviews across the conservation – development continuum. However, there appears to have been a significant shift in social appreciations of the instream values of freshwater systems in Canterbury over the last ten years, although this may not yet represent a sufficient ‘groundswell’ to tip the enduring balance of rural development influence in this IWM cycle.

8.2.3.1 Ngai Tahu in Canterbury, and at Te Waihora/Lake Ellesmere

Ngai Tahu are the Tangata Whenua Iwi in Canterbury, and indeed, across most of the South Island (Figure 34). The distribution of Ngai Tahu Rūnanga (councils) across south Island is shown in Figure 34.



Figure 34: Ngai Tahu Runanga Map (NgaiTahu, 2010).

At the time of the introduction of the RMA, Ngai Tahu were still fighting their case for reparation of their historical grievances under the Treaty of Waitangi. After one hundred and fifty years of struggle, Ngai Tahu were finally granted ownership of part of the lake bed in 1998, as partial settlement through the Waitangi Tribunal settlement process. The Rūnanga with responsibility for kaitiakitanga, or stewardship of Te Waihora/Lake Ellesmere is Te Taumutu Rūnanga (the Council of Taumutu), described as:

“The administrative council of the hapū. In this role, the Rūnanga has a responsibility to protect the natural resources, mahinga kai, and other values of the takiwā for the benefit of those people of Ngāi Tahu descent who have customary interests in the area.” (Te Taumutu Rūnanga Natural Resource Management Plan, 2003, p. 11).

Sites of particular importance to Ngai Tahu in Canterbury, as detailed in the Te Taumutu Rūnanga Natural Resource Management Plan, 2003, are shown in Figure 35.

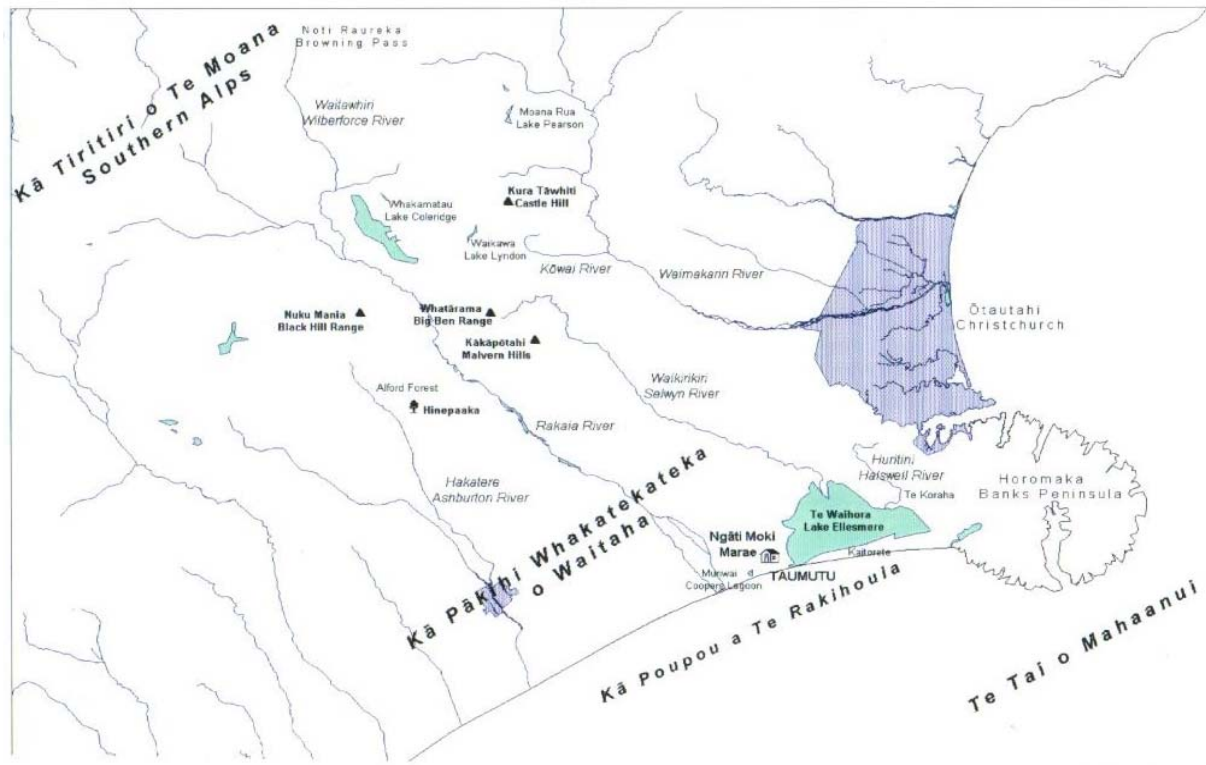


Figure 35: Ngai Tahu Runanga Map of Canterbury. Source: Te Taumutu Runanga Natural Resource Management Plan, 2003.

In an example of the difference in worldviews between Maori and Pakeha, Te Taumutu Rūnanga consider that there are three types of knowledge relevant to the management of their natural resources. These are:

“Whānau based knowledge – This is the core knowledge, the stories, tikanga, history and spiritual knowledge that is kept within whānau and community.

Hapū knowledge – This is the information and knowledge that is used by the Rūnanga to guide interactions with the environment and other people. This kind of knowledge is primarily for internal use, but some of it is also shared externally.

Knowledge that others need to understand – This is the information and knowledge that is important for others to understand, in order to meaningfully work alongside tāngata whenua in natural resource management. ("Te Taumutu Rūnanga Natural Resource Management Plan," 2003, p. 15).

This section has briefly characterised the multi-scale contexts within which IWM in Canterbury and for Te Waihora/Lake Ellesmere has been operating, under the RMA 1991-2009. This has included the resource systems' key characteristics, uses, and markets: the

intentions of the RMA, and; the competing cosmologies and worldviews of the user groups. The next section will report on the RMA outcomes for these coupled SESs.

8.3 Multi-Scale RMA Outcomes for Canterbury, and Te Waihora / Lake Ellesmere

In this section, I will briefly describe the key outcomes of the RMA cycle for the resources, the rules, and the user-groups of Canterbury, and Te Waihora/Lake Ellesmere, shown in bold in Figure 36.

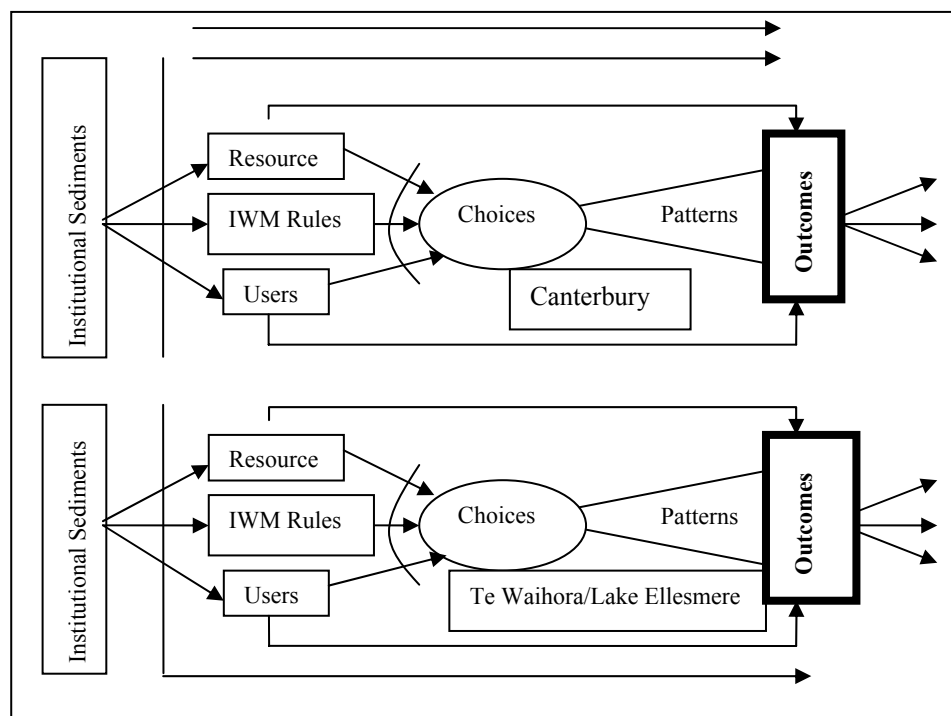


Figure 36: Representing Multi-Scale IWM Outcomes for Evaluation

8.3.1 Freshwater System Outcomes in Canterbury

The outcomes of the RMA for Canterbury's freshwater systems have been mixed. In general, the alpine and hill rivers remain relatively healthy, but lowland streams are coming under increasing strain from non-point source pollution and low flows from up-catchment abstractive overshoot ("Canterbury Water Management Strategy," 2009; Creech et al., 2010; Hughey & Taylor, 2009).

Some water bodies have been protected by Water Conservation Orders (WCOs), for example the Rakaia River (1988) and Te Waihora/Lake Ellesmere (1990). While the WCO on the Rakaia has been very successful in protecting the in-stream values of that river so far, it is now under threat from central government ambitions for water storage, dairy, and irrigation development in the region, as noted in the previous chapter. Given the 'health difficulties' experienced in Te Waihora/Lake Ellesmere as early as 1995, this WCO has arguably been less successful. However, it should be remembered that these are two quite different Orders. Indeed, the protection of the Rakaia's environmental flow regime can be viewed as the opposite end of the spectrum from that found in the WCO for Lake Ellesmere/Te Waihora, which is effectively a flood control measure intended to protect the wildlife habitat of the lake surrounds. Moreover, the resource consenting process relating to the Te Waihora/Lake Ellesmere opening regime under the WCO became a key driver to the formation of the informal Statutory Agencies Group (SAG) in 2007.

8.3.1.1 Outcomes for Te Waihora/Lake Ellesmere

The volume of water abstracted from the Rakaia-Selwyn groundwater zone that feeds the lake, has increased almost five-fold since 1990 (Figure 37). The impact of increased abstraction up-catchment has meant that Te Waihora/Lake Ellesmere has suffered from the combination of lower inflows and higher rates of pollution, particularly of nitrogen, and is subject to toxic algal blooms as noted in subsection 8.2.1.1.

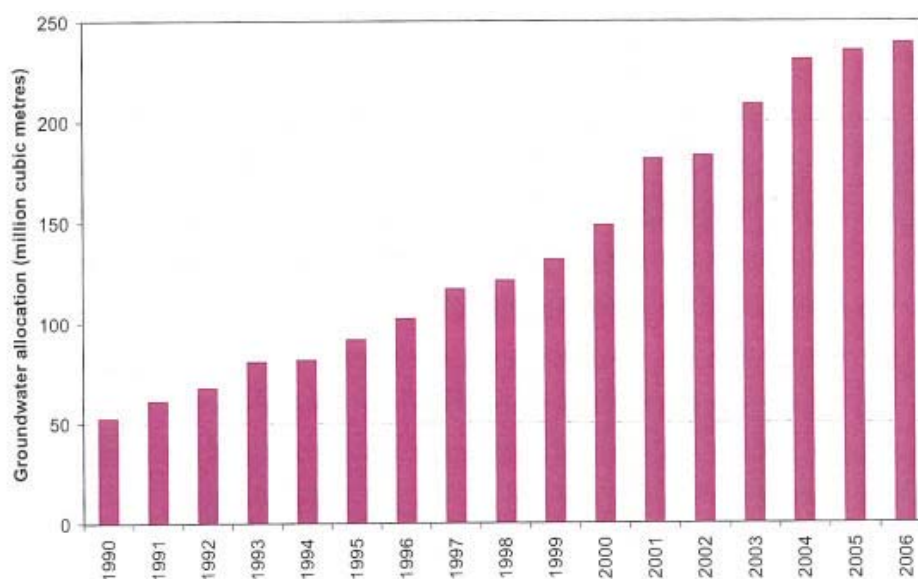


Figure 37: Annual Allocation Volume from Groundwater in the Rakaia-Selwyn Zone: 1990-2006. Source: (H. Williams, 2009)

On the other hand, the riparian plantings of the Living Streams Programme run by ECan; the education, research, and restoration work undertaken by the Waihora Ellesmere Trust; the implementation of the groundbreaking Joint Management Plan between Ngai Tahu and the Department of Conservation, and; the riparian fencing that has been undertaken through the Dairying and Clean Streams Accord in the Selwyn Catchment, have all contributed to the improved health of the lake. While Ngai Tahu Mahinga kai (customary Maori food and resources gathering) values are still heavily compromised (James, 1991, 1993; Te Taumutu Rūnanga Natural Resource Management Plan," 2003; Tipa & Tierney, 2003; J. Williams, 2007, p. 149), they are improving. Further, the recently completed review of groundwater consents in the over-allocated, 'red' (i.e., over 80% allocated) Selwyn/Rakaia groundwater zone, should begin to show benefit in improved lowland spring flows given time.

Lastly, there is a typically IWM paradox present in the current allocation difficulties facing the region, the Selwyn catchment, and the lake. Greater storage, and more irrigation on the Canterbury Plains is unlikely at this stage to improve environmental flow regimes for either the Rakaia or the Waimakariri rivers, from which the water will come. However, it may, quite by chance, result in gains to Lake in-flows, and lowland stream flows. Unfortunately, the question of non-point source pollution would remain, although with nutrient budgeting plans for farms and enhanced riparian management, this too may be addressed. Thus it comes about that the intensification of the dairy industry on the Canterbury Plains, if properly managed, may help rather than hinder the wellbeing of the Lake. This, however, was much debated by scientists during the Central Plains Water hearings and will likely be further debated in the future.

8.3.2 Social Outcomes

Social outcomes, like those for the freshwater systems in Canterbury, may be considered as mixed. Certainly, in some instances there has been an increase in social costs: financially (in fighting court cases and in foregone opportunities); between opposing development or conservation camps, or between Maori and Pakeha perspectives. One excellent example of fiercely conflicting opinions, and competing and potentially conflicting rights domains in the region, is that arising from the Hurunui River Water Conservation Order Application and process.

A recent (2007) WCO Application on behalf of the Hurunui River, lodged jointly by Fish and Game and the New Zealand Recreational Canoe Association, was only partially successful. Following the WCO decision to exclude the South Branch, proposals to dam it for hydro-generation and irrigation of 42,000 ha were lodged almost immediately by the Hurunui Water Project. The four groups behind the project are the Hurunui Irrigation and Power Trust, the owner of Eskhead Station, MainPower, and Ngai Tahu Property (Hurunui Water Project, www.hurunuiwater.co.nz; ECan www.ecan.govt.nz, both accessed 1st March 2010). The presentation made to the Ministry for Agriculture and Forestry by the Hurunui Water Project (HurunuiWaterProject, 2008) is particularly interesting to this study. In the presentation, the following questions are purported to represent the local community view: “Why is the project so difficult? Why does so much water go out to sea? Why do fishermen and canoeists have so much influence when they contribute so little? Why are there so many statutory processes?” When compared with the high in-stream values held by other, admittedly often more geographically remote stakeholders such as anglers and canoeists, the potential for serious social conflict arising from such widely divergent worldviews and perspectives as exist in Canterbury becomes clearly apparent. What is also interesting to this study is the involvement of Ngai Tahu in the Hurunui Water Project. This supports the observation made in earlier sections, that notwithstanding the Maori Environmental ethic and cosmology, the tensions between economic development and abstractive values for freshwater, and conservation of less tangible in-stream values, exists within cultures as well as between them.

On the other hand, there has been considerable social capital developed by ECan since the arrival of Bryan Jenkins, (ECan Chief Executive Officer) in 2003, and his post-regulatory, collaborative approach to complex, adaptive, common-pool freshwater systems governance. This is perhaps most apparent in the wide support for the Canterbury Water Management Strategy, almost ten years in the development. Further, since the publication of Creech et al. (2010), and that report’s recommendations to relieve the Council of its freshwater responsibilities, there has been strong and vocal support for the Council from a wide range of sources.

8.3.3 Institutional Outcomes in Canterbury, and for Te Waihora/Lake Ellesmere

The institutional outcomes of the RMA under the recent post-regulatory, collaborative ECan approach have also been mixed. As Creech et al., (2010, p5) point out, early failures in planning, and in freshwater management and consenting have undoubtedly hindered progress towards sustainability in Canterbury. This poor performance in the 1990s raised transaction costs and levels of uncertainty for users, and lowered the robustness and quality of lowland freshwater systems in particular. However, as also noted, the turnaround in the Council and its approach since the appointment of Dr Jenkins has resulted in some valuable gains for the region's freshwater governance rule-sets (Ibid). The Canterbury Water Management Strategy at the regional level, and the Statutory Agencies Group for Te Waihora/Lake Ellesmere, are prime examples of this. These two approaches to decision-making for freshwater systems have both emerged in response to what have been identified in this study as polycentric IWM problemsheds, in the relevant scales of SES. The polycentric IWM challenges to both scales of SES are summarised in Table 10, and described below.

Table 10: Polycentric Challenges to IWM in Canterbury Region, and for Te Waihora/Lake Ellesmere

	Canterbury Region	Te Waihora/Lake Ellesmere
The locus of decision-making power has become unclear.	ECan decisions undermined by Legal rulings; decision-making tensions between developers, councillors, and Commissioners; Ngai Tahu's statutory standing, proposed transfer of decision-making power from the Council to an appointed not elected Regional Water Authority.	Multiple systems of property rights; imbricated decision-making authorities at different scales (e.g., DoC/Ngai Tahu, District Councils; ECan) Implications of Creech et al., (2010) report for the lake are still unclear, but may affect the Statutory Agencies Group.
There is a new spatiality to policy-making and politics.	Currently four scales of management at ECan: regional, catchment, stream-reach, and individual properties. Also global market forces (particularly relating to dairy and tourism) are becoming increasingly influential.	Because Te Waihora/Lake Ellesmere is a lowland lake, land-use up-catchment is of critical importance.
The standard view of participation and democratic governance may have to be re-thought.	Regional council decision-making constrained through councillors as elected representatives; questions of block allocation to approved authorities; the renaissance of Ngai Tahu; the regional-scale, multi-catchment CWMS, and the implications for devolved decision-making within the recommendations of Creech et al., (2010).	The renaissance of Ngai Tahu; the development of the Statutory Agencies Group; the increasingly influential role of the Waihora Ellesmere Trust.
Scientific authority is undermined.	'Science' has not prevented (and technology has in fact accelerated) overshoot in freshwater allocation in Canterbury; Insufficient monitoring and data for robust decision-making over cumulative effects (e.g., Lynton Dairies case).	Science has not prevented (and technology has accelerated) the decline of Te Waihora/Lake Ellesmere; conflict between competing Ngai Tahu and Science perspectives.
The context of policy-making is expansive.	Policy regarding freshwater benefits and their allocation impact on, for instance, national hydroelectric supplies, export earnings, local biodiversity, and Maori cultural wellbeing.	Policy for Te Waihora/Lake Ellesmere will impact on Ngai Tahu cultural wellbeing, wider recreational values, biodiversity and wildlife values, and upstream land-use for example.

The locus of decision-making power has become unclear: This is particularly the case for Canterbury Region in the wake of the recommendations from Creech et al. (2010), to replace elected Councillors with an appointed Canterbury Regional Water Authority. However, prior to that, the Canterbury Water Executive and ten water management zones proposed by the Canterbury Water Management Strategy had just entered implementation, and prior to that, the courts had presented several challenges to ECan's consenting authority (e.g., Lynton Dairies v Canterbury Regional Council (ECan), as already reported. Before that, there had been a central government 'call in' for the Waitaki catchment, and a resulting Resource Management (Waitaki Catchment) Amendment Act, 2004, no 77, which was, and to an extent remains, a sorely contested issue (Creech et al., 2010 and 7th Sept, 2004; Hansard, 2004; Pauling & Arnold, 2009).

In the case of Te Waihora, the Ngai Tahu Settlement of 1998, and the resulting Joint Management Plan with the Department of Conservation (2005), put them in a strong position to challenge upstream actions that may adversely impact on their ‘property’, i.e., the bed of the lake and lake margins, and associated Mahinga kai. As with the regional-scale SES, the court decisions on allocation and cumulative effects blurred the decision-making locus, and had adverse impacts on the Lake. Lastly, while potentially of smaller impact than at the regional scale, the Creech recommendation (Creech et al., 2010) to install an appointed Regional Water Authority, also has implications for the informal but effective Statutory Agencies Group, and the locus of decision-making power for Te Waihora/lake Ellesmere.

There is a new spatiality to policy-making and politics: there are two different manifestations of this challenge at the regional scale in Canterbury. Firstly, there are now four geographical scales of decision-making being addressed at ECan, each with different issues. These are:

Regional, where key issues are water availability and land use intensification;

Catchment, where sustainability levels of water use and its effects, cumulative impacts of water use, and reliability of supply are the main issues;

Subcatchment or stream-reach, where environmental flow requirements in river reaches and management of streams and riparian margins are the most important issues, and;

Individual property level, where the land use practices that influence water quality and water quantity are defined. (Adapted from Jenkins, 2006, p3).

Secondly, the national government’s intervention in the governance of Canterbury’s freshwater, particularly in light of its stated development aims, demonstrates the increasing influence of global markets to the country. These issues apply equally to Te Waihora/Lake Ellesmere.

The standard view of participation and democratic governance may have to be re-thought:

The more recent approach reported in the literature has been to ask how “authorities and stakeholders [can] reach policy agreements that serve them well? (Scholz & Stiftel, 2005, p.

5/6). This has been addressed in the Canterbury and Te Waihora/Lake Ellesmere SESs through formal and informal collaborative approaches to plan development, and the increasing use of self-regulation. However, where decision-makers are elected, they are in a difficult situation. If politicians misjudge social opinion about an issue, then they will simply be voted out at the next election, whether or not their views are ecologically sound. Particularly in New Zealand, where the regional councils are elected, this has caused some considerable difficulty. The life of a freshwater politician cannot be easy – after all, if ‘too harsh’ a line is taken, and held, then they will find themselves out of office and no longer able to exert any influence, as witnessed by the recent events at ECan.

Scientific authority has been undermined: The challenge has now become one of identifying, generating, acknowledging and integrating different or competing information, or ways of knowing, effectively. This is particularly with respect to inadequate science for legal rulings on cumulative effects (*Lynton Dairies v Environment Canterbury*), and the Maori cosmological conflict with the Pakeha (‘Western’ science). This second issue is especially acute where the clashes involve the Maori perspective on the mixing of waters, and the Maori interpretation of management responsibilities which demands that the ‘essential character’ or essence (*Mauri*) of a place be retained. This is in direct contradiction to the Pakeha perspective of management, which includes the right to change the resource by making improvements (subsection 4.3.2). That said, Ngai Tahu appear to be becoming increasingly supportive of the Lake research undertaken by the Waihora Ellesmere Trust, for example . Finally, Creech et al., (2010, p26) criticise ECan (particularly resource consenting) as being “science *led* rather than science *informed*.”

The context of policy-making is expansive: The Region’s contribution to the national coffers through primary production and hydroelectricity generation has already been noted. Furthermore, as hydrological data is gathered and the hydrology of the region is increasingly understood, the potentially distant implications of actions become clearer. Moreover, since the introduction of the Local Government Act (2002) and its requirement for the development of Long-Term Council Community Plans based on the ‘four well-beings’ (economic, environmental, social, and cultural, although this latter is not really applicable to freshwater), the critical nature of freshwater to all aspects of society is demonstrated, and the expansive context of freshwater decision-making is becoming increasingly apparent.

One worrying example of polycentric challenge is the central government's stated intention to reduce the volume of freshwater that reaches the sea. This aim does not yet appear to have been considered in terms of the potentially devastating effects that changes in salinity may have on fragile coastal ecosystems and ecological communities, as discussed by Hayward and Ward, (2009) in relation to Te Waihora/Lake Ellesmere, for example.

Even for a lowland 'sink' such as Te Waihora/Lake Ellesmere, the context of policy-making has become increasingly expansive over the last two decades. This is because of the wide range of values and benefits that the Lake provides and that are increasingly being articulated, including *inter alia*: customary Ngai Tahu values including Mahinga kai; the internationally important migration stop-over and destination for birds; the commercial eel fishery, and; the Lake's increasingly appreciated recreational and amenity values, recently enhanced by the Rail Trail, for example (Little River Rail Trail, www.littleriverrailtrail.co.nz accessed 2nd March 2010, also (Booth, 2009).

This section has reported on the outcomes of the RMA for Canterbury, and for Te Waihora/Lake Ellesmere. In the following section, I will first identify the broader institutional arrangements that have been implicated in the generation of these outcomes by interview respondents, and supported by secondary data. Then, I will analyse their role in front-loop elements of the multi-scale IWM processes.

8.4 Institutional Arrangements and Multi-Scale Front-Loop Elements of IWM

In the foregoing two sections, I have characterised the key internal contextual factors of regional and Te Waihora/Lake Ellesmere IWM processes under the RMA, and their multi-scale outcomes for the resources, IWM institutions, and user-groups at these scales. It is widely acknowledged that at the regional scales, freshwater resources are under increasing strain, and are in some instances over-allocated (e.g., the Selwyn/Rakaia groundwater system). On the other hand, significant progress has been made in some areas of management, particularly with regard to the general health of Te Waihora/Lake Ellesmere, and many of its wide range of complex adaptive ecological communities (Hughey & Taylor, 2009; Pauling & Arnold, 2009).

What, then, are the problematic institutional arrangements for IWM in these SESs, and what has been their role the multi-scale RMA outcomes for Canterbury, and Te Waihora/Lake Ellesmere? In this section, I will first describe the key problematic institutional arrangements to sustainable freshwater outcomes in these coupled SESs. These are described in the order of the market forces, the systems of property rights, and the competing cosmologies and social appreciations of the freshwater systems. Then, I will analyse their role in: the social selection of the emerging operational rules in use, and the individual decisions arising (subsection 8.4.2), and; the resulting multi-scale patterns of use, and coupled institutional voids (subsection 8.4.3). These front-loop elements of the IWM process are shown in bold in Figure 38.

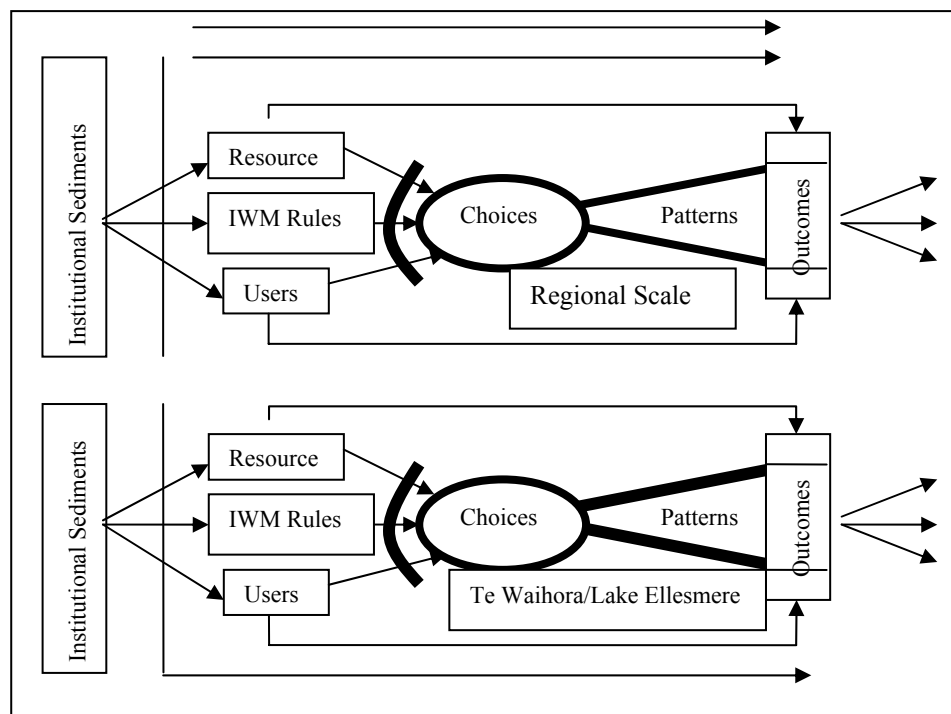


Figure 38: Representing Institutional Arrangements and Multi-Scale Front-Loop Elements of IWM for Evaluation

8.4.1 Institutional Arrangements

Interview respondents identified several institutional arrangements that were considered to be particularly problematical for IWM in the case Canterbury, and for Te Waihora/Lake Ellesmere. As with the national-scale SES, these are:

- 1) A lack of clear limits to freshwater use, and a vision for the freshwater systems, in combination with the neoliberal agenda;

- 2) Multiple types of property rights, some of which are in conflict. This includes legal rulings that have reinforced the persistence of the inadequate first in first served approach to allocation of freshwater system benefits, and confirmed the increasing security of tenure in water resource consents as property rights;
- 3) Competing cosmologies and worldviews (specifically Maori and Pakeha).

8.4.1.1 The Neoliberal Agenda and Market Development

The regional and national markets for water have changed significantly over the last two decades, as demonstrated in subsections 8.2.1 and 8.3.1. New Zealand's economy is still, as it has always been, heavily dependent upon export revenues from primary produce, particularly dairy. However, as already noted, tourism revenue flows are becoming increasingly important. As might be expected in a purposively selected exemplar of regional and local-scale IWM challenges in New Zealand, the problems and conflicts present in these SESs are essentially the same as those at the national scale.

There has been increased hydro-electricity generation, dairy farming, and irrigation, and also increased urban consumption of water and its benefits, and clearer articulation of in-stream recreational values. In particular, the long-term neo-liberal strategising from the hydro-electricity and primary production sectors far outstripped strategising for environmental planning at ECan during the early years. This situation demonstrates a lack of business acumen in decision-makers, and has resulted in an increased economic value for water at the expense of other environmental, Ngai Tahu, and social values, and allocation overshoot in some freshwater systems. Over the last two decades in particular, dairying in New Zealand nationally has become an effective monopoly, and questioning its future viability or failing to enable its expansion is "political suicide" (Skelton, Research interviews, April 2008, p7), as recently demonstrated in Canterbury. However, there have been some encouraging recent developments towards a more balanced approach, for instance the call-in of the dairy proposals in the Mackenzie Basin, already mentioned.

High land prices in North Island and availability of water in Canterbury (even though it is a dry area) "opened the floodgates" in the late 1990s (Donaldson, Research interviews, April 2008, p3), and drove dairying South under the country's free market. "Technology and the value of dairying products in particular, is enabling them to invest in changing that

environment... to more or less remove the natural constraints” (Rennie, Research interviews, April 2008 p12). The capital investments for required irrigation infrastructure are now considered to be economically viable, because the global dairy boom has distorted resources allocation and land prices. Since the global economic meltdown of November 2008, many dairy farmers are finding themselves over-indebted.

Another area of particular concern in New Zealand at the time of writing is the Mackenzie Basin, in South Canterbury. This is another dry-land area, but both more iconic and ecologically fragile than the already heavily modified Plains, and which is being considered for dairy expansion and/or intensification, including increases in irrigated hectares and effluent disposal. The CEO of ECan, Dr Bryan Jenkins, wrote to the Environment Minister on the 23rd of Dec, and three of the larger proposals were ‘called in’ by the Minister on the 27th Jan, 2010, as matter of national interest (New Zealand Government, www.beehive.govt.nz accessed 1st March 2010). As I have noted in Chapter Seven, it remains to be seen whether this is to ensure protection from, or exposure to, economic development. However, public (and farming) opposition to the proposals has already been very strong (Mackenzie Guardians, mackenzieguardians.co.nz accessed 1st March, 2010), and the Environmental Defence Society has launched proceedings against these proposals in the High Court (www.eds.org.nz/ accessed 5th March 2010).

There appears to be a growing, if reluctant, acceptance that limits are being reached, and farmers will no longer have virtually ‘free’ access to water. It should be noted that proposals for water storage and irrigation in Canterbury have been around since the 1930s. While financial cost was prohibitive, there was no dam, but the contexts have changed, and the question of freshwater storage and associated intensities and types of land-use has come back to the fore (Skelton, Research interviews, April 2008). Interestingly, one role of ECan as suggested by Dr Jenkins, is that the council is “there to be the social conscience, and most people do not like having a social conscience, because it is constraining on their behaviour” (Research interviews, June 2008). It appears that a regulatory style is not welcomed in rural Canterbury, and there has been (and still continues to be) a strong resistance to the constraint, or perceived constraint of individual freedoms for public benefit where water is concerned.

On the other hand, at the second Waihora Ellesmere Trust (WET) Living Lake Symposium in November 2009, the overall lake condition from an integrated environmental management

perspective was reported as approximately 70% of ecological optimum. Given that the ecological condition is a market represented by recreational, biodiversity, and Mahinga kai values for example, as the lake health continues to improve from 'dead' (although obviously, reports of its death were greatly exaggerated), it becomes increasingly expensive to attain another unit of 'health' (the law of diminishing returns). The lake is no longer the single focus. This has expanded, and what is now being discussed are management regimes for surrounding wetlands and riparian enhancement. Because the 'market' for riparian and wetland improvement is still relatively 'untapped', lake management will now essentially get 'more bang for its buck', from stream-reach projects. This, of course, is primarily focused on lowland stream flows and quality enhancement, or (partial) re-instatement, which in turn are likely to generate two outcomes.

- 1) The lake will benefit without further management efforts beyond the protection of current levels of ecological health.
- 2) Lowland stream health leads directly to consideration of up-catchment socio-economic pressures.

However, in this instance, there are more people, representing a wider range of interests, to drive the agenda-setting and decision-making. In other words, the balance of power with respect to the management of Te Waihora/Lake Ellesmere is slowly tipping in a new direction. Outcomes for the lake, and the region, remain in the balance, but at least the core problems are now being identified, articulated, and considered.

8.4.1.2 Property Rights

The reinstatement of Ngai Tahu customary use rights, development of the dairy industry and associated irrigation practices, and hydroelectricity production, have been key influences on the emergence of multiple types of property rights attaching to land and water in Canterbury. Further, because of increasing intensities of water use, rights domains with respect to multi-dimensional benefits from this complex adaptive common-pool resource are increasingly overlapping, as identified by Giordano, 2003. Under the RMA, as under the 1967 Water and Soil Conservation Act, water remains a publicly (Crown) owned resource. So far, there has been a constraint on the issuance of water rights because of ongoing Maori challenge to 'own' water under the Treaty of Waitangi. This issue is yet to be resolved, but regional councils have so far concentrated on freshwater management rather than ownership. Burton and

Cocklin (1996, p96) report that in this matter, “There is justifiable concern on the part of many Maori claimants ‘that the resolution of their Treaty-based historic grievances will be pre-empted by consents or other decisions pursuant to the RMA’ “.

Te Waihora/Lake Ellesmere is now subject to multiple types and systems of property rights, including those attaching to land, water, fisheries, recreational access, and cultural expression for Ngai Tahu, as the incumbent iwi (Table 11).

Table 11: Selected Key Property Rights for Aspects of Te Waihora/Lake Ellesmere and Associated Benefits

Aspect/Benefit	Selected Key Property Rights
Freshwater	<ul style="list-style-type: none"> • Crown Property, also often; • ‘Presumed’ private rights, and; • Emerging private rights
Bed of the Lake	<ul style="list-style-type: none"> • Private property (where Ngai-Tahu owned, it can be considered the property of that community).
Margins of Lake	<ul style="list-style-type: none"> • Private property- individual farms/properties; • Private/community property – Ngai Tahu land and Marae; • Crown Property, e.g., land belonging to the Conservation Estate and under the administration of the Department of Conservation.
Fisheries and Mahinga Kai	<ul style="list-style-type: none"> • Fisheries are a mix of customary and private quotas, and purchased public access. • Mahinga kai is linked to the Ngai Tahu customary rights, linked into land and resources.
Riparian Strips and Plantings	<ul style="list-style-type: none"> • Mixture of private and public property.
Up-catchment	<ul style="list-style-type: none"> • Private property as individual farms, some held by multinational corporations. • ‘Community’ property such as Selwyn District Plantations, and Ngai Tahu held-land.

These aspects and rights are variously held as common property (in the case of Ngai Tahu as a collective entity), Crown (public) property (e.g. Department of Conservation land), and private property (e.g. individual farms). Increasingly in law as well as public perception, water resource permits are being viewed as property rights, with right of tenure ("Aoraki Water Trust v Meridian Energy Ltd ", 2005).

Along with the regional council’s freshwater role, and the potentially successful outcomes of the Canterbury Water Management Strategy, public discussion over the re-negotiation of rights to water would appear to have been one of the more immediate casualties of the recent Creech et al., (2010) recommendations, and resulting central government actions. Without even beginning to address the wider cosmological or property rights issues which are emerging through Maori claims, the Canterbury Strategic Water Study has already identified

that the re-negotiation of property rights is central in the minds of Cantabrians to any question of storage, and should be undertaken *before* the construction of such infrastructure is begun. Unfortunately, as has been so clearly flagged by Ministers and their representatives, the drive is to ‘remove regulatory roadblocks’ to the further development of freshwater storage, and irrigation practices. This does not support any expectation that the freshwater rights debate will happen ahead of a physical infrastructure fait accompli.

8.4.1.3 Competing Cosmologies and Worldviews

As already noted, there is a wide range of competing worldviews and social appreciations of freshwater systems in Canterbury. These range across a continuum, from the perspective that every drop of water that reaches the sea is wasted at one end, to the perspective that the best place for water is in freshwater systems at the other. Clearly, there needs to be a ‘middle road’, but it is interesting to note that as a representation of Canterbury popular opinion in the matter, the Regional Council has been evenly split between more extreme expressions of these two interests since the 2007 elections.

As an interesting example of possible middle ground, under s33 of the RMA, Ngai Tahu could accept a transfer of authority for Te Waihora/Lake Ellesmere and its catchment management, although they would still be bound by RMA processes. Several interview respondents considered that Ngai Tahu accepting management functions might be good for Te Waihora (Rennie; Fish and Game respondent; Farming respondent; Research interviews, 2008). This was because under such a transfer, management would have to conform to Maori customary approaches already described, and Ngai Tahu would need to maintain the semblance of kaitiaki (guardianship) over their home rōhe through an environmentally sustainable regime. That said, Ngai Tahu also has aspirations in many sectors of the South Island economy (see, for example, Ngai Tahu Holdings Group, www.ngaitahuholdings.co.nz accessed 24th Feb 2010) and are also well aware of the benefits of the development of storage for irrigation, (Jansen, Undated) and of the dairy industry ("Central Plains Water Trust v Ngai Tahu Properties Limited and Canterbury Regional Council (NZCA 71)," 2008; Unknown, 2007). As I have already noted in subsections 7.2.3.1 and 8.2.3, the continuum of social freshwater appreciations between development and conservation exists within cosmologies, as well as between them, and there may be tensions between the corporation (Ngai Tahu

Holdings Group) as opposed to the Iwi (as guardians). One example of the potential for this, already described, is the Ngai Tahu involvement in the Hurunui Water Project.

8.4.2 Emergent Operational Rules in Use that Frame Choices

Once again, as with the national scale SES, there was a serious ‘policy lacuna’ (Memon and Gleeson, 1995), and the Natural Resources Regional Plan for Canterbury is yet to be completed. Although the RMA set up a system of regional plans and policies that enabled regional councils to “do some proper planning if they wanted to”, hard decisions (preparing water management plans) were postponed (Skelton, Research interviews, April 2008, p2). There were some special factors in the Canterbury region context. ECan arose from a catchment board and United Council merger, (essentially planning and engineers) where engineers were more numerous represented in new RMA structure. In the opinion of many interview respondents therefore, early ECan did not properly appreciate its planning function (Donaldson; Hughey; Fish and Game respondent; Memon; Regional Councillor; Rodgers; Skelton; Research interviews, 2008). First generation resource plans “were not terrifically well resourced, or well thought through, or generated by people who had been trained in resource management” (Donaldson, research interviews, April 2008). There was therefore limited ECan staff capacity to see connections between surface flows and lowland streams, for example.

Further, Regional Councils were persuaded that block allocation to activities was beyond their mandate, a viewpoint encouraged by MfE at the time, so as not to be seen to be ‘picking winners’. Finally, there was a significant judicial barrier to the new planning approach. Judges and Commissioners still saw themselves as ‘wise men’ choosing between potential uses, as they had been under the 1967 Water and Soil Conservation Act and its 1981 amendments, and “did not like this new system which had this fundamental environmental underpinning” (Skelton, Research interviews, April 2008 p10). Nationally and regionally, there has been strong resistance from district councils to regional councils being involved in land-use planning. In particular, there is a long history of bad feeling between the regional and some territorial authorities in Canterbury (Creech et al., 2010). At the time of their introduction, Regional Councils were wrongly seen by District Councils as

the “big bogey” because of their overview function (Skelton, Research interviews April 2008, p6). This was at least in part “politically mischievous” (Ibid).

The Local Government Act 2002 enhanced regional powers, but there is still no capacity to require consents for stocking densities. Diffuse pollution from intensive farming remains poorly regulated, “a huge gap” (Fish and Game respondent, Research interviews, June 2008, p3) and a missed opportunity. Having said that, it was also noted that the RMA had ‘beaten’ point-source pollution, “we’ve moved beyond that as a country, and I think that’s one battle we should be proud of having won” (Ibid p2).

8.4.3 Unsustainable Patterns of Use and the Institutional Void

As is widely appreciated by IWM scholars and practitioners, land-use and freshwater use are interdependent (Mitchell, 2005). The changes in land-use with respect to dairy farming in Canterbury between 2002 and 2007 are quite marked (Dalziel & Saunders, 2009) and are summarised in Table 12.

Table 12: Dairy Changes in Canterbury, 2002-2007. Source: (Dalziel & Saunders, 2009, pp. 8,9,10)

	2002		2007		change
Number of dairy farms	820	2.5%	858	9%	4.6%
Numbers of dairy cattle	542,610	5.8%	754, 937	8.3%	39.1%
Grassland (ha)	1,212,694	38.5%	1,252,564	40.7%	3.3%

From the same report, while sheep and deer farm numbers dropped quite dramatically (26%, and 26.3% respectively), and beef farm numbers went up slightly (10%), the number of dairy farms in Canterbury did not change significantly between 2002 and 2007 (a 4.6 % increase). However, although the number of dairy farms did not rise dramatically, the regional dairy herd did (39.1%), and is now the second largest in the country. Since the total area of grassland rose only by 3.3%, the implications for stocking densities of dairy cattle in Canterbury are obvious, and include the impact of effluent disposal and nitrogen leaching on waterways.

The institutional void in Canterbury is thus demonstrated as arising from several factors. The Natural Resources Regional Plan was not notified until 2004, by which time it was already

effectively out of date. It is still not operational, and has now been superseded by the Canterbury Water Management Strategy, 2009. The Waitaki ‘call in’ of 2004 also demonstrates a lack of institutional capacity at that time. The ongoing lack of national-scale guidance, and of capacity-building over the last two decades is also identified as a key aspect of the Canterbury institutional void.

8.4.3.1 Key Policies and Plans for Canterbury and Te Waihora/Lake Ellesmere

Although it has been suggested that Canterbury is too large for a single planning authority to be effective, regions need coherence in economic, social, and environmental terms (Gunningham, 2008). From this perspective, Canterbury is not too big, (especially when compared to, for example, the Murray Darling Basin in Australia) - it needs that size for cohesion. Looking at the region from a social perspective, “you may get some differences between South Canterbury, Mid Canterbury, and North Canterbury, but if you look at the colour of the letterboxes as you go South, they really don’t change to blue and gold from red and black until you get past the Waitaki” (Jenkins, Research Interviews, June 2008, p14) (Cantabrians are famously ‘one-eyed’ (biased) about their rugby team, The Crusaders, whose colours are red and black).

In the absence of a Natural Resources Regional Plan, three key public policies aimed at protecting and improving streams and rivers in Canterbury are: the Dairying and Clean Streams Accord; the Restorative Programme for Lowland Streams and; the Living Streams project. The first has enjoyed mixed results as already noted in subsection 7.4.3.3, and is discussed in greater detail in subsection 8.4.3.3 below. The two latter initiatives have been well supported and are enjoying early successes (Ecan, www.ecan.govt.nz accessed 2nd March, 2010). Two of these that particularly relevant to the wellbeing of Te Waihora/Lake Ellesmere are Harts Creek and Boggy Creek (ECan, 2009b). More recently, the Environment Canterbury Long Term Council Community Plan, a requirement under the Local Government Act (2002), is cited as a ‘good example’ by the Controller and Auditor General Website (www.oag.govt.nz accessed 26th Feb 2010).

Finally for the regional-scale SES, is the Canterbury Water Management Strategy (2009), as already referred to. This is a collaborative outcome of almost a decade. The Canterbury Water Management Strategy is an innovative, and essentially polycentric approach to the

issues facing Canterbury with respect to the governance, and particularly the allocation, of freshwater and its multi-dimensional benefits. As already noted, the Strategy provides for ten water management zones, each making decisions regarding their own zone, and a semi-autonomous Water Executive to oversee the strategy implementation and address Regional-scale concerns or issues. This new Strategy was facilitated by the non-statutory Canterbury Mayoral Forum, and published in November 2009, with wide support from all ten Districts, and their Mayors. Unfortunately, this Strategy had already been undermined by a letter from the ten District Council Mayors to the Minister for the Environment in the September of that year, and in defiance of the 'no surprises' agreement of the Triennial Agreement between ECan and the Districts (Mayoral_Forum, 2005)

The result of this was the Investigation into the performance of Environment Canterbury (Creech et al., 2010), under s.24 A of the RMA amendments (2005), considering resource management functions. The recommendation that the Regional Council be relieved of its water management functions in favour of an appointed Canterbury Regional Water Authority (Creech et al., 2010), has already been noted. The implications of this recommendation are wide-ranging, including those relating to the public's right to elected representation, and the implementation of the Strategy. In effect, the CWMS appears to have been too successful for the entrenched economic (dairy/irrigation) development interests in the region, and nationally. It threatens the well flagged intentions of the current government to remove blocks to (economic) development in the region. This appears to be a very big gamble on dairy export earnings, and will effectively lock in the region, and the country, to dairy. Further, why now? The timing and content of this report is strongly suggestive of central government seeing (and attempting to seize) an opportunity to usurp the wide-ranging social, cultural, and environmental benefits that are now beginning to trickle into the region, after six or seven years of real progress, and a great deal of highly skilled effort by a great many people. Any 'gains' made, or emergent, after the point of Commission take-over are highly unlikely to be widely advertised as the result of the previous authority's efforts.

Lastly, the idea of an incoming Commission at this stage in the implementation of the Canterbury Water Management Strategy will surely be detrimental, as it would be for any fledgling authority. Decision-making frameworks have just been agreed upon, and are hardly

begun (both at huge cost), when the locus of decision-making power has been transferred to a less representative, even newer 'authority' which will almost certainly be perceived as illegitimate by many, if not most, of Canterbury. The Councillors and Mayors of Canterbury's TAs may be vociferous enough, and, apparently, more influential than might be expected in other economic conditions, but they are a very few people in comparison to the population of Canterbury and New Zealand. On the other hand, as perverse as the outcome of the current situation appears at the regional scale, as observers have already noted this may be the catalyst for the type of publicly demonstrated social freshwater appreciation that is required for a regional social sustainability transformation. Unfortunately, at this stage in proceedings, the probability of this being sufficient to over-ride potential economic development so strongly encouraged by the national government, is not high.

8.4.3.2 Key Legal Rulings

The key legal rulings are as discussed in subsection 7.4.3.2, and relate to: first in first served allocation approach ("Fleetwing Farms v Marlborough District Council (3 NZLR 257 (CA)), 1997); security of tenure ("Aoraki Water Trust v Meridian Energy Ltd ", 2005), and; cumulative effects ("Lynton Dairies v Canterbury Regional Council, Decision No. C108/2005," 2005). Other rulings of interest include Central Plains Water Trust v Ngai Tahu Properties Limited and Canterbury Regional Council (NZCA 71), and Central Plains Water v Synlait Ltd, 609 (NZCA 2009), two refinements of the first in first served allocation approach.

8.4.3.3 Informal Social Action to Address the Institutional Void

In subsection 7.4.3.3 I noted that one of the better known of New Zealand's informal social actions aimed at addressing an institutional void in freshwater governance was the Fish and Game 'Dirty Dairy' campaign. This was launched in 2002, and resulted a year later in the Dairy and Clean Streams Accord (2003), a voluntary agreement between Fonterra, and the Ministers for the Environment, for Agriculture & Forestry, and Local Government representing the Regional Councils. Five years on, there would appear to be an interesting difference of opinion regarding the effectiveness of this voluntary approach.

The Dairying and Clean Streams Accord does not seem to have performed particularly well in Canterbury (Blakemore et al., 2009; Deans & Hackwell, 2008b). Deans & Hackwell, (2008a, p. 24) representing Fish and Game, and Forest and Bird respectively, are strongly critical of the snapshot reporting. Amongst other issues, they refer particularly to the Rhodes Stream/Petrie's creek catchment in South Canterbury, suggesting that some of Fonterra's data as reported by the MfE might be less than accurate. Further, in their opinion, the Accord has not fulfilled its intentions, and should be abandoned in favour of stronger regulatory measures.

A peer review of Deans and Hackwell's (2008a) critique of the Accord and its monitoring, from Federated Farmers (Jessen & Harcombe, 2008, p. 17), roundly concludes that the Deans and Hackwell (2008a) critique "makes baseless and misleading statements unsupported by verified or independent sources of information". Meanwhile, the The Environment Canterbury dairy report (Blakemore et al., 2009) concludes that there has been little change in practice over the last five years, although it also notes that the dairy industry is becoming more engaged in leadership and compliance. As to the claims and counterclaims of the opposing parties, the report merely states that "Environment Canterbury has previously reviewed the information supplied by Fonterra and its shareholders in the tier II Petrie's Creek and Rhodes Stream catchments. The information is considered to be at odds with Environment Canterbury's physical inspections of the catchments in 2007" (Ibid, p20). Clearly, there is progress yet to be made in this area. That being said, ECan and Fonterra support staff have developed action plans for each farm within the Rhodes/Petries catchments. Blakemore et al., (2009, p22) state that "these actions plans are formulated around the five aspects of the Clean Streams Accord and have been well received by the farmers".

In general, it seems that the non-statutory collaborative approach to freshwater governance has been more successful than the statutory regulatory approach in Canterbury. However, Interview respondents were generally agreed (and supported by the wider literature) that both approaches are required: that neither people nor rules can generate and maintain sustainable freshwater outcomes by themselves, and that both were needed to work together.

8.5 Discussion and Concluding Comments

From the foregoing sections of this chapter, with respect to freshwater in Canterbury, and for Te Waihora/Lake Ellesmere, there is now a layering of: international and national conservation perspectives; external economic drivers; Ngai Tahu cultural imperatives, and Pakeha social imperatives. Some of these include: the emerging questions of Tangata Whenua ownership of water resources under the Waitangi Tribunal processes, now potentially coming to a head in Canterbury; the need to clarify and enforce other water rights bundles; a technologically and water availability-driven neoliberal response to the boom in the global dairy market, which is rapidly locking Canterbury into dairy and irrigation; climate variability; poor management from ECan for the first decade; and contested science. Taken together, these factors have generated what one respondent called “a bloody mess” (Rodgers, Research interviews, April 2008; p3). Interestingly, this is a very succinct description of polycentric governance systems as described in the wider literature (Blomquist, 1992; Blomquist and Schlager, 2005; Ostrom, 1999).

In this section, I will discuss the fit of the study results with the theoretical expectations developed in Chapter Five. There, I proposed that institutional arrangements exerted an influence on IWM outcomes. This proposition was supported by the findings of Chapter Seven, which unfortunately concluded that the predominant influence of these institutional arrangements on RMA freshwater outcomes for the national-scale SES has been strongly detrimental.

The broad findings of this chapter are twofold. Firstly, it is clear that despite the impressive advances made by ECan since 2003, (particularly with respect to the adoption of post-regulatory collaboration in decision-making), the institutional arrangements identified in this chapter have exerted a detrimental influence on RMA freshwater outcomes in Canterbury. Unfortunately, the enduring, and apparently still dominant perspective of freshwater as a resource which is there to be abstracted (e.g., for irrigation), or used instream for private economic benefit (e.g., for hydroelectricity generation), has proved remarkably resistant to change. Ultimately, it is these institutional arrangements which have driven the District Mayors’ letter to the Minister in Sept 2009, the recommendations of Creech et al. (2010), and central governments speedy response to those recommendations.

Secondly, however, (and perhaps unsurprisingly, given the Lake's lowland, brackish nature) this study has found that the abstractive use perspective is less dominant in the Te Waihora/Lake Ellesmere SES. Instead, the New Zealand 'outdoors' characteristic is strongly demonstrated, showing strong support for activities related to in-stream uses and healthy ecological systems. Further, there remains the IWM paradox, that increased abstraction from the Rakaia and/or the Waimakariri 'upstream', of Te Waihora/Lake Ellesmere, and increased Plains irrigation, may actually improve lowland stream flows and the water balance of the Lake.

The opportunity to address a chronic 'open access' mentality in Canterbury has arisen through the public demand, voiced in the Canterbury Strategic Water Study, (a non-statutory process) for a reconsideration of the structures and contents of bundles of property rights. Where they have not been blocked by public opinion, ongoing proposals for storage have so far been thwarted by economic shortfalls between the value of water, and the cost of technology to produce a more reliable supply infrastructure, i.e. dams: following the recommendations of Creech et al. (2010), this now seems set to change. Lastly, ECan has clearly demonstrated over the last six or seven years that collaboration with users is one of the keys to drawing, and maintaining, sustainable limits to use.

The case study of Te Waihora/Lake Ellesmere has provided many examples of the challenges to freshwater governance. The water resource system is heterogeneous temporally and spatially and needs to be managed by catchment, but it is clear from the hydrological linkages and the required social cohesion for effective management that this needs to be from a wider catchment, if not regional, perspective. There are multiple competing *and collaborating* uses and user-groups, over multiple jurisdictional, property rights, temporal and geographic imbrications. There are historical grievances from Ngai Tahu which are yet to be legally settled, but quite aside from questions of freshwater 'ownership', as owners of part of the Lake bed, they are in a strong position to challenge upstream activities that compromise the wellbeing or value of that Tangata Whenua common property. There are tensions between upstream and downstream users, between the abstractive users of the system and the non-abstractive users, between rural and urban populations, and between district and regional councils. There is also an encouraging, science-led progress towards meaningful collaborative governance between ECan and stakeholders, enhanced and facilitated by the Waihora Ellesmere Trust towards increasingly inclusive, and scientifically *informed*, decision-making.

From the perspective of markets, patterns of use, and an emerging institutional void, dairy intensification has outstripped institutional capacity to manage it (to regulate internal patterns of use) in Canterbury. This is largely because the dominant *institutional arrangements* welcomed the opportunities it brought for private economic benefit, and therefore by extension, regional economic development. Further, the rules (institutions) were designed under a perception that there would be plenty of water for everybody. There can be little debate that Canterbury enjoys plenty of water in global terms: however, the distinction between *plentiful* and *limitless* is beginning to be understood by many New Zealanders. Yet, perhaps the biggest challenge to sustainable freshwater governance in Canterbury at the moment is the way in which the critical, underlying issue of property rights re-negotiation is being subsumed by a battle over perceived dairy profits from water use. To be sure, farmers who have survived the System Change of the 1980s, and the removal of subsidy, and who have gone on to see and fill a niche in the market, have done exactly what the prevailing neoliberal agenda and facilitative RMA mandate have encouraged. Resentment arising from recent spectacular gains in the dairy industry has focused on reasons why dairy is bad for the environment and should go, or on casting dairy farmers as thieves who are making private profit from a public resource, without paying for its use. Now, to be sure, as demonstrated above there is evidence that there is some merit in both of these arguments. But it is also worth considering whether the debate would be so acrimonious, if dairy was operating at the same scales and intensities but was only just managing to break even economically.

Canterbury is a region in transition, and is an exemplar of both the wickedness of the problemshed which has generated the emergent polycentric IWM processes, and of the wickedness of the challenges facing this process. The case study has shown that the system change in Canterbury from the RMA- driven, effects-based regulatory approach, to the management of common-pool resources, to an LGA- embracing strategic post-regulatory collaborative model is well under way. However, perhaps one of the most interesting findings from this case study has been the role of chance in proceedings. Key pieces of legislation, key groups, actors, appointments, and collaborative drivers have been in the right place at the right time to produce an outcome (the Canterbury Water Management Strategy) that could have been good for the structure and processes of Canterbury's water resource decision-making, if not yet for its water resource systems themselves. Of course this did not mean that these resources and their wider ecologies were no longer threatened, or that a period of

intense, heated, and acrimonious conflict did not loom on the immediate (and protracted) horizon. What it did mean was that Canterbury was poised to make water management decisions in a way, and through a framework, that could have made a positive contribution to New Zealand's water management history.

Unfortunately, it would appear that the Canterbury Water Management Strategy may have been a victim of its own success. This conclusion has been reinforced by the central government's recent activities, professed perspectives, and plans for water, particularly relating to Canterbury region. This has been clearly signalled by the Prime Minister John Key, who intends to "remove regulatory roadblocks" to increased freshwater storage and irrigation in Canterbury (Parliamentary address, Feb 18th, 2010), in order that "less of the water that currently pours out to sea does so" (Parliamentary Debates, Feb 23rd, 2010).

8.5.1 Key Chapter Findings

The evaluation as reported above has generated the following key findings.

- Ongoing lack of capacity-building and guidance by central government has been a key area of shortfall. Embedded institutional arrangements, particularly property rights, markets, and perverse legal rulings, have proved highly detrimental to IWM outcomes at the regional scale. In particular, the apparently still dominant appreciation of freshwater as an abstracted economic good has proved remarkably resistant to change.
- The Regional story since 2003 has been one of a potentially highly effective and sustainable IWM outcome, undermined at the eleventh hour by economic interests (particularly dairy, irrigation, and hydroelectricity generation), lobbying at the national scale. In short, the Canterbury Water Management Strategy has been a victim of its own success.
- Within the above, RMA outcomes in Canterbury are mixed. In general, alpine and hill rivers remain relatively healthy, but lowland streams are coming under increasing strain.
- Ngai Tahu are finding voice, and enjoying increasing, although still limited influence. However, they must also deal with diversity of opinion between exploitation and conservation within themselves.
- At the local scale, perverse outcomes at the regional scale may yet provide benefits for Te Waihora/Lake Ellesmere. This is a typically IWM paradox.
- Chance remains an often critical, but unforeseeable element in IWM proceedings.

In the last two chapters I have first identified key institutional arrangements which have proved to be problematic to successful RMA outcomes for freshwater systems in New Zealand, at multiple scales of SES. I have then analysed their role in front-loop elements of the RMA cycles at each scale of SES. The detrimental effects of markets, competing and/or overlapping systems of property rights, the first in first served allocation approach, and dominant social appreciations of the SES freshwater systems, have been demonstrated in the national-scale and Canterbury SESs. The exception has been the findings for Te Waihora/Lake Ellesmere, which as a brackish lowland lake unsuitable for abstractive uses, has benefited from the resurgence in social appreciations of its biodiversity, recreational, and Ngai Tahu customary values. Arguably, such a resurgence can occur at local scales but is much more difficult to accommodate nationally or regionally.

How have these problematic institutional arrangements come about? In Chapter Five I argued for the conceptual perspective that particularly in polycentric problemsheds, such as have been identified for all three SESs, problematic institutional arrangements are the historically embedded social sustainability transformation avoidance tactics of a society, with respect to its patterns of freshwater system use. Thus, in the following Chapter Nine, I will seek evidence of the proposed historical origins of the problematic institutional arrangements identified in this and the previous chapter.

9 The Historical Origins of Problematic Institutional Arrangements in New Zealand

9.1 Introduction

The previous two chapters have demonstrated the highly detrimental role played by specified institutional arrangements in the front loop of the complex adaptive IWM process in New Zealand under the RMA cycle, 1991-2009. The evaluations in the previous two chapters were undertaken at the national, regional, and local scales. The institutional arrangements implicated as particularly problematic to the fulfilment of the sustainability intentions of the RMA, have been identified in broad terms as relating to the three main internal contextual factors of the evaluative framework. As analysed in the foregoing chapters, these are: market forces, particularly as they relate to the export of primary products; misalignment or tensions between multiple systems of property rights, and; competing Maori and Pakeha cosmologies, and competing worldviews along the continuum of preservation, conservation, or exploitation.

To recap briefly, in Chapter Four, I re-drew IWM as the social process of the integrated management of complex, adaptive, common-pool freshwater systems. Two key questions remained for consideration in Chapter Five: firstly, why have sustainable freshwater outcomes been so elusive, particularly in places with IWM advantages? Secondly, in what ways do the current polycentric IWM challenges exceed the capacity of current institutional designs to address them? As I theorised in Chapter Five, answers to these questions have their roots in the history of social sustainability avoidance tactics, arising from the particular confluence of plentiful freshwater, technological capacity to store freshwater for a more reliable supply, and a pioneer social context, focused particularly on economic development.

From this theoretical perspective, I argued that the current freshwater challenges in New Zealand (and other type 4 IWM contexts) are so wicked because they are deeply embedded within 150 years of sustainability avoidance tactics, rather than having undergone a social sustainability transformation. In other words, the institutional arrangements identified as underpinning current unsustainable IWM outcomes in New Zealand, should have their origins

in the repeated reification of unsustainable social appreciations of, and patterns of multi-dimensional use of, the freshwater systems.

9.1.1 Chapter Aim

Thus, it is the aim of this chapter to investigate the historical origins of these institutional arrangements. This analysis will seek evidence to support the theory that these are historically embedded social sustainability avoidance tactics, as suggested by the theoretical perspective on the emergence of polycentric IWM problemsheds proposed in Chapter Five. Further, the analysis can contribute to the clearer understanding of the emergence of current polycentric IWM problemsheds both in New Zealand, and in the wider literature.

Therefore, the focus of this chapter is on the ‘institutional sediments’ (Healy, 2005), that underpin the current situation of constitutional politics in New Zealand, with respect to the governance of that country’s freshwater resource systems. This element of the evaluative framework is highlighted in bold, in Figure 39. This is particularly important in light of the bicultural differences tensions between worldviews, and the impending rights and governance conflicts, as already discussed.

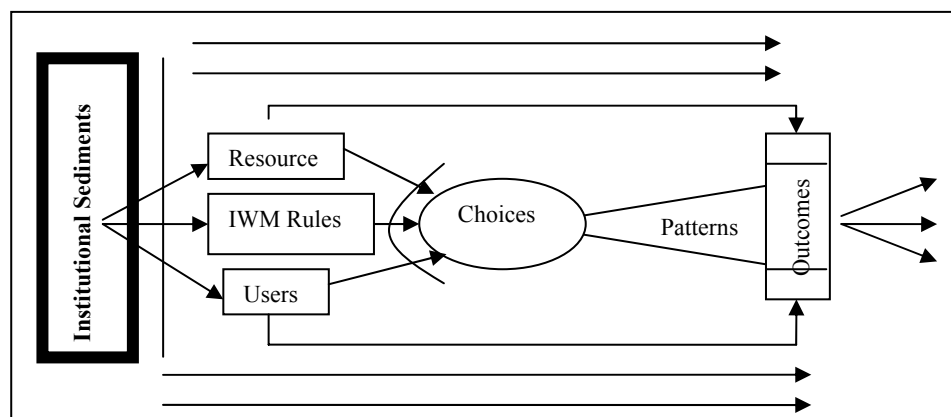


Figure 39: Representing Institutional Sediments for Evaluation

9.1.2 Chapter Overview

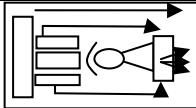
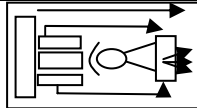
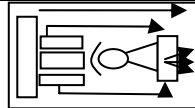
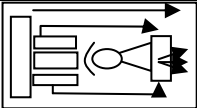
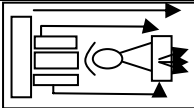
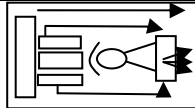
This chapter is laid out as follows. In the following section, I will describe the historical underpinnings of the institutional arrangements implicated in the current multi-scale polycentric IWM problemsheds in New Zealand. Then, in section 9.3 I will analyse these findings from the perspective of the development of the current cosmological contestation and

competing worldviews, multiple systems of property rights, key legislative change, and developing markets. Section 9.4 will present a summary of chapter findings.

9.2 The Origins of Problematic Institutional Arrangements

The previous two chapters have demonstrated that the institutional inertia associated with the effective non-implementation of the RMA's sustainability intentions, at all scales of decision-making, is an outcome of the influence of broader institutional arrangements on the front loop IWM processes. These processes are: the emergence of operational rules in use from the social interpretations of the IWM institutions, and their influence on individual decision-making, and; the resulting emergent patterns of cumulative use. Having implicated specific institutional arrangements in the current polycentric IWM problems at multiple scales, the final task is to analyse the historical origins of those institutional arrangements. How have they come about? Why have they endured? A summary of the historical underpinnings to IWM in New Zealand is shown in Table 13.

Table 13: Summary of Main Historical Underpinnings to IWM in New Zealand

Table 13: Summary of Main Historical Underpinnings to IWM in New Zealand						
						
IWM Cycle	Customary Maori	1840, Treaty of Waitangi cycle, culminating in 1941	1941-1967, The Soil Conservation and Rivers Control Act	1967-1981, The Water and Soil Conservation Act	1981-1984, The “Wild and Scenic” amendments	1991-2009, The Resource Management Act
Cosmology	Maori	Pakeha	Pakeha	Pakeha Re-emergence of Maori	Pakeha Re-emergence of Maori	Both: Maori relationship with freshwater recognised.
Property Rights	Kinship based, customary	Presumed riparian	Riparian	Crown	Crown	Crown, customary, increasingly private
Legislative Focus	Maintenance of Mana	Development of physical and legislative infrastructure.	Soil erosion	Pollution and allocation between uses	Environmental values	Sustainable management; ecological, social, economic values
Decision-making arrangements	Holistic approach Decisions expected to take time and discourse. Dependent on cooperation. Leaders directly and personally responsible for outcomes.	Ad hoc approach. Centralised 2-tier system. Focus on flood control and provision of drinking supplies. Difficult or ‘unproductive’ projects not tackled.	Integrated Catchment Management Centralised 2-tier system. Compromised by schism between Min of Agriculture and the Soil Conservation and Rivers Control Council. Central Government as developer.	Integrated water resource management 3-4-tier system. Central Government as developer and conservator. Statutory bodies, including recreational and conservation groups, could apply for a conservation order.		Integrated Water Management A two-tier system, effects-based. Hampered by lack of rules or guidelines, and the neoliberal paradigm.
Markets	Limited Technology, absence of money, reliance on ‘mana’ and ‘tapu’.	New technologies, domestic and export markets. Exports are primary produce.	Increasingly challenging international markets. Rapid technology transfer post WWII.	Government as developer until 1981. Heavily subsidised export sectors.		Free market, neoliberal approach, increasingly criticised.

Patterns of interaction and outcomes	Due to lack of controlling technology and a valuable connaissance, Maori had learned to live with the constraints of their water resource systems.	Deforestation leading to accelerated soil erosion, flood damage costs. Ad hoc and uncoordinated collection of legislation. Parts of North Island lost up to 50% of their soils.	Schisms between the Soil Conservation and Rivers Control Committee and the Ministry of Agriculture prevented successful integration of soil conservation and water control projects. Increasing conflict between multiple uses as well as users.	Catchment management blocked by parochial district boards. Increasing public/NGO involvement. Water Conservation Orders.	Freshwater systems are increasingly used for a wide range of activities. Currently, dairying is abstracting and polluting (non-point-source) to the detriment of other users.
Governance Outcome	Sustainable Primarily in-stream uses	Unsustainable Regulation of stocking densities blocked.	Unsustainable Unimplemented Symbolic Policy	Potentially Sustainable Water Conservation Orders Successful; Overtaken by System Change Unresolved difficulties with allocating between uses	Unsustainable Unimplemented Symbolic Policy Issues exceed institutional capacity
Missed Opportunities	Unknown	Failure to take advantage of Maori connaissance. Failure to establish local-level decision-making and governance systems.	Failure to pass stocking type and density provisions in the Act. Failure to create mandated catchment councils in 1945 for land-use control.	Regional boards voluntary and no statutory backing. Councils adopted 'model code'. Ineffective prosecution and penalties.	Voluntary nature of Regional Plans. Inadequate capacity-building. Non-implementation of sustainability intentions.

This evaluation begins with a brief review of key customary Maori concepts and practices, with respect to the governance of freshwater. It is increasingly being recognised that indigenous peoples have a great deal of ‘connaissance’⁶ to offer to freshwater governance efforts (Meppem & Bourke, 1999; Prystupa, 1998; Tipa & Welch, 2006; J. Williams, 2006). As already mentioned, in New Zealand, Tangata Whenua have a strong environmental ethic and a completely different cosmological and cultural appreciation of the freshwater resource base from Europeans. Further, Maori are not only specifically identified as a special interest group in the RMA 1991, whose relationship with their natural resource base is a matter of “national importance” (RMA 1991, s.6). They are also still in the process of negotiating reparation for past wrongs through the Treaty of Waitangi settlement process. The concepts and perspectives that underpin this worldview are therefore highly relevant to the study (Maxwell & Penetito, 2007; Tipa & Welch, 2006; J. Williams, 2006).

9.2.1 Customary Maori Freshwater Governance

Tangata Whenua are thought to have arrived in Aotearoa between 850AD (Maxwell & Penetito, 2007) and 1300AD (Pawson & Brooking, 2002). Customary Maori society was a technologically limited (no metalworking or metal tools), post-collapse society that moved between subsistence (J. Williams, 2006), and a rich and highly developed social system and oral culture (Ballara, 1998; Gudgeon, 1885; Tipa & Welch, 2006). The early period of Maori habitation followed the pattern of heavy initial consumption of resources and expansion, as is the typical pattern for pioneer societies (Anderson, 2002). The key points of Maori customary freshwater governance are presented in Figure 40.

The exact causal chains behind the population crash, estimated to have occurred during the 1400s, are unknown, but large-scale deforestation and species extinctions have been dated as occurring around that time (Anderson, 2002; Pyle, 1992). Given the technological constraints of the society, the freshwater resources post-collapse were probably not significantly affected, although prolonged drought may have been a factor in the collapse (Diamond, 2005). However, it is noted that after this crash, a holistic attitude was adopted that adapted patterns of life to conform to the temporal and spatial patterns of the environment, rather than the other way around (O'Regan, 1984; Patterson, 1994).

⁶ Used by LeFebvre to mean ‘a knowledge less formal, more local’ (c.f. Cocklin & Blunden, 1998, p. 62).

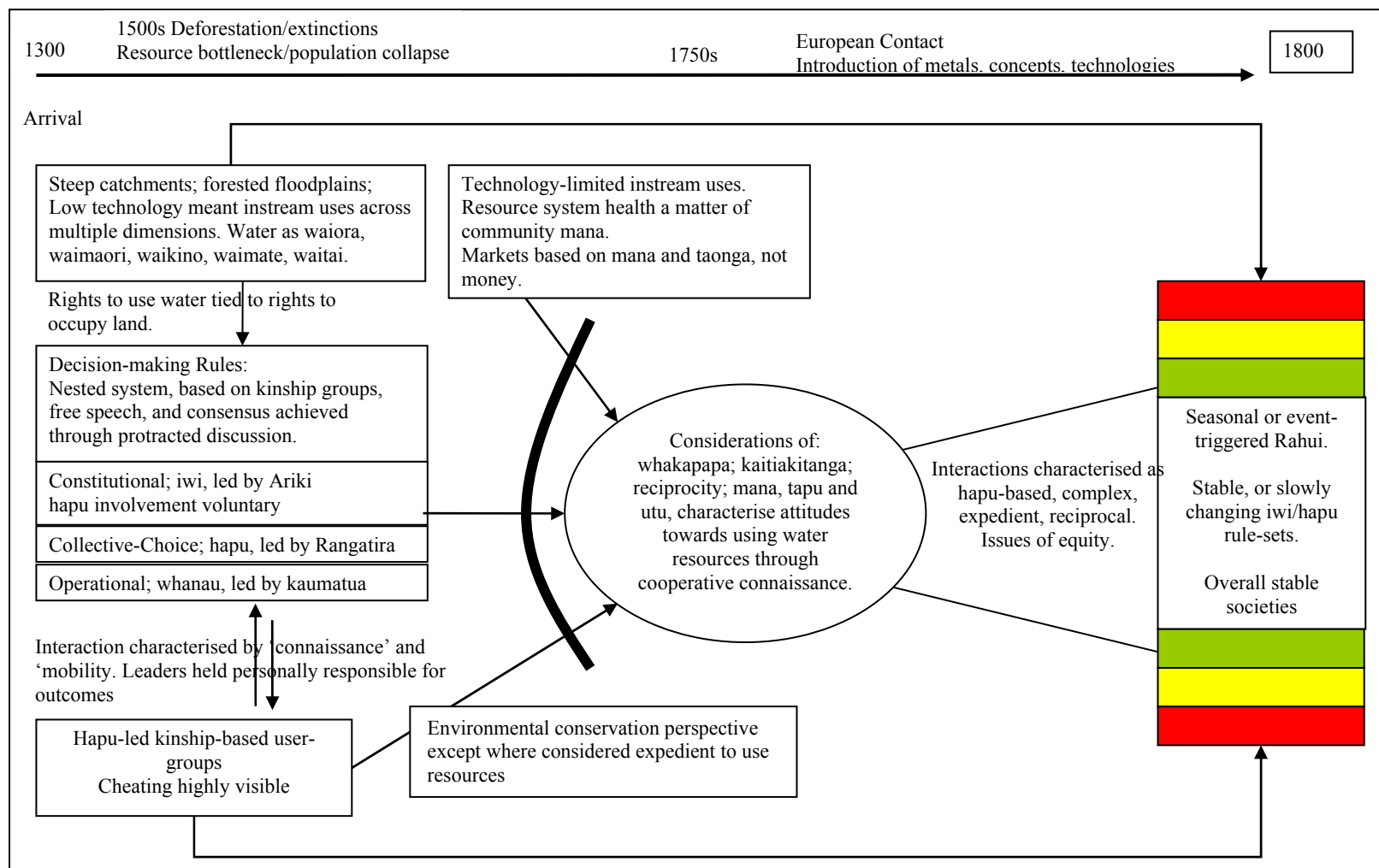


Figure 40: Representing Customary Maori Freshwater Governance for Evaluation.

As previously stated, Maori society was, and remains, structured around a kinship regime of three tiers: Iwi, (tribe or clan), hapu (often called a sub-tribe), and whanau, or extended family group (Ballara, 1998; King, 2003; *Te Waihora Joint Management Plan*, 2005; Tipa & Welch, 2006). Ballara (1998, p. 163) states that the "...largest, most successful hapu ...were the largest socio-political units whose members at least *sometimes* acted together as a corporate group". Through this overlapping system, "...sophisticated management systems were established and enforced. These allocated specific areas to specific rünanga, and determined their usage rights within those areas" (Marsden, 1989, p. 3). Although descended from (most probably) a small group of individuals, Maori were not 'one people'. There appears to have been no single or national authority, or even regional ones: this was essentially a small-scale, polycentric society (Ballara, 1998; Gudgeon, 1885; Maxwell & Penetito, 2007). Gudgeon (1885, p10) goes so far as to suggest that "There never was a general government or general intertribal polity among the Maori race. They had no common head, no common tribunal, no common interest". Instead, the individuality of each Iwi (and to a lesser, although often still considerable extent hapu and whanau) was a reflection of the rohe⁷, the mana of its historical and incumbent leaders, and the circumstances of the group (King, 2003; O'Regan, 1984).

Importantly, markets for water resource system benefits operated through concepts of mana (power or standing) and taonga (value, or preciousness) which existed at a community as well as an individual level, rather than money (Patterson, 1994). The key methods of governance for pre-European contact Maori were mana and tapu. These are seen as two ends of a continuum, where tapu is the negative aspect, and mana the positive. These attributes come from a spiritual aspect, and are part of every living (and inanimate) thing (Gudgeon, 1885; Marsden, 1989; Maxwell & Penetito, 2007; Tipa & Welch, 2006; J. Williams, 2006).

Mana may be interpreted as positive power, influence, or standing of an entity. Mana came from whakapapa (ancestry or lineage, traced back to deities) knowledge or actions (for example, esoteric understandings or bravery in battle), or the possession of taonga ('precious' things, including natural resources). Moreover, the "...concept of mana was collective to the community as well as being individual" (Pyle, 1992, p63). A community would lose mana if their rohe's resources were depleted, particularly to the extent that they were unable as hosts to provide regional delicacies to their guests (Ibid). From the point of view of natural

⁷ A rohe is a geographical territory.

resources and their use, Patterson (1994, p. 406) states that their mana was often ‘delegated’ to a human authority who became their kaitiakitanga, or guardian, but that “...mana does not have to be seen as an authority over a part of the environment so much as an authority over other beings in relation to that part of their environment”. This is a key point of note, since it directly echoes the observation from Bromley (1992), noted in subsection 4.3, that property rights are less about relationships between individual people and the resource, than they are about relationships between individual people.

Tapu lies at the opposite end of the spectrum from mana. This is often interpreted as ‘sacred’ but may benefit from the wider terminology of ‘out of bounds’. Tapu is not so much a rigid and unquestioning adherence to rules, as it is a way of seeing life: for Tangata Whenua, “...the right to make use of the ‘resources’ of the world in which one lives has to be established, and is conditional” (Patterson, 1994, p402). It is the respect due to any thing that is not yours. The strength of tapu could be considerable, and avoiding tapu objects certainly required great care and attention from all members of the community at all times (Gudgeon, 1885; Maxwell & Penetito, 2007; Polack, 1840).

A truncated or shortened form of tapu employed in resource management was (and remains) known as rahui. Rahui fulfilled two functions. The first was the conservation or regeneration of the resource, and the second was the provision of time and space for healing after a disaster, e.g., to allow the elements to remove tapu after a death. When the period of rahui was over, the ban was lifted through ritual, and the resource became available for use again (Maxwell & Penetito, 2007; Patterson, 1994).

From the above, it would appear that the customary approaches to water management employed by Maori post-collapse resulted in outcomes of stability in institutional arrangements. Whether this was due to low population densities and levels of technology is difficult to say, but almost certainly these factors had a large influence, and the longevity of such management structures as were employed will have been enhanced by the negligible rates of change, particularly of technologies and markets, leading to a relatively stable demand for resources. However, from a more modern IWM perspective, the frequent problem of inequity in resource allocation typically reported in customary commons situations (Giordano, 2003) was certainly present.

9.2.1.1 Key Points of Maori Customary Freshwater Governance

Resources were managed through a system of mana, tapu and rahui. Decision-making structures were polycentric, and discursive, ‘free speech’ processes were used to reach consensus. Maori were deeply embedded in their immediate environment, and their attitudes to water were strongly rooted in their cultural respect for whakapapa, tapu, and mana (subject to a degree of collective expediency) (James, 1993; Marsden, 1989; O'Regan, 1984; Patterson, 1994). These are based on Maori cosmology and worldview that links humans to the natural world around them, as well as their ancestors (the eldest and most important of which were gods). This was a post-collapse society whose perspectives of power and wealth were based on the prowess, wellbeing and productivity of themselves and their natural resources.

Property rights approaches were viewed in much the same way as nowadays, in so far as they relate to social relationships. But as already noted in Chapter Seven, there is a fundamental opposition between the current ‘Western’ right of management (the right to regulate internal patterns of use, and to transform the resource by making improvements), and the Tangata Whenua environmental ethic, which states that the essential Mauri (the life-force) of the resource must remain intact (J. Williams, 2006). One of the major issues arising from this is the Tangata Whenua resistance to the mixing of waters. This clearly holds potential for conflict in current management approaches (Tipa & Welch, 2006).

Patterns of interaction are characterised as- hapu based; complex; expedient; and reciprocal, and outcomes were apparently sustainable. It is not possible to know what role chance has played, or which choices have not been made, given the temporal remoteness of this analysis. However, it seems likely that technology was a very limiting factor in management.

It has been the purpose of this subsection to offer a brief overview of the key points of customary Maori cosmology, their social decision-making practices, and systems of property rights. In the following subsections, I will provide a characterisation of the key points of each of the IWM cycles in New Zealand between 1840 and 1984, as they relate to the chapter aim. As stated in subsection 9.1.1, this is to seek evidence of currently problematic institutional arrangements as historically embedded ‘institutional sediments’ (Healy, 2005).

9.2.2 IWM under the Treaty of Waitangi, 1840 - 1941

Beginning with the Treaty of Waitangi in 1840, the current IWM challenges in New Zealand can be traced through several ‘causal chains’ (Agrawal, 2002). The evaluative framework for this IWM cycle in New Zealand is shown in Figure 41.

The ‘discovery’ of New Zealand in the mid 1700s triggered a flood of new settlers from the overcrowded nations of Europe, in particular the United Kingdom. The speed and scope of the changes that came after 1840 were of a scale that Maori could not have imagined, and began “... a revolution in land use” (Ward & Scarf, 1993, p. 63), based on an assumed system of English Common-Law riparian rights. Thus, the new culture also prized the holding of land and its natural resources, but on an individual level rather than a collective one, and “to many of the assisted migrants leaving a near feudal agricultural system in the United Kingdom, the idea of owning a piece of land was extremely important” (Ward and Scarf, 1993, p64). A further major area of mutual incomprehension was the fact that Pakeha culture did not have any direct spiritual or ancestral link to particular resources. Many Maori fought bitterly and long to hold their lands, and it was not until 1870 that peace broke out and the government could devote itself to issues of national economic development (Memon, 1993).

Since 1840, New Zealand as a country has traditionally based its economic growth on the development and export of its primary natural resources (King, 2003; Park, 1995; Valentine et al., 2007). As well as the ubiquitous use of water as a refuse site, particularly in towns and cities, particular early examples are: water powered mills for flour and timber in the 1840s (Roche, 1994); extractive uses in gold-mining in the 1850s and 60s (Ward and Scarf, 1993); hydroelectricity generation from the 1880s (Wheen, 1997), and; the advent of refrigerated shipping which opened up the export markets for meat and dairy products, as well as wool (Ericksen, 1990). Indeed, dairying had always been part of British plans for their latest acquisition (Park, 1995). Control of rivers was also needed to maintain travel and transport routes (Ericksen, 1990; Memon, 1993; Park, 1995; Ward & Scarf, 1993). All of these export goods are heavily dependent on plentiful, clean water, and during the early stages of settlement and infrastructure development, rights to water were awarded on a first-come first-served approach which even then, quite rapidly proved to be inadequate (Ericksen, 1990). Along with the new markets came new means of accessing resources that had previously been too remote or too marginal to exploit.

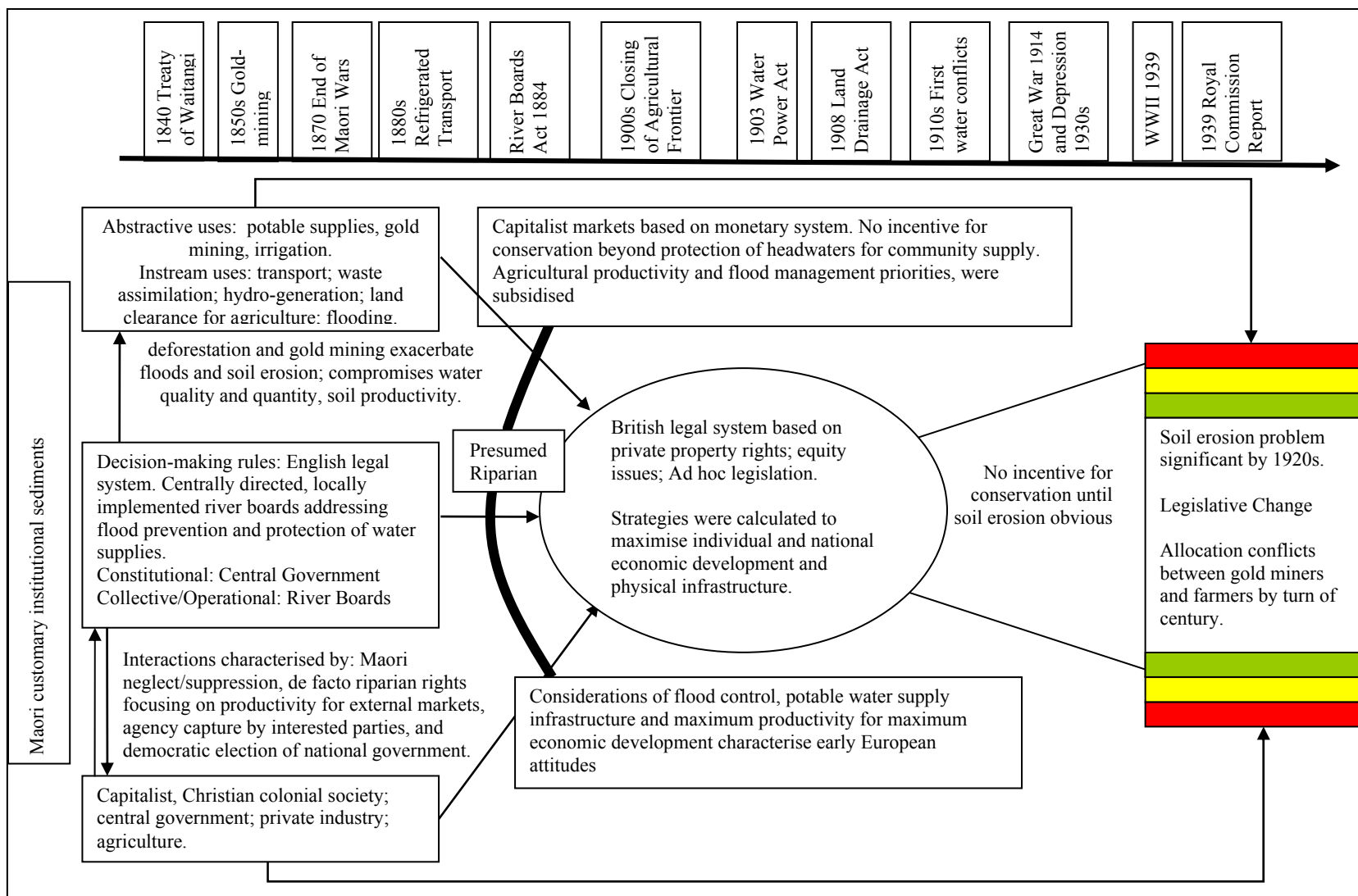


Figure 41: Representing the IWM cycle under the Treaty of Waitangi for Evaluation.

However, New Zealand's water resource systems could (and can still) be very unpredictable. Until the 1900s, potential markets had been primarily constrained by the need provide potable water to communities and businesses as part of a growing colonial outpost, and to prevent what little physical infrastructure as existed from being damaged, or entirely swept away, by flooding (Memon, 1993; Roche, 1994). During this period, a shortage of capacity meant that triage decision-making was inevitable, and management was typically "fragmented over limited lengths of a river: in some cases on one side of it" (Ericksen, 1990, p50), reinforcing the social tendency to use rivers as boundaries, rather than catchments. This is still the case in some districts in New Zealand such as Selwyn, as discussed in the previous chapter. Overall, the planning system of the late 1800s is generally criticised as more ad hoc than strategy (Memon, 1993; Roche, 1994; Sharp, 1991; Wheen, 1997).

Catchment-based River Boards of the time were concerned almost entirely with the prevention of floods and flood damage, until the detrimental effects of soil erosion finally made themselves felt in the early 1900s. By then, occupied land had risen to 40 million hectares, "representing in effect the closing of the agricultural frontier in New Zealand" (Roche, 1994, p. 25). In the 1920s, the Great War and the following economic depression had hit Europe, and the British markets were heavily compromised (King, 2003; Roche, 1994). It was during this period that the first Labour government was elected and began the then visionary process of developing a welfare state, along with its attendant regulated markets and subsidised production (Memon, 1993). By the 1930s, the erosion of soils had finally become as much of a concern as the management of floods, by which point some areas had lost up to 50% of their soil (Ericksen, 1990; Memon, 1993).

9.2.2.1 Key Points of IWM under the Treaty of Waitangi 1840 - 1941

The new pioneer society held views of freshwater systems that were both sacrilegious and incomprehensible to Maori. There was little or no understanding of the type of youthful geology, hydrogeology, or soil types of New Zealand. Detrimental environmental outcomes were rapidly felt, and Dobson's (1871) management recommendations "represented one of the first statements in the New Zealand context, of an integrated approach to catchment management" (Roche, 1994, p. 21). However, shortfalls in capacity meant that triage

decision-making had to be used, and difficult or ‘unproductive’ projects were not addressed, and an ad hoc and uncoordinated collection of legislation accumulated.

Rights to water were now presumed riparian, with the exceptions of hydro-electricity generation, and water for gold mining in Otago. The New Zealand SES was now based on: individual ownership of land and associated natural resources such as freshwater; money, and; the construction of physical infrastructure for flood prevention and supply, made available by the new export trade. In essence, land was property, and property equated to wealth. That said, New Zealand was also one of the first countries in the world to develop a welfare state.

The first come first served approach to the allocation of freshwater and its benefits was introduced to New Zealand very early in its Pakeha history. The overarching approach to governance during this period has been characterised as a “...laissez faire exploitation of the country’s wealth... a process equated with economic growth, individual advancement and community betterment” (Memon, 1993, p29).

By the 1930s the crisis of soil erosion and the downstream impacts of this (siltation, turbidity, etc) which had arisen through unsustainable land uses, were threatening production. District committees were established under the aegis of the Public Works Department to address soil erosion, and the floods of 1938 added impetus and urgency to this task (Ericksen, 1990). It was against this background that the new legislation was developed (Ericksen, 1990; Memon, 1993; Roche, 1994). The following subsection considers the IWM cycle in New Zealand under the Soil Conservation and Rivers Control Act of 1941.

9.2.3 IWM under the Soil Conservation and Rivers Control Act, 1941

In 1941, New Zealand became “one of the first countries in the world to recognise, through legislation, the interrelationship between land and water resources, and the importance of management on a catchment-wide basis” (Ericksen, 1990, p51). The Soil Conservation and Rivers Control Act 1941, was an innovative effort at integrated catchment management, as it was then called. The evaluative framework for this cycle is shown in Figure 42.

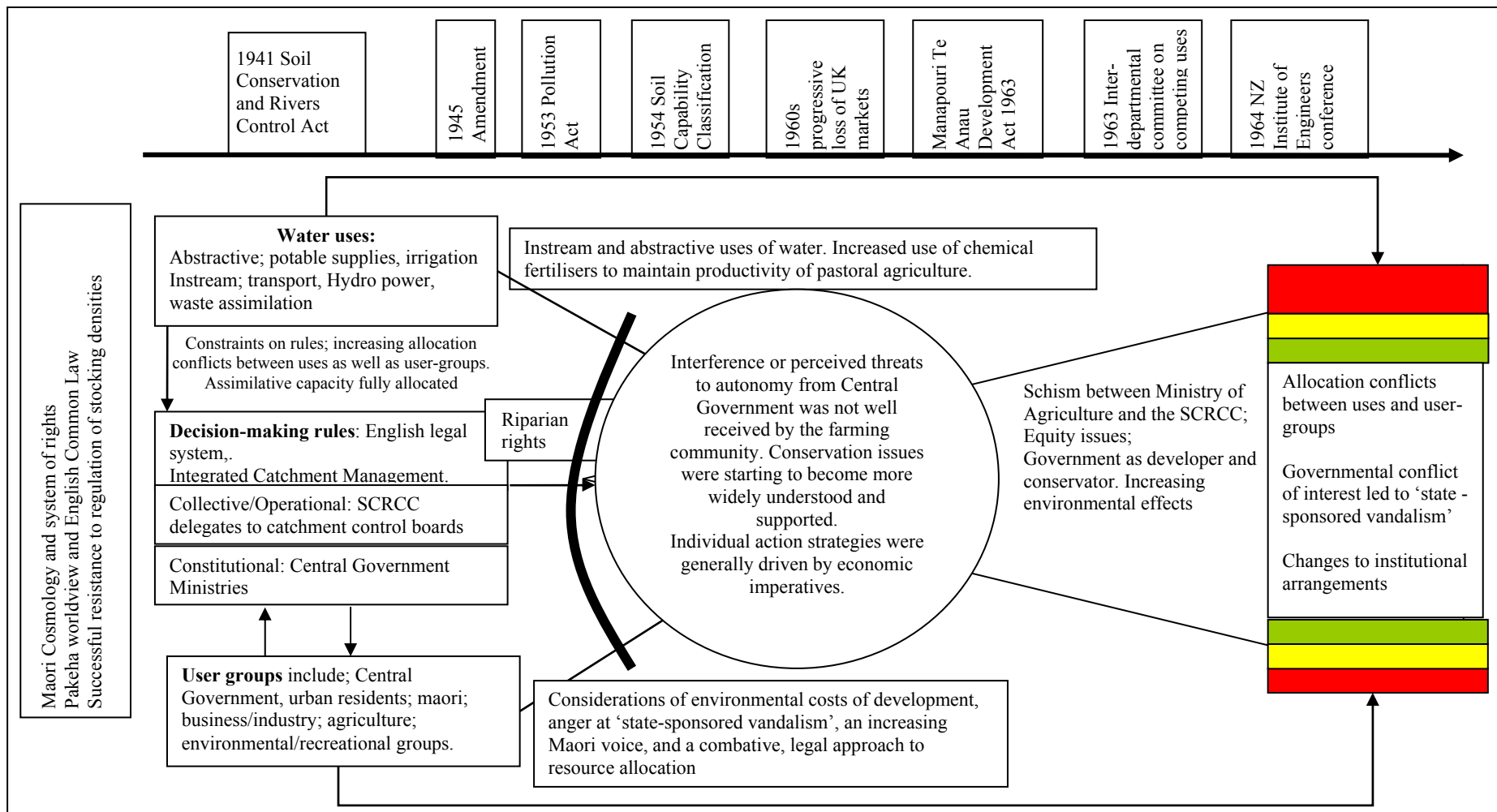


Figure 42: Representing the IWM Cycle 1941 – 1967 for Evaluation

The changes that came with this Act were fundamental. Although the Act legitimised the previously assumed English Common-Law system of riparian rights, it also instigated catchment boards directed by the central Soil Conservation and Rivers Control Council (SCRCC), which was mandated to impose taxes and develop rules (bylaws).

Catchment scale management and planning responsibilities were delegated to regional catchment boards by the SCRCC. These regional catchment boards were considered as corporate bodies under legislation, and survived until the System Change of 1984-1991 swept them into the wider re-structuring, and expanded the regional role to all natural and physical resources. The 1941 Act did not make catchment boards mandatory for the simple reason that "...it was politically expedient at the national level" to leave this as a voluntary choice by locally interested parties (Ericksen, 1990, p53).

Lance McCaskill (one of the original policy entrepreneurs associated with the Act's development) saliently observed that "these were far-reaching solutions to enable control of land use in a country where the landowner claimed a traditional right to treat the land as he saw fit" (c.f. Roche, 1994, p. 46). Indeed, during the development of the 1941 Act, an attempt was made to include Crown rights to limit stocking densities and types. This was eventually abandoned, after fierce opposition from the farming lobby and the suggestion that the catchment boards would be able to levy such high rates that the future of farming would be jeopardised (Roche, 1994). Further, there was a considerable degree of continuing distrust which had arisen during the Royal Commission of the 1930s, over any suggestion that water rights could be constrained by the Soil Conservation and Rivers Control Council "without adequate compensation" (Ibid p53).

An amendment to the Act passed in 1946, and held up by almost a decade of controversy over the Royal Commission report, "...enabled Soil Conservation Committees at district level to specify the class of stock to be carried on land for agricultural or pastoral purposes, to regulate stocking, ploughing and cultivation of land, and to place restrictions on changes to land use, but such committees had never been formed" (Roche, 1994, p64). Between the legacy of the Royal Commission into the Sheep-farming industry in the 1930s, the protracted wrangle with the Department of Agriculture over the placing of soil conservators, and delays in amending legislation, the Soil Conservation and Rivers Control Council remained in uncertainty for over a decade, severely constraining its possible effectiveness. Reasons for not

adopting catchment boards included conflict over "... the basis of representation, reluctance to pay additional rates, difficulties in developing rating classifications and objections to the powers conferred on catchment boards" (Ericksen, 1990, p53). To combat this reluctance, the SCRCC resorted to larger grants and subsidies (Memon, 1993, Roche, 1994).

Markets for New Zealand produce were not immune to the wider influence of global events. The Second World War impacted strongly on the demand for agricultural produce, and exports of meat, wool and dairy products continued to grow. An important point to note here is the continually increasing role of the Government in resource development as an entrepreneur, which increased significantly after the post Second World War boom in population and economy (Memon, 1993). During the 1950s, increasingly noticeable effects from pollution were emerging, as a result of new chemical uses and intensification of industries (Ward and Scarf, 1993). Moreover, the continually increasing population and production pressures meant that by the 1960s, significant conflicts were occurring not just between users, but between competing uses (Ward and Scarf, 1993). In 1963 the Manapouri Te Anau Development Act came into being, enabling the construction of hydro-electricity generation dams that were intended to supply aluminium smelters. There was public outrage at this, and the concessions to conservation that were won at that time arguably marked the 'coming out' of New Zealand's environmental movement. In response to the debacle, the Minister of Works established a ten-department committee to address the increasingly urgent problems of competing water uses. This was followed by the 1964 New Zealand Institute of Engineers conference, where the Minister of Works, the Hon P B Allen, suggested in the opening speech that

"...foremost, some agency must take on the job of completely coordinating all water administration to ensure effective action... there is also a need for allocating functions to someone for the many matters that are not now the responsibility of any particular organisation- water conservation, water allocation, further aspects of water quality and general administration (and) comprehensive research." (Ericksen, 1990, p59 c.f Allen, 1964).

The three reasons given for the conference were; the problems relating to competing uses of water; "...the failure of existing structures to deal effectively with large polluting industries, and ; "a fear of the unbridled power of the Crown riding roughshod over potential users" (Ericksen, 1990, p59, c.f Howard, 1988).

9.2.3.1 Key Points of IWM under the Soil Conservation and Rivers Control Act 1941 - 1967

This Act introduced the concept of integrated catchment management, but ironically this was compromised by sectoral schisms between the Ministry of Agriculture and the Soil Conservation and Rivers Control Council (SCRCC). The wide-ranging powers of the SCRCC and the voluntary nature of the regional catchment boards that would operate under its aegis were a significant departure from the previous arrangements. However, the strongly centralised nature of water management resulting from this arrangement has been heavily criticised by Memon (1993) as being unable to adequately understand or respond to regional needs.

The Manapouri Te Anau Development Act 1963 sparked public outrage at ‘state sponsored vandalism’ that seemed to be inherent within the Government’s increasing role as resource developer and the ‘think big’ approach of the time, and marks the coming out of New Zealand’s Environmental movement.

Ultimately, the Act failed to deliver on its integrated management intention. In particular, the 1945 amendment provided for Soil Conservation Committees, whose role was to regulate the livestock types and densities, and agricultural land-uses and intensities. However, these were never formed, and the amendment became what may be one of the earliest symbolic IWM policies in the world. Further, large-scale point-source pollution had exceeded the capacity of the legislative structures to address effectively.

Twenty-five years earlier, the 1941 Act had addressed the interconnected issues of soil erosion and flooding. By 1967, however, the IWM problemshed in New Zealand had moved forward through a second developmental cycle, and new approaches to regulating emerging scales of pollution, and to allocating freshwater benefits amongst competing uses was needed. The response was another visionary and innovative piece of legislation that abandoned the prevailing riparian rights system and vested all rights to the appropriation, damming, and use (including use of assimilative capacity) in the Crown. Thus, the following subsection considers the IWM cycle in New Zealand under the Water and Soil Conservation Act from 1967 until 1984, including the Wild and Scenic Rivers amendment of 1981.

9.2.4 IWM under the Water and Soil Conservation Act 1967 - 1984

The Water and Soil Conservation Act 1967, was an imaginative and farsighted one, and forms the basis of the RMA as it relates to water. The evaluative framework for this cycle is shown in Figure 43.

As summarised from Wheen (1997, p79), this Act aimed to “promote a national policy in respect of natural water, and to make better provision for the conservation, allocation, use, and quality of natural water... and [to] promote and control multiple uses of natural water..., and to ensur[e] that adequate account is taken of all the needs of primary and secondary industry, water supplies..., fisheries, wildlife habitats, and all recreational uses of natural water”.

All rights to use water were now vested in the Crown (Ward and Scarf, 1993; Wheen, 1997). This repealed the Riparian rights regime of the 1941 Act, but not the Act itself. The two Acts existed alongside each other, making for significant confusion. The main management tool provided by the 1967 Act was the reform of water rights, which was to be “the means by which water classification and water allocation plans could be implemented” (Ericksen, 1990, p66). This remarkably uncontested shift in property rights was the result of political negotiation which assured influential users (particularly the farming lobby) that the status quo of water allocation would remain essentially unaffected. Thus, the property rights system for water and land in New Zealand now vested all rights to the appropriation, damming, and use (including discharge) of water in the Crown, and permits were required before any private citizen could engage in any such activity beyond that which would meet their immediate family and stock drinking needs (Ericksen, 1990; Ward & Scarf, 1993; Wheen, 2002). Ericksen (1990, p62) observes that decision-making arrangements under the 1967 Act were a “commendable attempt at instituting Integrated Water Management in New Zealand”. Among the many features of the Act which would coordinate such management were “a good system of grants to entice cooperation, a democratically elected local system of management, and powers to act on a wide range of functions” (Ibid).

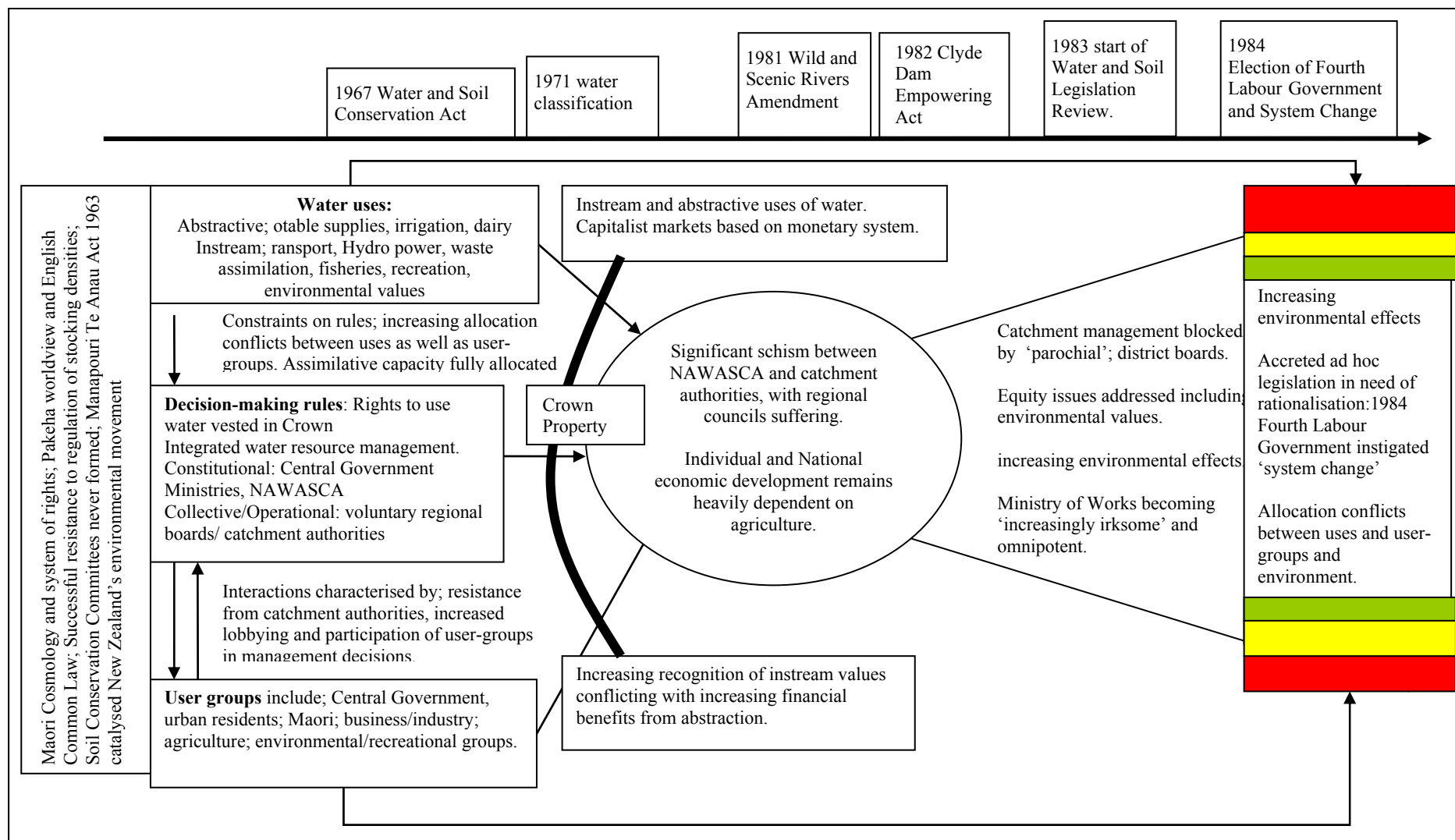


Figure 43: Representing the IWM Cycle 1967 - 1981 for Evaluation

The 1981 amendment (usually referred to as the ‘Wild and Scenic Rivers’ amendment) took another large step along the road to holistic resource management. This time, it was not the rights of the Crown (or the public) which were being addressed, but the rights of the Environment itself, (albeit from a heavily anthropocentric view). Here, the country acknowledged that protection of certain bodies of water (in the form of Water Conservation Orders) was necessary to ensure the continued flow of their benefits. Although New Zealand had legislated for (largely) aesthetic benefits which had little or no obvious economic value (the scenery), through the development of its National Parks a century earlier, this was the first time that such a non-tangible set of benefits had been acknowledged with respect to water bodies specifically. New Water Conservation Orders could be applied to either nationally or locally important water resources, and importantly, provided for statutory bodies “to make application nationally or locally, to preserve as far as possible in its natural state the wild and scenic characteristics, etc, of a water body” (Ward and Scarf, 1993, p67). Although the Act was visionary and bold, it had serious problems in operation. It “proved full of legal pitfalls because there could be many claims on one body of water and many uses of it already in existence” (Ericksen, 1990, p66 c.f. Poole, 1983). The 1981 amendment radically changed the way that surface waters were valued in law in New Zealand, but was ultimately compromised by the necessary time-frames for applications, the costs of resource investigations and analysis of competing claims, and uncertainty over the legal result (Ward and Scarf, 1993).

9.2.4.1 Key Points of IWM under the Water and Soil Conservation Act 1967 – 1984, and the Wild and Scenic Rivers Amendment, 1981

One major innovation that was introduced after 1967 was the development of a water classification system. This was expected to integrate with the existing land capability classification to finally provide an integrated framework for land and water use decision-making. The water classification system was developed by the Water Pollution Council (WPC), and provided for four types of freshwater, and five types of saline (Ericksen, 2000; Ward and Scarf, 1993; Roche, 1994).

The 1967 Act was always going to be difficult to implement successfully, given its cooperative nature and its attempts to address subjective trade-offs between uses as well as

user groups. In essence, this was an Act that aimed to provide a framework for ‘decisions on water allocation through water rights based on the interlocking concepts of multiple use, beneficial use, and balanced use (Ericksen, 1990, p66). With the 1981 amendment, this scope was broadened from the purely anthropocentric to include environmental and in-stream values. These were never going to be uncontested legislations.

This section has identified and described the historical origins of the currently problematic institutional arrangements in New Zealand, relating to: market influences and the neoliberal agenda; conflicting and competing systems of property rights and rights domains; allocation difficulties, and; competing cosmologies and worldviews. As predicted by the theory proposed in Chapter Five, the key institutional arrangements identified as problematic in the foregoing chapters have been shown to be historically embedded, and sometimes repeated, avoidance tactics.

The following section will discuss the study findings from this theoretical perspective.

9.3 Analysis of Historical Underpinnings of Problematic Institutional Arrangements for IWM in New Zealand

In previous chapters, I have proposed that New Zealand’s current freshwater governance problems are so wicked, because they are the cumulative outcomes of many cycles of sustainability avoidance, and reification of unsustainable social appreciations and patterns of interaction, instead of a sustainability transformation. In other words, as reported in the interviews, New Zealand is “still in pioneer mode”, a “young country that has not really had to face up to resource shortages yet”, with a “Daniel Boone mentality” (Hughey, 2008; Skelton, 2008, Research interviews, jointly and severally). Avoidance tactics have already been identified as legislation that was blocked, or that had no ‘teeth’, was not implemented, or that avoided overshoot and/or reduction in individual levels of use, through economies of coordination, technology, or both. In this section, I will consider the findings reported above from this perspective.

In Chapter Five, I considered the paradox of the current generation of wicked IWM problems, which already exceed the capacity of existing institutions to address equitably and efficiently, being most acute in certain IWM advantaged SESs. Integrated Water Management advantages

include plentiful freshwater, available technology for storage and transport, and extant collaborative, or at least cooperative, IWM plans, policies, and programmes. I theorised that it was the particular confluence of these attributes with a pioneer social background that had generated multiple cycles of social sustainability avoidance, rather than transformation in these SESs. Arising from this theoretical perspective is a typology of IWM contexts, in which New Zealand, and other similar SESs such as Florida or British Columbia, are considered as type 4. These are described as developed, ‘Western’ jurisdictions with abundant freshwater (albeit unevenly distributed through time and space), the technology and infrastructure to have secured essential domestic supplies, and a European, pioneer background. The theoretical perspective suggested that in each cycle of IWM, type 4 SESs have avoided socially unpalatable reductions in levels of use through various combinations of technological efficiencies, and/or economies of coordination, but that in doing so, they have reified unsustainable social appreciations of the freshwater resource, making future change more difficult. In this chapter, I have shown that the New Zealand cycles of IWM development have followed the pattern of increasing complex, contested, and wicked IWM challenges: control of floods; provision of domestic supplies and infrastructure; control of nutrients and pollutants, and; the protection or restoration of ecological systems. Comparing these results with the observed pattern of IWM development in Florida as noted by Scholz and Stiffler (2005), during the same broad period (Table 14), shows that these two SESs have indeed followed the same pattern of IWM challenges. This lends support to the theoretical perspective.

Table 14: Development of IWM in Florida and New Zealand

Everglades in the 20th Century	New Zealand in the 20th Century
Control unwanted floodwater	Control of unwanted floodwater the SCRC Act 1941
Sustain water supply to a growing population	Sustain water supply and infrastructure the SCRC Act 1941
Control nutrients from land-use intensification/interactions	Control nutrients/pollution W&SC Act 1967
Bring about ecosystem restoration	Ecosystem restoration/protection W&SC Act 1967 and W&SR Amendment Act 1981

In the century and a half since the Treaty of Waitangi, agriculture, and particularly the dairy industry and associated irrigation practices, has enjoyed the characterisation of being ‘the backbone of the country’. Unfortunately, the agribusiness sector does not seem to have realised that without legs, or feet, or other ‘limbs, organs, senses, and dimensions’, the

backbone will not get very far. The ongoing exportation of freshwater in the form of milk solids and other primary produce may be understandable from the point of view of maintaining national revenues for development of infrastructure, but as demonstrated in the foregoing two chapters, it has generated a lock-in, and has also retarded a more holistic approach to the country's natural wealth. Other problems have resulted from a lack of coordination of legislation, lack of integration between professional disciplines (primarily between the water engineers and soil conservators of the 1940s and 1950s), and turf protection between agencies. Further issues have arisen through agency or government capture (as in the resistance to stocking rate controls in the 1941 Act), and the principles of riparian rights to water which were imported wholesale from English Common Law. Until 1967, these riparian rights had first supported and then enforced the individual's right to use his land (and the associated water resources) as he saw fit, without consideration of the wider context. The transfer of water rights to the Crown in 1967 was a remarkable achievement, but between the lack of commitment to the newly mandated regional councils and the 'parochial' nature of the local catchment boards, this Act was never fully allowed to deal with issues that it had been designed to address.

It seems that the more enduring and successful facets of the RMA 1991 owe more to the 1967 and 1981 water management legislation than to System Change. Although the RMA consolidated a great many statutes, it streamlined and 'rationalised' environmental planning. There is very little in the RMA for water that was not in place under the 1967/1981 system of governance, and much that has been inherited word for word. One of the main differences is that regional councils have been accorded statutory standing, but many were already in voluntary existence, so the difference here is really one of commitment. If the management body is voluntary, it must develop commitment through consensus-building. If the body is statutory, it possesses a degree of 'command and control'.

New Zealand has generally opted for cooperative legislation in water management, beyond the conscriptive powers of river boards to execute flood prevention works. This has not always worked as it was perhaps envisaged, due to the widely-recognised problems of commitment implicit within any cooperative agreement (Hajer, 2003; Margerum, 2001). One key challenge for IWM has been that because IWM has emerged from an overshoot that has already happened, institutional design has been one step behind uses. Sustainability overshoots are the reason that institutions are needed, but institutions appear to have been

consistently one step behind in the arms race between increasing social-economic pressures arising from, amongst other things, human ingenuity and entrepreneurial flair, and their necessary regulation.

9.4 Chapter Summary and Concluding Comments

The aim of this chapter has been to seek evidence in support of the theoretical proposition that institutional arrangements particularly implicated in the emergence of polycentric IWM problems in type 4 SESs such as New Zealand, have their roots deeply embedded in a century and a half of sustainability avoidance tactics, with respect to freshwater. The results of this analysis, as described in the foregoing sections, support this proposition.

At its broadest, and bluntly put, it has not been politically expedient to actually implement the rules which have been carefully, expensively, and often imaginatively designed with the specific intention of addressing existing freshwater system overshoot in New Zealand.

Therefore, the conclusions reached in this chapter are that there is strong evidence to support the theoretical perspective of problematic institutional arrangements as historically embedded social sustainability transformation avoidance tactics. More particularly, from the summary above, several recurring themes begin to emerge. These are:

- Unresolved, or irreconcilable tensions between Maori and Pakeha cosmologies, and resulting worldviews with respect to freshwater, its values, perceived limits to use, and management;
- A perverse endurance of the first in first served allocation approach;
- Ad hoc accretions of legislation, where need and urgency are the drivers;
- Catchment scale focus. Water and land have been considered at the catchment level, but management has never really achieved integration. This has often been due to schisms between professional disciplines within and between management agencies (e.g. the engineers and the soil conservators of the 1941 Act), or between governance levels (e.g. no autonomy for regional unified councils under the 1967 Act);
- Attempts to constrain land use or intensity of use have failed. There has been a continuing emphasis on primary productivity, but environmental costs of intensifying productivity have not been fully reflected in water resource management;
- Successive legislations have been either the product of agency capture (e.g., the 1941 Act), or have suffered emasculation through lack of statutory power, resources, or turf

protection/uncertainty. Further, successive legislations have failed to enforce particular arrangements, either through non-implementation (e.g., councils mandated for but not formed) or by making them non-statutory (i.e., voluntary).

Overall, although the most challenging aspects have generally been avoided (those more wicked problems based in conflicting subjective values), the changing systems of New Zealand's institutional design for freshwater governance has shown several positive attributes. It has grown and adapted in step with changing contexts, understandings, and pressures. It has provided an imaginative and often visionary framework for design of institutional arrangements, yet these have often been either blocked or ignored, typically by the rural/agribusiness/hydro-electricity lobbies. Where need or urgency have existed in order to prevent structural damage to property or infrastructure, or compromise life or economic wellbeing, reaction has been quick and typically engineering-based. However, when any kind of subjective values have been considered, the environment has regularly been subsumed in the quest for economic development, as noted in the wider work by Owens (1997). As Ericksen (1990), and Ward and Scarf (1993) have noted, ironically much of the 'cavalier' treatment of New Zealand's water resources has arisen from their very abundance and quality.

Thus, the analysis in this chapter has provided support for the theoretical proposition that as a type 4 IWM context demonstrating emergent polycentric IWM challenges, the problematic institutional arrangements identified in the previous two chapters will be deeply embedded in New Zealand's social history. After over 150 years, the 'hard' questions, the core challenges of competing cosmologies, worldviews, ways of knowing, of valuing, of deciding on issues and making long-term plans, and of using freshwater system benefits for private, community, or public good have yet to be properly addressed, or limits to use set in national policy. Current central government manoeuvrings notwithstanding, New Zealand must finally identify, and accept, its freshwater quantity frontier. As already noted, the quality frontier was reached with the 1967 Water and Soil Conservation Act, although as also noted, water quality, particularly in lowland streams and water bodies such as Te Waihora/Lake Ellesmere (The Manawatu River notwithstanding), remains at times dangerous to human, and animal, health (ECan, www.ecan.govt.nz accessed 24th Feb 2010). With the exception of the individual successes of the Water Conservation Orders such as that on the Rakaia River, limits to use are long overdue in New Zealand, and the freshwater overshoot that has occurred in the meantime will be difficult and expensive to remediate.

This chapter concludes the empirical portion of this study, in fulfilment of the third research objective, as stated in subsection 1.4. The final objective of this research, the derivation of insights, is addressed in the following Chapter Ten. There, I will reflect upon the implications of the study findings for the future of New Zealand's freshwater resources, and for the conceptual perspective argued for in this thesis. This is that the social sustainability transformation process is a necessary and non-substitutable driver for 'successful' IWM. Further, that the wider, complex adaptive systems of a society's institutional arrangements exert a powerful influence on the sustainability or otherwise of IWM outcomes, which must be taken into account in the design of IWM institutions, if they are to have a chance of fulfilling their sustainability intentions.

10 Discussion and Conclusions

10.1 Introduction

The overarching research problem addressed in this study has been the ongoing IWM implementation gap and resulting unsustainable freshwater outcomes, particularly in what have been identified in Chapter Five as type 4 SESs such as New Zealand. Emergent polycentric IWM problems in these SESs already exceed the capacity of existing institutional designs to address them, and the literature is increasingly of the opinion that given the wide range of contexts under which IWM operates, there is no ‘one way’ or single scale that is capable of generating and maintaining sustainable freshwater outcomes. The literature is clear that the need for more robust models of IWM, and associated evaluative frameworks capable of their accommodation, is both critical and urgent.

This overarching problem has been considered in terms of three main research questions. Why have sustainable IWM freshwater outcomes been so elusive in jurisdictions such as New Zealand? What is the role of institutional arrangements in IWM outcomes? And, how do IWM problems in countries like New Zealand exceed the capacity of current institutional design to address them?

Arising from the research problem and questions, this study has had two main research aims. The first aim has been to reconceptualise IWM, in order to provide a more robust theoretical understanding of its elements, processes and problems. Related to this, the second aim has been to employ that understanding in a multi-scale evaluation of the role of key problematic institutional arrangements in IWM outcomes in New Zealand, under the RMA 1991.

In order to achieve these two aims, this study has so far been guided by the first three of the four research objectives as stated in section 1.4, and recapped below.

- The first objective was to seek a more realistic and conceptually robust theoretical underpinning for IWM. This was addressed in Chapters Three, Four, and Five.
- Based on this, the second objective was the development of an evaluative framework for the re-conceptualised IWM process. This was addressed in Chapter Six.

- The third objective was the employment of the evaluative framework in the multi-scale case study analysis of the role of institutional arrangements in IWM outcomes in New Zealand. The case study results were presented in Chapters Seven, Eight, and Nine. The remainder of this chapter will address the final research objective as recapped below.

10.1.1 Chapter Aim and Overview

The aim of this chapter to fulfil the fourth and final research objective as stated in section 1.4, which is to identify insights arising from the study, and to draw conclusions on:

- a) The theoretical underpinning for re-conceptualised IWM;
- b) The evaluative framework, and;
- c) The influence of key institutional arrangements on IWM outcomes in New Zealand, and some suggestions towards improved future outcomes.

In the following section 10.2, I will briefly summarise the main conceptual arguments and empirical findings of this study. In section 10.3 I will reflect on the study findings from the perspective of their conceptual contributions, and in section 10.4, I will likewise reflect on the significance of the empirical findings from the perspective of reconfiguring institutional arrangements for IWM in New Zealand. Finally, in section 10.5, I will reflect on the shortcomings and strengths of the study, and suggest some areas for future research.

10.2 Thesis Summary

Having defined the research problem, questions, aims, and objectives in Chapter One as reported above, and detailed the case study methods in Chapter Two, in Chapter Three, I reviewed the origins and attributes of IWM as reported in the literature. In this chapter, I identified several stages of procedural development in IWM that ranged from coercive through cooperative to collaborative, and most recently, polycentric. I described the currently recommended collaborative planning process as comprising the elements of: initiation; problemshd definition; resourcing for collaborative plan development and implementation; coordination of the collaborative planning process; outputs (the plan), and; outcomes. I also noted that the narrow focus on good planning process does not necessarily result in sustainable freshwater outcomes, and highlighted three key areas of difficulty for IWM. These were: the perennial nature of IWM; the necessity to accommodate multiple scales of

governance, and; the increasingly normative nature of decision-making contestations within and between multiple SESs.

In order to address these difficulties, in Chapter Four I broadened the field of enquiry to include two key literatures, also pertaining to the attainment and maintenance of sustainable freshwater outcomes. These are complexity thinking, and Commons Theory. Firstly, I identified a theoretical convergence in the IWM, Commons, and complexity thinking literatures, regarding the procedural attributes of the collaborative and integrated plan development and implementation process (detailed above). Then, employing concepts, practices, and insights gleaned from this wider enquiry, (especially regarding the characteristics of complex adaptive systems and their processes of complex adaptive change, and freshwater's status as a complex, common-pool resource), I proposed a re-drawn model for IWM, in response to calls in the literature as already noted. The proposed IWM model, as developed in Chapter Four, re-draws IWM as one type of complex adaptive process of social change, through collaborative planning processes addressing the integrated management of complex common-pool freshwater systems. As I noted in that Chapter, this re-drawn, complex adaptive model of IWM can be used as a building block, whereby it can be used as a way of "breaking down complex processes into small chunks that can be used in multiple ways and recombined repeatedly at diverse levels" (Ostrom, 1999, p523).

The key elements of the proposed model for IWM in Chapter Four are as follows. The management concept of integration remains robust, and well-suited to the governance of complex, common-pool freshwater systems. Re-drawn IWM adopts a complex adaptive systems perspective, where systems can learn and change through experience, and can generate new, larger-scale systems. Complexity thinking offers a perspective of changing IWM procedural attributes from coercive to cooperative, collaborative and now polycentric, as cycles of complex adaptive change. This occurs through front-loop processes of entrepreneurial exploitation and emerging patterns of use, and back-loop processes of system disturbance and reorganisation. These complex adaptive procedural attributes apply to any complex adaptive system, such as freshwater, societies, or the wider systems of institutional arrangements through which it is argued that SESs frame decision-making in IWM.

The re-drawn IWM model also identifies institutional change and IWM as concurrent, coupled, but essentially different processes, whereby cycles of IWM are punctuated by

institutional re-design in order to accommodate challenges posed in new political spaces. New political spaces emergent between collaborative and polycentric IWM are characterised by Hajer (2003) as: the locus of decision-making power has become unclear; there is a new spatiality to decision-making; the nature of citizen involvement may need to be re-considered; scientific authority has been undermined, and; the context of policy-making is expansive. These ‘preconditions to a good deliberation’ (Ibid), are generated in response to an emerging institutional void, and associated unsustainable trajectory of cumulative SES freshwater use. The process of social sustainability transformation, with respect to freshwater, was also identified as a key, imbricated process.

From the theoretical convergence identified in the three contributing literatures, the process of collaborative and integrated plan development as proposed in the IWM model comprises the elements of initiation, problemshed definition, resourcing of collaborative plan development and implementation, coordination of the collaborative plan development, outputs, and outcomes. Rule-sets also identified in this theoretical convergence for collaborative IWM are, at the collective-choice level, rules for scope, membership, position, authority, information, and aggregation/decisions. These rule-sets are used to guide the collaborative crafting of rules for individual decision-making at the operational-choice level, which relate to boundary, allocation, input/output, and penalty. Taken together, these rule-sets are considered in terms of the resulting systems of collective-choice level and operational-choice level property rights. Lastly in Chapter Four, I also noted that the re-drawn model for IWM, as proposed, remained unable to reliably generate sustainable freshwater outcomes in the type of IWM context of greatest interest to this study, such as New Zealand. Indeed, the polycentric IWM problemsheds currently being experienced in this type of jurisdiction already exceed the capacity of existing institutional designs to address fairly and effectively. This raised three key inter-related challenges, addressed through a conceptual synthesis in Chapter Five.

The three challenges addressed in Chapter Five were: the increasingly normative nature of decision-making in polycentric IWM; structural challenges to institutional design posed by polycentric IWM, and; the underpinning question of why sustainable freshwater outcomes in jurisdictions such as New Zealand have remained so elusive. In this chapter, I argued that the critical, non-substitutable driver for sustainable freshwater outcomes from *any* approach to decision-making is a social sustainability transformation. I further argued that the perennial nature of IWM, the increasingly normative challenges to decision-making, and ongoing

sustainability gaps, when considered together over long time-scales can be understood and explained from the perspective of cycles of complex adaptive social change. This perspective as applied to the relationship between these three difficulties suggests that in spite of legislative evidence, SESs such as New Zealand have not yet addressed the underlying social issues and unsustainable social appreciations of freshwater systems, which have generated freshwater overshoot. Instead, they have successfully applied avoidance tactics which have raised the effective limits to use, but have also reified, and further embedded the underlying socio-economic drivers.

SESs with IWM advantages, such as New Zealand, are identified in Chapter Five as type 4 IWM contexts. From this typology, type 4 IWM contexts are characterised as technologically developed ‘Western’ jurisdictions with extant collaborative or cooperative IWM policies, plans, or programmes, and plentiful freshwater resources (although unevenly distributed over time and space). These SESs have invested in physical infrastructure for storage and transport of freshwater, and have already secured essential domestic supplies. Yet these are the SESs where the currently intractable polycentric IWM challenges are most noticeable. Therefore, following on from the above, I argue that these SESs are still to undergo their freshwater sustainability transformations. The key to this situation is, of course, ‘constitutional will’, described as the combination of political will and social capital that results in the identification *and social acceptance of* limits to multidimensional freshwater use.

The foregoing three chapters (7, 8, and 9) have reported the findings of the empirical portion of this study, in fulfilment of the third research objective. Thus, in these chapters I have applied the evaluative framework developed in Chapter Six to a multi-scale analysis of the role of institutional arrangements in IWM outcomes in New Zealand during the RMA cycle. The particular focus of the empirical evaluation has been on the role of wider institutional arrangements in RMA outcomes, through the shaping of emergent front-loop stages in the IWM process of complex adaptive change. For the IWM process as re-drawn in this study, front-loop stages are specified as: emerging operational rules in use, framing the selection by individuals of one action strategy from many available, and; resulting patterns of interaction, and cumulative levels of multi-dimensional freshwater system use.

Chapter Seven has identified key problematic institutional arrangements in New Zealand, and demonstrated their devastating effect upon the fulfilment of the RMA’s sustainability

intentions at the national scale. In that chapter, the framework was applied to a national-scale analysis of the role of: dominant social freshwater appreciation ('plentiful'); unresolved tensions between systems of property rights (e.g., the capacity for private financial gain from public property), and; the neoliberal agenda as so successfully employed by the country's agricultural sector, in emergent front-loop RMA processes at that scale.

In particular, the focus of analysis was on the way that these institutional arrangements had 'filtered' the RMA institutions, to shape the emergent (socially acceptable) operational rules in use. In the first instance, these framed successive national-government choices (inaction), thus influencing the trajectory of cumulative patterns of use (highly unsustainable).

Unfortunately, the combination of social appreciations, systems of property rights, a neoliberal agenda with very few limits to freshwater use, and a growing dairy export market, also provided sufficient resistance to the 'curtailment' of individual freedoms, (as represented by the facilitatory, effects-based, RMA and its amendments, and the LGA 2002), to ensure an institutional void, and even perverse legal rulings, where identification and enforcement of limits to freshwater use, for agriculture in particular, was concerned.

The focus for analysis in these chapters was the role of institutional arrangements in the front-loop interactions of the RMA cycles. This was particularly with reference to the influence of institutional arrangements on the individual selection of action strategies, and the trajectory of the emerging cumulative patterns of use which have resulted in unsustainable IWM outcomes at the local, regional, and national scales of governance. The institutional arrangements present in New Zealand have exerted a detrimental influence on the sustainability intentions of the RMA. Further, the results of Chapters Seven and Eight have demonstrated that the RMA, and IWM, are competent to generate and maintain sustainable freshwater outcomes for New Zealand's freshwater systems, as well as for Canterbury and Te Waihora/Lake Ellesmere, considered in Chapter Eight. The issue has been that the RMA has not been used. The foregoing chapters have demonstrated that the failure of IWM to generate and maintain sustainable freshwater outcomes in New Zealand is a direct result of the unsustainable influence of that country's institutional arrangements. Furthermore, those institutional arrangements identified as the most critically detrimental to the achievement of the RMA's freshwater sustainability intentions, have been clearly demonstrated in Chapter Nine to be the historically embedded outcomes of ongoing sustainability avoidance tactics. In particular,

successive legislative efforts to constrain individual farming freedoms for the wider collective benefit have simply never been allowed to succeed.

10.3 Reflections on the Conceptual Contributions

In this thesis I have proposed a more realistic, and theoretically robust model for collaborative IWM. I have extended this re-drawn model through a theoretical synthesis, to address the normative and structural challenges that face institutional design for polycentric IWM problemsheds. As part of this, I have proposed a theoretical perspective on the underpinnings and emergence of polycentric IWM problemsheds, in what are termed in this study type 4 IWM contexts, such as New Zealand. I then developed a framework for the evaluation of IWM and associated complex adaptive processes, identified as institutional change, and social freshwater sustainability transformation.

The results of this evaluation have clearly demonstrated that wider institutional arrangements, particularly those relating to the worldviews, markets, systems of property rights, and the *de facto* locus of decision-making power, are pivotal in the generation of IWM outcomes, sustainable or otherwise. Institutional arrangements influence IWM outcomes through their role in the social selection of operational rules in use. In this study, emergent operational rules in use have been defined as IWM institutions after they have been interpreted, amended and/or supplemented by the wider complex adaptive social system of institutional arrangements. Thus, emergent operational rules in use are a collection of socially acceptable institutions, which include but are not limited to, IWM rules. The emergent operational rules in use are then used by individuals to frame decisions regarding the exercise or otherwise of their allocated property rights. The cumulative effects of these individual decisions give rise to patterns of use, and sustainable or unsustainable freshwater outcomes.

I have applied that framework to the evaluation of the historical origins, and the role of key problematic institutional arrangements in emergent front-loop RMA processes, at multiple scales of governance. This evaluation has undertaken the following steps. First, the framework was used to identify key problematic institutional arrangements in New Zealand. Next, I analysed their role in the front loop IWM phases of the RMA 1991-2009, at multiple scales of decision-making. Lastly, I analysed the historical origins of these particularly problematic institutional arrangements. This analysis found that they were indeed deeply

embedded within New Zealand's social history. Beyond the technological avoidance tactics employed, resistance to the curtailment of individual freedoms for a collective benefit has presented in this study as iterative, symbolic policies, in the form of Act after imaginative, innovative, and ultimately unsuccessful, Act. Each *could* have generated and maintained sustainable freshwater outcomes, and some even generated significant advancements towards this ostensibly desired social goal. But their sustainability intentions were, quite simply, prevented from fulfilment by the role of export revenues from primary produce, particularly as provided by the increasingly influential agriculture lobby.

New Zealand is yet to undergo its sustainability transformation with respect to its freshwater systems. This is because of a highly successful series of previous avoidance tactics that have reified unsustainable perceptions and patterns of use. This is a characteristic of SESs in type 4 IWM contexts. Institutional sediments have been identified as highly influential in the 'failure' of IWM to generate and maintain sustainable freshwater outcomes. Given the lack of 'constitutional will' implied by the above and implicated in the emergence of the current polycentric IWM problemshed, IWM has been performing well at increasingly difficult tasks. Polycentric IWM is so wicked because it is required to address the core questions that have defied resolution during all previous attempts. Also, in type 4 IWM contexts, the essential potable supplies have been secured, so contestations are now a normative debate over how to use an SES's 'disposable freshwater income' to the greatest common benefit.

The foregoing chapters have clearly demonstrated that institutional arrangements in New Zealand, and in Canterbury, relating to property rights, markets, and cosmologies and worldviews have been, and continue to be the key barriers to sustainable freshwater outcomes in that country. Furthermore, Chapter Nine has demonstrated that the most problematic expression of these has been the ongoing resistance to regulation of land-use. In particular, there has been an ongoing and successful resistance to the constraint of individual freedom for a wider collective benefit by the agricultural and economic development sectors of the society. This has been demonstrated as a deeply embedded institutional sediment, resulting from a century and a half of successfully negating legislative attempts to address the detrimental effects of land-use practices arising from those sectors. These avoidance tactics have facilitated the ongoing dominance of the unsustainable social appreciation of freshwater systems and their benefits in that country.

In summary, the key conceptual findings of this thesis are that:

- A complex adaptive perspective of IWM as cycles of social learning can help to explain the presence of procedural difficulties, since each cycle must re-negotiate IWM institutions to accommodate changing IWM contexts.
- Employing a complexity thinking perspective enables a description of Polycentric IWM as an emergent, self-organising outcome of (potentially multiple, concurrent) collaborative IWM ‘failure(s)’, operating at the aggregate collective-choice level of decision-making without any one single ‘ultimate’ decision-making autonomy, and thus subject to unpredictable, and self-generating change that is not subject to control from above.
- Wider, socially constructed complex adaptive systems of institutional arrangements are critical to IWM outcomes, through their influence on the front-loop elements of the IWM process of complex adaptive social change.
- IWM should now be considered in terms of one of several imbricated complex adaptive processes critical to the attainment and maintenance of sustainable freshwater governance. Others particularly noted here are those of institutional change, and social sustainability transformation.

10.4 Reflections on the Empirical Findings

The RMA has been identified in this study as a symbolic policy – ‘a good Act not implemented’. This must be considered as a clear indication of a lack of ‘constitutional will’ for a sustainable freshwater transformation in New Zealand. This conclusion has been strongly supported by the recent government commissioned report into ECan (Creech et al., 2010), which clearly signals a central government intent to develop, and Canterbury Plains are to be the ‘sacrifice paddock’. Next on the list may be the Mackenzie Country in South Canterbury, already the subject of a call-in by the Minister, in respect to consent applications for three large dairy developments in that iconic and fragile area. After the fundamental production shift from pasture to the housing of dairy cattle to combat winter weather in the farther south regions of New Zealand, Southland will become the next most attractive source of land and water for the industry in this country. Otago’s regional water plan looks robust at this stage, and has excellent buy-in from Ngai Tahu, so that region may be expected to be less of a development target.

Moreover, the arguments for introducing water use charges, while perfectly reasonable and understandable, and even sensible, cannot be further investigated without a realistic debate on the issue of compensation for those who will lose out from the rule-change. The resistance to this seems obtuse, and seems to be in danger of becoming a case of history repeating itself. As shown in Chapter 9, the matter of the control of rates of stocking on land was raised in the 1930s, and almost entirely due to the perception that changes to the rules which would adversely affect farmers were not to be compensated for, the opportunity was missed. It is easy to see from this case study the way in which unintended consequences of policy can converge into perverse outcomes, but perverse outcomes in themselves cannot be taken as a reason to negate perfectly legitimate compensation issues when rules are changed.

The conclusion that New Zealand has yet to properly address its sustainability issues with respect to the governance of its freshwater systems has been drawn from the analysis and discussion of the empirical results. Post Treaty of Waitangi, a series of ‘avoidance tactics’ has generated a succession of more complex and increasingly subtle institutional arrangements that negated the necessity to change patterns of use. This has been the result of the particular combination of the quality and quantity of the freshwater systems themselves, the technological capacity available, and the Pioneer perspective. The exceptions to this have been the 1967/1981 legislations, that made water Crown property, addressed point-source pollution, and environmental values. In particular, the Water Conservation Orders, part of the 1981 Amendment, have proved themselves one of the most enduring, robust, and successful pieces of legislation in New Zealand. This is for the simple reason that they identify ecological flow regimes, set limits to use, and enforce them. This model was certainly travelling the right direction for sustainable freshwater outcomes, but was derailed by the system change of the 1980s and the new, neoliberal paradigm under which it was conducted.

It has been this combination of free marketeering, along with the perception of plenty as demonstrated by the voluntary nature of regional water planning, which has been the key contributor to the current situation. So far, the RMA 1991 has been effectively a symbolic policy, or Act, since this study concludes that it has been that it is ‘a good Act not implemented’. The issues identified by this study also find that the issues with this Act (flawed to begin with; never implemented; contestation over the meaning of Section 5, and; the development of ‘default’ case law in lieu of regional council implementation), are all constitutional-choice level issues, reinforcing the emerging importance of this governance level in iterative IWM decision-making.

As a symbolic policy, the central reason for the failure of the RMA as IWM legislation in the national-scale New Zealand SES, is already widely recognised as including a lack of leadership and political will (section 7.1). This implies that notwithstanding the explicit sustainability intentions of the RMA, New Zealand has not yet undergone the necessary social sustainability transformation, with respect to its freshwater systems. From the perspective of lack of ‘constitutional will’ (comprising leadership, political will, and social capital, as defined in Chapter Five), it must therefore be considered that in spite of the facilitative nature of the mandate, even the few institutions designed to limit individual freedoms for public benefit that were included were either unwelcome or unpalatable. How were they avoided? Essentially, they have been ignored – unimplemented, as discussed. Because of the resource quality and quantity, particularly in the exemplar national- and regional-scale SESs, it has not been politically expedient to draw limits to freshwater resource use until remarkably recently. Neither has it been considered politically expedient to proactively address the underlying property rights conflicts and misalignments, and social contestations over strategies for allocation. This situation has now changed with respect to a Proposed National Freshwater Policy Statement. However, central government have stepped in to potentially take control of freshwater decision-making in Canterbury with remarkable speed. This, coupled with the overt intention to increase storage for irrigation and dairy expansion in particular, does not suggest that a public debate on the re-negotiation of property rights to freshwater and its benefits is imminent.

The New Zealand Experiment with a neoliberal approach to the development of freshwater uses, under the presumption from policy-makers and the public (if not Maori), that water was plentiful, has not worked well for the freshwater systems. But the key point here is that in global terms, water *is* plentiful in New Zealand. The country lies in the top ten nations globally for per capita freshwater availability. Even accepting that this natural plenty is very unevenly spread across time and space, there is more than enough to meet domestic and stock drinking requirements, even at currently high stocking rates. Therefore, the question of the sustainability of dairy and related irrigation practices in dry-land areas such as the Canterbury Plains must be re-addressed. The Parliamentary Commissioner for the Environment’s report ‘Growing for Good’ (M. Williams, 2004) highlighted difficulties with intensification of agribusiness land-use, but like other potential constraints on individual freedoms, was essentially ignored to the general detriment of New Zealand’s freshwater systems and wider

environment. One reason for this is that New Zealand's economy is still based on the export of its primary produce, of which freshwater is the most significant. The fact that it is exported in the form of milk powder, as a very low-value-added basic product, does not negate the fact that the export of freshwater is essentially what contributes the major portion of that country's annual revenue. Indeed, there are now more dairy cows in New Zealand than there are people (5.6 million as at June 2008) (Bascand, 2009).

From the above, it is the reluctant conclusion of this study that the window of opportunity for a social sustainability transformation is closing rapidly at the national scale, without a sustainability transition having been undergone. Unless there is a rapid, vocal and influential outcry at the intent of the Creech report (Creech et al., 2010), the opportunity for a sustainability transformation will be missed at this national scale, and for this electoral cycle, at least. Further, the Creech report findings, and its subsequent government level implementation decision, must be realistically interpreted as seriously compromising the validity, possibly the future, certainly the probable Government responses to 'non-binding' recommendations, of the Land and Water Forum, too.

From the study findings, it seems as though New Zealand has another cycle or two of learning yet to go, before it is ready for the prerequisite social sustainability transformation that will enable 'successful' IWM. From the discussion above, it is clear that the sheer complexity of IWM, the complexity of the systems involved, their complex adaptive nature, and interdependencies of timing and preparation means that chance must play a key, but by definition unpredictable role in IWM and the generation and maintenance of sustainable freshwater outcomes. Now, New Zealand must address a very wicked problem indeed. Current challenges to sustainable freshwater IWM outcomes identified include the Maori claims to freshwater benefits, the existing lock-in to the dairy export market, and compensation issues for those that will be adversely affected by rule-changes. The immediate future for New Zealand's 'good debate' looks messy.

In conclusion, the RMA has brought New Zealand very close to a social sustainability transformation. Clearly, fundamental constitutional-choice decisions remain to be made at all scales of decision-making, but primarily by individual New Zealanders. At this stage, they are the only actors in this 'Drama of the Commons' who can now prevent the country from lock-in to low value-added export of its water.

In summary, the key empirical findings of this thesis are that:

- New Zealand is yet to undergo a social sustainability transformation with respect to its freshwater governance.
- New Zealand, and particularly Canterbury, are at the point of being locked-in to unsustainable dependence on the revenues generated by the export of their natural resources and low value-added produce.
- The RMA has become a symbolic policy.
- The Canterbury Water Management Strategy has been a victim of its own success in challenging embedded and powerful agricultural and energy-production interests.
- The urgently needed debate regarding the collective re-negotiation of property rights to freshwater system benefits (as Crown property) is yet to be undertaken. This is particularly acute in the case of the inherited, inadequate, but remarkably persistent ‘first-in-first-served’ approach to allocation of those benefits.
- Institutional arrangements relating to market forces, legislation, policies, and plans, competing cosmologies, and social customs, have been demonstrated as exerting a critically detrimental influence on RMA sustainability intentions across multiple governance scales.
- Perverse outcomes at the regional-scale SES, through national-scale SES interference, may well paradoxically generate beneficial outcomes for the local-scale SES.

10.5 Study Strengths and Weaknesses and Future Research

In this section, I will consider the research process, described in Chapter Two and applied in this study, from the perspective of its improvement. In this study, I have identified two excellent examples of difficulty in this type of research: it is not always possible (or even likely) that a researcher will be able to identify the underlying drivers for actions easily, or in rapidly changing situations such as have been discussed above, in real time. This is particularly the case in respect to commercially or politically sensitive information, as demonstrated by the report on ECan (Creech et al., 2010), and the violation of the Triennial Agreement of ‘no surprises’ by Canterbury’s Mayors. While this argues in part for the approach adopted by Steins & Edwards (1999a), whereby the researcher lives with the community under analysis until it is felt that they ‘can be trusted’, this approach is unrealistic

in the corridors of central, or regional, government. Moreover, there remains no guarantee that such information will be forthcoming, accurate, or useful. This is a research problem that is implicit within the very nature of IWM, and exceeds the scope of this thesis to address.

Secondly, I noted in Chapter Two that the flexibility of the selected methodology was both a strength and a weakness of the approach. During this study, particularly in the last eighteen months, contexts locally, regionally, nationally, and globally, have all experienced significant and rapid change. It is my opinion that the evaluative framework has coped well with this, and has demonstrated a capacity to accommodate and integrate 'breaking news'. Further, I consider that in this study at least, the flexibility and capacity of the methodology and the framework to respond to rapid changes in the subject of the evaluation, have proved to be positive attributes.

10.5.1 Some Suggestions For Future Research

This study does not attempt to create a theory of everything for freshwater governance, nor to answer all questions pertaining to that subject. In particular, there are several key areas that have emerged in this research that deserve closer interrogation. These are presented below.

Further longitudinal studies are (urgently) needed (Adams et al., 2002; Agrawal, 2002; Laerhoven & Ostrom, 2007; Steins & Edwards, 1999a). In particular, further study as to the elements, processes, imbrications, and triggers or catalysts for change in wicked problemsheds, which coordinate the preparation, redundancy of learning and leadership, window of opportunity, and transformation of a society, are clearly indicated from the results of this research, and supported by the wider literature (Abernethy, 2005; Berkes, 2002; Blomquist & Schlager, 2005; Gunderson & Holling, 2002; Medema et al., 2008; Memon & Weber, 2008; Painter et al., 2008; Scholz & Stiftel, 2005; Singleton, 2002; Weber & Khademian, 2005; Yorque et al., 2002). In this respect, New Zealand nationally, and Canterbury and Te Waihora / Lake Ellesmere in particular, are demonstrated as a rich vein for further enquiry into these urgent and important areas.

Arising from the above, the following testable hypotheses are suggested for future studies in this area:

Ho: The outcome of IWM institutions (derived from coercive, cooperative, collaborative, or polycentric decision-making processes), is directly dependent upon the attributes of the wider social systems of institutional arrangements in which they are embedded.

Ho: Polycentric IWM, as defined by the presence of Hajer's (2003) five 'preconditions to a good deliberation', will emerge at the aggregate collective-choice level, as the outcome of (potentially several concurrent) collective-choice level 'failure(s)'.

There remains an interesting line of enquiry in the tentative typology of IWM contexts developed in this study. The polycentric problems being experienced by what are here identified as type 4 jurisdictions have been typified in the wider literature (cited in Chapter Five) as the most complex, wicked, and normatively contested experienced by freshwater managers so far. I have theorised that this is because of the peculiar interactions between the resource, technology, worldview, and institutions in these societies, which has allowed unsustainable social appreciations of freshwater systems to become increasingly embedded in the social fabric, and thus more difficult to change. In New Zealand, the approaches of the Nordic countries are being studied as a possible model for change (Salmon, 2007 and also the proposed National Policy Statement, 2008). There are a great many potential benefits to this model, but unless the fundamental difference between these societies and New Zealand, so clearly demonstrated by Creech et al. (2010) is understood (i.e., that these are mature, conservationist societies, instead of pioneer exploitative ones), there may be more resistance than anticipated to the proposed changes. Clearly, this is another area deserving of more research.

Arising from the above, the following testable hypotheses are suggested for future studies in this area:

Ho: SESs in type 4 IWM contexts (including plentiful freshwater, technological capacity, and, critically, a Pioneer background) are more likely to generate PIWM over time than those SESs where this combination of attributes is incomplete.

Ho: Where collaborative (or at least, enforceable) re-negotiation of property rights has not yet occurred, the use of market instruments for allocation of freshwater benefits will generate perverse (unsustainable) IWM outcomes.

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