Final Report for the

NEW ZEALAND BUSINESS ROUNDTABLE

REFORM OF THE WATER INDUSTRY

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Table of Contents

Section Page

Summary i1.0

Background 11.1 Introduction 11.2 Nature of Project 11.3 Problems with Current Arrangements 21.4 Structure of Report 41.5 Summary 52.0 Current Arrangements 72.1 Introduction 72.2 Overview of Sector 72.2.1 Sources and Uses of Water 72.2.2 Institutional Arrangements 92.3 Water, Sewerage and Drainage Businesses 102.3.1 Services Supplied by Utilities 102.3.2 Service Providers 112.3.3 Pricing of Services 122.4 Major Water Utilities 122.5 Legislative Controls 142.6 Summary 153.0 Reform of Institutional Arrangements for Water Allocation 173.1 Introduction 173.2 Administrative Allocation of Water 173.2.1 Introduction 173.2.2 Administrative Compared with Market Allocation 183.3 Tradeable Water Permits 223.3.1 Introduction 223.3.2 Potential Benefits of Tradeable Water Permits 233.3.3 Definition of Rights 243.3.4 Initial Allocation of Permits 253.3.5 Potential Difficulties with Tradeable Water Permits 273.3.6 Free Riding on Conservation, Cultural and Recreational Values 283.3.7 Water Quality 323.3.8 Effect of Transfers on Third Parties 343.3.9 Other Third Party Effects 353.3.10 Variability of Supply and Use 363.3.11 Monopoly Concerns and 'Speculation' in Water Permits 373.3.12 Institutional Arrangements 393.3.13 Transitional Arrangements 413.3.14 Summary 423.3.15 Overseas Experience with Tradeable Water Rights 433.3.16 Recent Developments in New Zealand 443.4 Use of Economic Instruments for Wastewater Disposal 483.4.1 Tradeable Discharge Permits 483.4.2 Pollution Charges 493.5 Rights to Water Resources 493.5.1 Ownership by the Crown 493.5.2 Treaty of Waitangi Claims 503.5.3 Existing Water Permit Holders 503.6 Realisation of Value for the Crown 513.6.1 Resource Rent as User Charge 513.6.2 Resource Rent as Tax 523.7 Constraints Imposed by the Resource Management Act 543.7.1 Constraints on Permits 543.7.2 Scope for Use of Economic Instruments 553.7.3 Local Versus National Issues 573.7.4 Unitary Authorities 583.8 Summary 584.0 Efficient Pricing of Services 614.1 Introduction 614.2 Current Pricing Arrangements 614.2.1 Overview 614.2.2 Implications of a Fixed-Rate Regime 624.3 Marginal-Cost Pricing 624.3.1 General Considerations 624.3.2 Marginal-Cost Pricing of Water Supply 654.3.3 Marginal-Cost Pricing of Sewerage 664.3.4 Marginal-Cost Pricing of Drainage 674.3.5 Welfare Benefits of Marginal-Cost Pricing 684.3.6 Increasing-Block Tariff 714.4 Possible Reasons for Deviating from Marginal-Cost Pricing 724.4.1 Measurement Costs 724.4.2 Public Goods and Spillover Effects 724.4.3 Equity Considerations 734.5 Alternative Approaches to Controlling Water Consumption 754.6 Summary 755.0 Regulation of Market Power 775.1 Introduction 775.2 The Nature of the 'Market Power' Problem 775.3 The Market Power of Water and Wastewater Service Suppliers 775.3.1 Supply of Water 775.3.2 Sewerage and Sewerage Treatment 805.3.3 Drainage 805.4 Summary: The Case for Regulation 815.5 Regulatory Options to Address Monopoly Concerns 825.6 Comparison of the Major Options 835.6.1 Customer Protection 835.6.2 Incentives to Reduce Costs 855.6.3 Incentives to Invest 865.6.4 Regulatory Burden 885.7 Summary 896.0 Regulation of Quality 916.1 Introduction 916.2 Justification for

Regulation of Quality 916.2.1 Provision of Quality by an Unregulated Monopolist 916.2.2 Effect of Price Regulation on Incentives to Provide Quality 926.3 Regulation of Drinking-Water Quality 936.3.1 Case for Regulating Drinking-Water Quality 936.3.2 Regulation of Drinking-Water Quality 956.4 Summary 977.0 Structural Issues 997.1 Introduction 997.2 Implementing Preferred Structural Arrangements 997.3 Economies of Scale and Scope 1017.3.1 Introduction 1017.3.2 Horizontal Merger of Utilities 1017.3.3 Integration of Freshwater and Wastewater Services 1037.3.4 Integration of Sewerage and Drainage Services 1047.4 Vertical Integration Issues 1047.4.1 Transaction Costs Associated with Specific Investments 1047.4.2 Monopoly Pricing by Vertical Monopolists 1077.5 Structure of Wholesale and Retail Supply in Auckland and Wellington 1077.5.1 Introduction 1077.5.2 Process for Determining Appropriate Structure 1087.5.3 Economies of Scale and Scope 1087.5.4 Vertical Integration 1087.5.5 Other Considerations 1087.6 Summary 1098.0 Ownership Arrangements 1118.1 Introduction 1118.2 Current Ownership Arrangements 1118.3 Corporatisation of Water Businesses 1138.3.1 Framework 1138.3.2 Gains from Corporatisation 1148.3.3 Opposition to Corporatisation of Local Authority Businesses 1158.3.4 Experience with LATE Corporatisation 1168.3.5 Application of the Corporatisation Model to the Water Industry 1178.4 Watercare Services Limited 1188.5 Club Ownership of Bulk Supply in Auckland and Wellington 1218.6 The Case for Privatisation 1228.6.1 Private Ownership 1248.6.2 Franchising and Contracting Out 1258.7 Summary 1269.0 International Experience 1299.1 Introduction 1299.2 The English Model 1299.3 The American Model 1329.4 The French Model 1339.4.1 Forms of Franchising 1339.5 Variants of the French Model in Other Countries 1369.5.1 Argentina 1369.5.2 Guinea 1369.5.3 Ivory Coast 1389.5.4 Macao 1389.5.5 Mexico 1399.5.6 Germany 1399.6 Summary 14010.0 Summary 14110.1 Introduction 14110.2 Case for Reform 14110.3 Key Conclusions 14210.4 Water Allocation 14310.5 Pricing of Water Services 14410.6 Regulation to Constrain Market Power 14610.7 Regulation of Quality 14710.8 Structure of the Utility Industry 14710.9 Ownership of the Utility Industry 14810.10 International Experience with Private Participation in the Industry 149

Appendices

Appendix A Criteria for Assessing Options

Appendix B New Zealand Water Utilities

Appendix C Marginal-Cost Pricing

Appendix D The Nature of the 'Market Power' Problem

Appendix E Regulatory Options to Address Monopoly Concerns

Appendix F Corporatisation

Appendix G Conversion Factors and Basic Statistics

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Summary

Introduction

This report examines the potential for reforming the water industry. It focuses on mechanisms for allocating water between different uses as well as the institutional arrangements governing businesses that supply water and wastewater services. It discusses possible problems with the status quo and examines options for reform.

The review is motivated by the importance of water as a resource and the sizeable public investment in water and wastewater infrastructure in New Zealand. The value of natural water for waste disposal, water supply, recreation and commercial fisheries (and excluding ecological and cultural values) has been estimated at around $1.5 billion per annum. The accumulated investment by local government in water supply and wastewater assets is of the order of $6 billion. This is larger than the investment in Telecom Corporation of New Zealand's network and roughly comparable to the national investment in the electricity transmission and distribution system.

Case for Reform

Although reform of the water sector has taken place over the past ten years, a number of concerns about the industry remain:

• Water permits are sometimes assigned to low-valued uses at the expense of higher-valued uses in water-short areas;

• Water quality in the lower reaches of many streams is poor;

• Many territorial authorities have poor information on the condition of their infrastructure assets, although this is being addressed;

• The pipelines of many water and sewerage businesses are in poor condition;

• System failures result in the discharge of untreated effluent into coastal waters;

• Water losses from pipeline systems in some areas are high by international standards;

• Water restrictions are common in many towns and cities during summer months;

• The quality of drinking-water poses health risks in some areas;

• The decision-making process for major capital expenditure can be slow and costly, as demonstrated by the time it took the Wellington City Council to decide on its sewage treatment plant; and

• Controversy surrounds the introduction of usage-based pricing for water despite the environmental and efficiency benefits of such a pricing approach.

These problems suggest that institutional arrangements governing water allocation may be deficient. They suggest also that the ownership and control arrangements for the businesses delivering water and wastewater services may provide inadequate incentives for performance. Although the problems do not establish that the benefits from reform would exceed the costs, they do motivate further research and the examination of possible options for change.

Key Conclusions

Our analysis suggests that efficiency gains could be achieved by the following:

• Making greater use of tradeable permits for allocating water in water-short areas;

• Amending the RMA to allow permits to be obtained for in-stream uses and removing restrictions on the terms of permits;

• Introducing marginal-cost-based pricing for piped water and wastewater services for domestic consumers;

• Improving the incentives for performance of the local government-owned water and wastewater businesses through corporatisation;

• Making greater use of franchising and contracting-out if there is a strong political preference to retain public ownership;

• Removing the special restrictions in the Local Government Act which prevent Watercare Services Limited operating in a fully-commercial and accountable manner;

• Privatising the water and wastewater businesses to overcome the deficiencies inherent in the corporatisation model; and

• Regulating any market power problems through a light-handed regulatory regime relying on the Commerce Act and information disclosure requirements.

Water Allocation

Water is used in a number of competing activities including in-stream uses such as electricity generation, recreation, and the sustenance of flora and fauna; land use including irrigation and stock watering; and household, industry and commercial consumption including the provision of sewerage services.

Regional councils and unitary authorities are responsible for controlling the taking, use, damming and diversion of water and for the control of discharges into water. Whatever allocation regime is adopted, it is inevitable that there remains a substantial role for a centralised body to research the extent of the resource; decide on the quantity of water available for allocation; decide the initial allocation of permits; monitor water flows; define permit rights; and enforce compliance with permit conditions. In the foreseeable future, regional councils and unitary authorities are likely to fulfil these roles.

Regional councils and unitary authorities generally allocate water on a first-in first-served basis. Once the resource is fully allocated those with permits for low-valued uses have few incentives to transfer them to higher-valued uses. In water-short areas, the result is that water is sometimes put to low-valued uses while higher-valued uses are denied access.

Where there are few competing demands for water relative to supply, administrative allocation of permits is likely to be relatively efficient. Where water is scarce relative to demand, a tradeable permits regime may provide advantages. Trading in permits provides incentives for permit holders to reallocate water to higher-valued uses. Trading can establish the opportunity cost of water in different uses and locations at different times. Trading can assist in decisions on whether to leave water in-stream or allocate it to abstractive uses.

Permit holders should be allowed to hold permits for the purpose of leaving water in-stream. If permits could be purchased to leave water in-stream, environmental, Maori and other groups would be able to increase in-stream amenities by such purchases.

Minimum flows could be established through administrative means. Alternatively, the full flow of a stream could be allocated, with councils or a central government agency retaining permits for in-stream flows or allocating them to private conservation groups. Permits could then be traded to maximise environmental values across rivers. Private individuals and groups would be able to increase environmental, cultural and recreational amenities by further purchases of permits for in-stream use.

Tradeable water permits could be allocated to Maori groups as part of Treaty settlements. Maori could then decide for themselves whether to leave water in-stream, abstract for their own use, or trade or lease permits and use the income for other purposes.

Adoption of a tradeable water permits regime (as with other regimes) requires resolution of a number of public good and third party effects. Experience with tradeable water rights in other countries indicates that these problems can be overcome sufficiently to enable net benefits to be achieved when water is scarce.

As long as permits are transferable, any method of initial allocation without strings attached is likely to be efficient within the constraints of transactions costs. The initial allocation may be controversial given the substantial wealth implications, particularly in water-short areas. Auctioning of existing permits may be undesirable because of the potential to expropriate the value of private investments. Auctioning of permits is particularly suited to the allocation of additional or unallocated supplies of water. The initial sale of water permits is currently constrained by the Resource Management Act.

The restriction of the term of permits to 35 years should be removed. Where the return to an investment is conditional on a user retaining a permit, it would be desirable to provide permits with a commensurately long term. Removing the restriction in the Resource Management Act on the term of permits would better ensure that the permit holder faced the benefits and costs of resource-use decisions and would avoid the uncertainty and distortions that arise as the term of a permit is reached. The longer the term of the permit, the more desirable it is that it be tradeable.

Tradeable permit regimes are possible under current legislation. Several regional or unitary authorities are actively investigating or implementing tradeable water permits. These include: the Auckland Regional Council (Omaha); the Manawatu-Wanganui Regional Council (the Oroua area near Fielding); the Marlborough District Council (the Wairau); and the Tasman District Council (the Waimea area).

Progress in other areas is slow. In some cases, water is not scarce or the local geography is less conducive to a tradeable permits regime. In others, individuals affected are resistant to reform or councils have not examined the potential for a tradeable permit regime.

The potential gains from a tradeable permits regime could be strengthened by amending the Resource Management Act. Desirable changes include removing the 35 year restriction on the term of water permits; clarifying that permits can be obtained to enhance in-stream flows (including removal of the requirement that permits must be exercised to be retained); and explicitly allowing councils to tender permits.

Pricing of Water Services

Most utilities in New Zealand do not meter water for domestic or small commercial customers. Service charges are usually fixed, with no charge per unit of water used. Large commercial and industrial customers are usually metered and charged on the basis of usage. Sewerage charges are generally fixed.

Where prices for the marginal use of water or sewerage services are set at zero (as is the case when only fixed charges apply), or the full opportunity costs of consumption are not taken into account, there is little incentive for users to take proper account of the costs of supplying water and sewerage services. The result is that too much water is consumed, capital expenditure is brought forward, and greater environmental damage incurred.

When prices reflect the marginal cost of a particular good or service, they encourage efficient resource use by ensuring that at the margin customers pay an amount equal to the cost they impose on the economy.

Marginal-cost prices for water and sewerage services should (within the constraints of measurement) include the costs of depleting natural resources, the value of water in alternative uses (i.e. the opportunity cost of water), the cost of operating and maintaining the system, the opportunity cost of capital and the capital costs brought forward by demand. The capital costs should be calculated as the present value of all of the avoidable or incremental costs, whether they are incurred today or in the future, that are attributable to today's demand.

Marginal-cost pricing requires metering of usage or adoption of a proxy for usage. It is possible that the benefits of user charges may be outweighed by the costs of installing and monitoring meters in some supply areas for some customers. In assessing the viability of metering, account should be taken not only of the benefits of reduced demand, but also of the improvement in the utility's ability to monitor the condition of its pipes and to identify substantial losses of water from the system.

The cost of metering usage of water services has reduced to the point where it is economic at least in some areas, with a few major centres already metering domestic use. Measuring the discharge of effluent from residential and commercial properties is likely to be too costly at present. Since there is a reasonably strong correlation between water consumption and the volume of effluent discharged into sewers, it may be efficient to base the sewerage charge on water usage.

An increasing-block tariff is sometimes proposed on income distribution grounds. Initial blocks would be charged at zero or low prices with higher prices charged for additional blocks. If the maximum rate were set at marginal cost, and a large proportion of customers faced this charge, then an increasing-block tariff may be more efficient than sole reliance on a fixed levy.

An increasing-block tariff involves efficiency costs to the extent that significant numbers of customers consume only within those blocks for which price is below marginal cost. For efficiency to be maximised, the price for each consumer's marginal consumption should be set at marginal cost. It is irrelevant (in efficiency terms) whether the consumer's consumption is large or small. In addition, a utility's charges may be insufficient to enable it to cover total costs and additional efficiency costs could be associated with making up any shortfall.

Regulation to Constrain Market Power

The transmission components of the water industry pose some market power problems. Overall, the constraints imposed on water and wastewater service providers by substitutes appear moderate.

Choices between regulatory regimes for monopoly industries are choices between imperfect alternatives. No regulatory regime can provide a monopolist incentives for cost minimisation and efficient investment without also providing incentives for monopoly pricing.

With either private or public ownership under a sustainable commercial structure, a light-handed regulatory regime, involving reliance on information disclosure and the provisions of the Commerce Act, appears likely to impose the least costs while providing a constraint on the market power that monopoly suppliers of water and wastewater services might have.

The advantages of the light-handed approach include the benefits of retaining incentives for managers to optimise the efficiency of their organisations, the lower level of resources involved in the regulatory process and the consistency across different industries that it achieves. The regime does not, however, eliminate the possibility of monopoly pricing although it eliminates the prospect of major abuse. Uncertainty as to the precise nature of the regime is likely to reduce as guidelines emerge from decisions by the Commerce Commission and the courts. Concerns about monopoly pricing warrant continued monitoring of the regime. Only if monopoly problems become obviously costly or an *ad hoc* regulatory structure emerges would we advocate departure from the light-handed regulatory approach. Experience to date suggests that a light-handed regulatory regime will, in the long term, impose fewer costs than the heavy-handed alternatives.

Franchising appears to offer some benefits compared with price-cap and rate-of-return regulation, at least in the short term, and may be an option for increasing private sector involvement while retaining public ownership of infrastructure assets. Franchising, rate-of-return and price-cap regulation all require substantial government input, distort incentives for the regulated organisation to operate efficiently and require substantial resources for setting and monitoring prices. Rate-of-return regulation is the least desirable of the major regulatory options.

Regulation of Quality

Whether or not explicit regulation is required to control quality depends in part on the nature of any regulation to control market power. Our preferred regulatory option involves reliance on the Commerce Act, and a disclosure regime rather than price controls. In that case explicit regulation of quality (other than drinking-water quality) is unlikely to be required whatever ownership structure is adopted.

Given the difficulty of customers monitoring the quality of drinking-water and the potentially serious consequences of inadequate quality, a strong case can be made for the government or an industry body at least establishing voluntary quality standards, checking compliance with them and publishing comparative results.

Under the current regime, some supply systems are inadequately monitored and a number fail to provide safe drinking-water. There is little evidence to suggest that these failings could not be addressed under the current voluntary compliance regime.

Structure of the Utility Industry

It is nearly impossible for a central planner to determine accurately the optimal shape of an industry. Instead, it is preferable to give owners and managers of organisations involved in the industry the incentives and ability to seek out efficient organisational structures. However, unless the operations in the water and wastewater sector are privatised, owners and managers are unlikely to have strong incentives to achieve the optimal structure for the industry. Thus, if the utilities are to remain in public ownership, there may be a role for central government imposing structural reform on the industry.

It appears probable that technical economies of scale are exhausted in the larger of New Zealand's utilities, but that savings in costs might be achieved through amalgamating smaller utilities supplying towns and rural areas. Some savings in management, financial and overhead costs might also be achieved by integration.

Integration of headwater supply and distribution, and/or of the wholesale and retail distribution businesses, appears likely to reduce the transactions costs of contracting given the specific sunk cost assets involved in the relationship between the different businesses. It would also remove the possible distortion to prices which occurs when vertical monopolists independently set monopoly prices. A single organisation would have clear responsibility for the quality of supply, reducing the 'politicking' over problems that is a feature of the current structure.

There do not appear to be substantial economies of scope from integrating water supply with wastewater disposal although some management economies are possible. Interrelationships between sewerage and drainage operations could be handled contractually and do not require integration.

Integration of wholesale and retail operations in Wellington and Auckland may offer some benefits over alternative arrangements. Integration may allow modest economies of scale and savings in management and overheads; it may reduce transactions costs arising from contracting between bulk and retail supply given the relationship-specific assets involved; it may increase the probability that organisations in the industry operate commercially and reduce the politicking that currently distorts pricing and investment decisions. However, integration would reduce the limited scope for competition from headwater suppliers and would involve transitional costs.

Ownership of the Utility Industry

Since the reform of local government in 1989, councils have made substantial changes to the organisation of their business activities, making increasing use of business units to deliver their water and wastewater services. The establishment of business units has helped to improve the commercial focus and discipline of these businesses. Nevertheless, the inherent tensions and conflicts with this arrangement are not conducive to good management even when councils appoint talented individuals to positions of responsibility. A failure to adequately separate political, commercial and regulatory objectives combined with limited external monitoring reduces the accountability of managers. The likely result is poor commercial performance.

Substantial improvements in efficiency could be achieved by corporatising the larger water and wastewater businesses using the local authority trading enterprise provisions of the Local Government Act. Experience in New Zealand and overseas suggests that as long as the integrity of the corporatisation model is retained, application of the model to the water industry would yield substantial efficiency benefits.

Some councils are opposed to corporatisation because of the unfavourable tax treatment of LATEs compared with business units. Although the formation of LATEs may result in efficiency gains from the national viewpoint, these gains, from the point of view of local authorities, may be outweighed by the tax paid to central government. Unfortunately there are practical obstacles to achieving tax equality between private organisations, LATEs and council operations. A possible solution to this problem is for central government to require corporatisation of activities that are readily identified as commercial. This approach was adopted for port and airport companies, among others.

The legislative restrictions applying to Watercare Services Limited result in a confused ownership and accountability structure. Application of the standard corporatisation provisions of the Local Government Act is likely to improve the company's performance.

While practical experience with corporatisation in New Zealand has shown that the gains can be substantial, it has also focused attention on the following incentive problems associated with continuing government ownership:

• Experience indicates that politicians may be unwilling to accept some of the basic principles of the corporatisation model. For example, councillors may be appointed to boards even when their commercial experience is limited;

• Capital market constraints on the performance of government-owned businesses are weak;

• There is an ongoing risk that businesses remaining in government ownership will be subject to politically-motivated intervention; and

• The ultimate owners of the businesses (ratepayers) have relatively weak incentives to monitor the performance of management.

Deficiencies inherent in the corporatisation model suggest that further gains could be achieved by greater use of contracting out, franchising, or privatising of water and wastewater businesses, as long as any monopoly concerns could be handled by light-handed regulation.

International Experience with Private Participation in the Industry

The supply of water in today's world is dominated by government provision. Full private ownership of large scale water utilities is rare, and is found only in England and the United States. Partial private sector involvement is less rare, but still infrequent. Nonetheless, private sector participation in water supply is increasing rapidly around the world. Government-owned systems have proven inefficient, and frequently lack the capital and expertise to implement water supply improvements.

Where private ownership or involvement is found, the accompanying regulatory regime is a major determinant of outcomes. Three basic models characterise overseas experience with private participation in water supply: privatised utilities and price-cap regulation (the English model); franchise contracts with municipalities (the French model); and rate-of-return regulation of monopoly utilities, which may or may not be privately owned (the American model). The problems with these regulatory regimes were noted earlier in this summary. The light-handed regulatory regime, which has been adopted in New Zealand for a number of monopoly industries, is rarely observed overseas.

Section 1.0 Background

1.1 Introduction

In this section we describe the motivation for the current study and provide an outline of the structure of the report.

1.2 Nature of Project

This report examines the potential for reforming the water industry. It focuses on mechanisms for allocating water between different users and the institutional arrangements governing utilities that supply water and wastewater services. It discusses possible problems with the status quo and examines options for reform.

The review is motivated by the importance of water as a resource and the sizeable public investment, estimated at around $6 billion, in water and wastewater infrastructure in New Zealand.

The principal criterion we use for assessing different arrangements is economic efficiency. Economic efficiency aims at obtaining the greatest possible benefit to the community from scarce resources and enabling individuals to attain, at least possible cost, any number of ends they value.

A crucial determinant of efficiency is the quality of institutional arrangements which mould behaviour by determining and constraining individuals' rights, incentives, opportunities and costs of transacting. Performance problems often result from fundamental problems in the way businesses are organised, including the accountability of managers to owners and customers. It is for this reason that we emphasise the importance of institutional reform in achieving improved performance by the water sector. Internationally, there is increasing acceptance that water is an economic good and that institutional arrangements are important in determining the performance of the water sector. The choice of efficiency as a criterion for assessing alternative options and the importance of institutional arrangements in determining outcomes are discussed in more detail in Appendix A.

1.3 Problems with Current Arrangements

A number of reforms of the water sector have taken place over the past ten years. The amendments to the Local Government Act in 1989 have increased the accountability of regional councils and unitary authorities in their resource allocation roles and improved the accountability of local authority businesses providing water and

wastewater disposal services. Most councils have to varying degrees separated their water supply and wastewater businesses from other activities and provide greater information on their operations. A majority of councils now deliver water and sewerage services through business units rather than council departments, a significant change from 1989. The Resource Management Act allows the use of market mechanisms for water allocation and a number of councils are investigating tradeable permit regimes. Nevertheless, a number of concerns about the performance of institutions in the water industry remain.

Permits to use natural water are still usually allocated by councils on a first-in first-served basis. In water-short areas this can result in water being assigned to low-valued uses at the expense of higher-valued uses. Once water is fully allocated, those with permits for low-valued uses have few incentives to transfer them to higher-valued uses.

In many rural areas, water scarcity is a growing problem, reflecting economic growth and a heightened interest in water for dairying and other purposes. In some areas (for example the Mackenzie Basin and Tasman District) forestry project proposals have aggravated water supply concerns.

Water quality in the lower reaches of many New Zealand streams and creeks is very poor. Many lowland river reaches, streams and creeks are not suitable for swimming, and in intensive dairying areas streams receiving multiple dairy farm and/or piggery discharges may not be safe for stock watering. Regional councils are moving to address these problems.

A number of deficiencies in the management information systems of territorial authorities for water and sewerage infrastructure were identified in a review conducted by the Controller and Auditor-General. The Auditor-General noted that the operating results of many authorities did not reflect their true position because all costs relating to infrastructural assets were not being taken into account. He noted also that few councils had reliable and objective assessments of sewerage, water supply or drainage system assets and that there was a lack of formal systems to monitor the conditions of these assets. As a result, it was not possible to know whether or not councils were maintaining these assets to the level necessary for long-term service delivery. The Auditor-General noted that most councils, were, however aware of these problems and that most were taking steps to introduce more formalised systems of asset management.

Other reviews have also identified problems with asset management. In 1993, it was estimated that 195 communities required new or upgraded sewerage facilities, and that 108 communities faced potentially serious health problems. Wastewater reticulation systems needed major upgrading in Gisborne, Auckland and Wellington. The Parliamentary Commissioner for the Environment reported contaminated water supplies in Paekakariki, Lyttelton, Gisborne, Whangarei, Taihape and that systems needed upgrading in Kaiteriteri, Clutha, Waitarere and West Otago. A number of territorial authorities, including Hastings, Flaxmere, Havelock North, Alexandra, parts of Dunedin, Kaikoura, Lyttelton, Whangamata, Rotorua's eastern suburbs, Massey, Turangi, Nelson city, parts of Tauranga, Mt Maunganui, Fielding and Geraldine currently fail to supply adequate water quality to their customers. The costs of rectifying poor quality supply are high (estimated for example in Dunedin at $100 million to bring the system to an acceptable standard).

Sewerage system breakdowns, and infiltration of sewerage pipelines by stormwater during rain, result in discharge of untreated effluent into coastal waters in many areas. The pipe burst in Haitaitai during storms late in 1994 illustrates the state of the reticulation system at least in the older inner-city parts of Wellington. Information on system failures and the resulting pollution is difficult to obtain because of a lack of record keeping by authorities.

Water-loss rates from reticulated systems in New Zealand are high. 'Unaccounted-for water', for example, stands at 26 percent in the Wellington region compared with 8-10 percent in Singapore, 29 percent in Santiago, 19 percent in Brasilia, 12 percent average for all utilities in the United States, and 11 percent for Macao. In the absence of water metering there are inadequate incentives for customer/emergency services to identify and fix leaking pipes and tobies and slow response times to complaints are sometimes observed.

Strong growth in tourist numbers is straining water systems in smaller towns and townships which are subject to marked seasonal fluctuations in their effective population. These pressures could stretch the financial resources of those communities under existing arrangements.

Water restrictions are common in many towns during the summer months and during extended drought periods such as that experienced by Auckland.

In Wellington, the time it has taken the city to take a decision on the treatment of sewage exemplifies the difficulties with political decision-making. The recent water shortage in Auckland illustrated how difficult it is under the current structure to implement any long-term solutions to the problems identified. Political point scoring by elected representatives and the absence of a common form of 'commercial corporatised governance' for the territorial authorities' water and wastewater operations have been identified as inhibiting an efficient solution to Auckland's future wastewater treatment needs.

Despite advice received by territorial authorities in the Wellington area that water metering and adoption of marginal-cost pricing could significantly reduce demand, protect environmental values and reduce water loss, the implementation of metering is politically difficult. Similar controversies surround metering in Christchurch.

Many councils recover costs from their residential consumers through fixed charges that have no usage component. Where usage charges are levied, they often fall short of a marginal-cost based approach, for example by not including the opportunity cost of capital, or the costs of environmental damage, or future capital costs.

These problems suggest that institutional arrangements governing water allocation may be deficient. They suggest that the ownership and control arrangements for the businesses delivering water and wastewater services may provide inadequate incentives for performance. Although the problems do not establish that the benefits from reform would exceed the costs, they do motivate further research into the issues and possible options for change.

1.4 Structure of Report

Section 2 gives an overview of the water sector in New Zealand, describes the services provided by water and wastewater businesses and reviews some of the major players in the industry. It provides background on the legislative provisions relating to the industry.

Section 3 discusses options for reforming the allocation of water to competing uses.

Section 4 examines the potential efficiency gains from more efficient pricing of the services provided by water and wastewater businesses.

The nature of the problem of market power, the extent of market power in the water industry and possible regulatory responses are discussed in Section 5.

Section 6 examines the case for regulating the quality of services provided by water and wastewater utilities.

Section 7 examines the potential gains from vertical and horizontal integration of existing businesses.

Possible options for reforming ownership of the utilities are reviewed in Section 8.

Private participation in utilities overseas is discussed in Section 9 and a summary is provided in Section 10.

1.5 Summary

The water industry is large by New Zealand standards and involves substantial investment in capital assets. The efficient operation of these businesses is important for New Zealand's economic performance. The current problems in the industry suggest further investigation of the following issues is warrranted:

• The method of allocating water to different users and uses;

• The pricing of piped water and wastewater services;

• Regulation of quality, including the quality of drinking-water;

• The structure of the industry (i.e. vertical and horizontal integration);

• The ownership of water and wastewater utilities; and

• Regulation of any market power in the industry.

Section 2.0 Current Arrangements

2.1 Introduction

This section discusses the current arrangements in the water sector. It describes the functions of the water industry, provides an indication of its size and describes relevant legislative provisions.

We begin in Section 2.2 by providing an overview of the water sector in New Zealand. Sections 2.3 and 2.4 describe the services provided by the water and wastewater businesses and provide some background information on some of the major utilities. The legislative provisions relating to the industry are examined in Section 2.5 and a summary is provided in Section 2.6.

2.2 Overview of Sector

2.2.1 Sources and Uses of Water

The total water resources available to New Zealand are estimated at around 300,000 million cubic metres, although these are not evenly distributed. The overall supply and use of water in New Zealand is summarised in Table B.1 in Appendix B.

Rainfall varies from over 10,000 mm per annum in a few areas to as little as 340 mm in others. In some parts of the country, including the Canterbury Plains, the Heretaunga Plains, and the Waimea Plains, underground water is an important resource. Christchurch, Lower Hutt, Napier and Hastings draw on underground water for at least some of their domestic, industrial and irrigation requirements.

Water is used in a number of competing activities. These include in-stream uses such as electricity generation, recreation, and the sustenance of flora and fauna; land use including irrigation and livestock consumption; and household, industry and commercial consumption (including provision of sewerage services). Throughput for hydro-electric generation is over 100,000 million cubic metres per year. Excluding hydro-electric generation, New Zealand's consumption of water approaches 2,000 million cubic metres per year. This is less than one-third of the annual flow of the Waikato river.

The value of freshwater for waste disposal, water supply, recreation and commercial fisheries has been estimated at around $1.5 billion per annum. This estimate does not include the ecological and cultural value of water.

Figure 2.1 breaks down New Zealand's water consumption by activity. Irrigation accounts for the bulk of consumption at 57 percent of the total. Consumption by livestock is the next major water use at 18 percent, followed by industry and household consumption.

Figure 2.1

Annual Water Consumption

Source: *New Zealand Official Yearbook 1994*, p 332.

Water is already scarce in some areas of New Zealand at certain times of the year and during periods of drought. In some regions, relatively cheap sources of water have already been exploited and increased demand can only be met by expensive developments or by reallocating water from low to higher-valued uses (typically from agricultural use to other uses, or from traditional agriculture to new developments).

Households put water to a variety of uses, not all of which require high quality water. Figure 2.2 summarises household use of water.

Figure 2.2

Household Water Usage

Source: *New Zealand Geographic*, (1993), Number 18, April-June, p 71.

2.2.2 Institutional Arrangements

The main legislation covering the water industry and service providers includes the Resource Management Act 1991, the Local Government Act 1974, the Health Act 1956 and the Commerce Act 1986.

The regional councils and unitary authorities are responsible for the administration of the RMA including the allocation of water to competing consumption and non-consumption uses.

Territorial and unitary authorities provide water supply and wastewater treatment services to urban and rural areas. Approximately 87 percent of the population is supplied by public water supply systems with the rest relying on an independent domestic supply (private provision, rain water, bores etc). Industry obtains about 33 percent of its requirements from public supply systems and 66 percent from its own sources.

There is some private investment in the industry. Many small towns, isolated communities (e.g. Waiheke Island), farms and baches have private water supplies. Oamaru city's water is supplied by the farmer-controlled Waitaki Irrigation Company Limited. Irrigation schemes, including all those previously owned by the government are now privately owned.

The Ministry for the Environment is responsible for advice to the minister on water resource management, development of policy initiatives on quality and allocation mechanisms and legislative development. Monitoring of compliance of councils with annual statutory documents is the primary responsibility of the Office of the Controller and Auditor-General. The Office also undertakes broader audits of the effectiveness of other functions undertaken by councils. The Department of Internal Affairs, Ministry of Agriculture, Ministry of Commerce and Treasury provide oversight in their areas of interest, but no agency currently monitors and provides feedback on the performance of local government water operations in a comprehensive way.

2.3 Water, Sewerage and Drainage Businesses

2.3.1 Services Supplied by Utilities

Water Supply

Most water in New Zealand is abstracted from rivers and streams, often from storage created by damming of waterways or from groundwater. Water released from storage is processed to meet standards for human consumption, and then piped to consumers.

In most water supply systems, installation and maintenance of the distribution system (i.e. pipelines) accounts for the bulk of the costs of supplying water. The main costs associated with storage are the resources required to construct dams plus the loss of value attributable to land inundation and to ecological damage to downstream valleys (not easily measured in dollar terms). Pumping and water treatment costs are a relatively small component of the total cost of providing water services.

Sewerage

Sewage disposal requires a network of sewers to collect effluent from properties, and to pipe it to treatment plants where it is normally processed mechanically and sometimes chemically to remove, neutralise or destroy harmful pollutants. Following treatment, the effluent is discharged into the environment. Some pumping is usually required. In isolated communities, sewage is stored in septic tanks and sludge is periodically removed and treated.

Sewerage services comprise essentially two components - the disposal of wastewater and the disposal of pollutants. Generally, the cost of disposal of effluent depends on the volume of wastewater involved, the distance to treatment and release, the costs of any pumping required and the nature of the pollutants.

Drainage

Drainage services are provided to dispose of stormwater run-off from properties, streets, roads and public places. The cost of providing drainage for a property depends on the area, the proportion 'built over', the composition and quantities of any pollutants that might require treatment (treatment is generally not undertaken although it may be required in the future in sensitive receiving environments), and the costs of transporting the run-off to the point at which it is returned to the environment. Capital costs comprise the bulk of the total costs of drainage services.

2.3.2 Service Providers

Local authorities are generally responsible for supplying water and wastewater services to household, commercial, business and rural consumers. District or city councils usually provide an integrated service supplying bulk and retail water, wastewater treatment and drainage. The major exceptions are Auckland and Wellington, where bulk water supplies and retail services are undertaken by separate entities. Some smaller communities (e.g. Oamaru) are served by private suppliers.

The water businesses are usually managed by council business units. A few councils, such as Rotorua City, have formed local authority trading enterprises under the general provisions of the Local Government Act. Auckland's bulk water supplier has been established as a local authority trading enterprise ('LATE') under special provisions of the Local Government Act. Service provision is occasionally contracted out. For example, Rodney District Council has contracted to Works Civil Limited for its supply and Wellington City's services are managed by the Wellington Regional Council.

The quality of information on the assets and performance of water businesses varies substantially between councils. Information about the condition of assets, comparative data on the cost of water supply to users and details of planned investments are generally sparse although many councils are building asset bases to meet audit requirements.

2.3.3 Pricing of Services

A variety of pricing policies exist at both the retail and bulk levels of water supply. Watercare currently charges its territorial authority customers on a per unit of water consumed basis. The Wellington Regional Council recovers the estimated costs of bulk water supply through a cost-based charge based on the proportion of the total water consumed by each of the four territorial authorities.

Territorial authorities commonly levy fixed water charges on their domestic customers with no usage charge. The cities of Auckland, Manukau, Waitakere, Papakura, North Shore and Rodney base their residential charges on metered consumption. Christchurch has almost completed the installation of meters city-wide and is expected to introduce charges based on metered consumption in the next three to five years. A number of other authorities are investigating the possibility of metering, although political resistance to change is sometimes high. Most suppliers meter their industrial and major commercial customers and charge for water consumed, with an annual supply charge sometimes applying as well. Where usage charges are levied, they often fall short of a marginal-cost based approach. For example, in many cases they do not include the opportunity cost of capital, the costs of environmental damage, or future capital costs brought forward by increased demand.

Sewerage charges are generally capital-value based, fixed or charged on a per-pan basis. Drainage charges are rarely charged for separately.

2.4 Major Water Utilities

In this section we briefly review some of the major New Zealand water utilities. A more detailed discussion of the major utilities is contained in Appendix B.

In Auckland, Watercare Services Limited, a local authority trading enterprise created by the Local Government Act and owned by the Auckland Regional Services Trust, provides bulk water supply and wastewater treatment. Retail distribution is undertaken by six territorial authorities in Auckland. Water is obtained from dams in the Waitakere and Hunua Ranges and an aquifer at Onehunga.

Hamilton City Council provides integrated water and wastewater services to its customers, drawing its water from the Waikato River.

In Wellington the Wellington Regional Council's Bulk Water Department supplies bulk water to Wellington City, Porirua City, Hutt City and Upper Hutt City. The territorial authorities are responsible for retail distribution, sewerage and drainage services.

Christchurch City Council supplies water to the Christchurch area from untreated underground sources. Water supply is managed through the Council's Water Supply Unit, a part of the Technical Services Group.

There is little aggregate information available on the water industry in New Zealand. Based on the 1992 accounts of most local authorities, supplemented and updated with the results of a survey undertaken in 1993, Davin estimated asset values and annual gross expenditures on water and sewerage, separately, for each local authority. He could not obtain valuations on a consistent basis; some were valued at replacement cost, others at depreciated replacement cost. Davin aggregated these estimates to produce the statistics summarised in Table

2.1. These estimates do not include the value of local government investments in drainage systems or flood protection.

Based on this data, the accumulated investment by local governments in water supply and sewerage in 1992-93 was of the order of $6 billion. This is larger than the $4 billion of fixed assets invested in Telecom Corporation of New Zealand's network and roughly comparable both to the scale of the Crown's $7 billion investment in the state highway network and to the national investment in the electricity transmission and distribution system.

Table 2.1

Local Government Investments and Expenditures in 1992-93

Asset Value Annual Expenditure

$ billion $ million

Water Supply 2.69 268

Sewerage 3.33 217

Total 6.02 485

Source: Davin, *op. cit.*, p 76.

Stormwater systems also involve very significant investments. Davin did not separately estimate local government investments in stormwater systems. However, some territorial authorities, including Rodney, Manukau, North Shore, Hamilton, the Hutt and Christchurch do provide estimated stormwater asset values. The total replacement value for stormwater assets for this group, based on the statistics provided in Table B.2 in Appendix B, was around $683 million, compared with $813 million for sewerage assets and $471 million for water supply assets.

Annual expenditure on water assets is also significant. Davin's estimate of $486 million in annual expenditure substantially exceeds Transit New Zealand's $314 million expenditure on the state highway system in the year ended June 1992.

Substantial capital expenditure by the industry is expected in the future. For example, the likely required investment in water and wastewater services in the 20 years to 2015 in the Auckland region has been estimated at between $2.6 and 2.8 billion.

2.5 Legislative Controls

The abstraction of water and disposal of effluent is governed by the provisions of the Resource Management Act 1991 (the 'RMA'). The stated purpose of the RMA is to promote the "sustainable management of natural and physical resources". The primary means provided by the Act for the promotion of sustainable resource management are prohibitions or restrictions on activities expected to harm the environment. Individuals or groups who seek exceptions to restrictions set out either in the Act itself or in the regional and district planning documents must do so by seeking permits or resource use consents.

Responsibility for the management of fresh water rests with the 12 regional councils and four unitary authorities. The Act sets out restrictions on the use of beds of lakes and rivers, water use and the discharge of contaminants. Permits are required for the taking, use, damming and diversion of water and the discharge of wastes (SS14,15). A resource permit to extract and discharge water has a maximum term of 35 years (S123). A water permit expires if it is not used within two years or such shorter or longer period as is expressly provided in the consent (S125).

Generally water permits are allocated through an administrative process involving application to the appropriate regional council for a consent. Limited trading of water permits is allowed by the RMA (S136). The RMA does not explicitly allow regional councils and unitary authorities to raise revenue by auctioning permits. They can impose charges on a cost-related basis (S36).

The main legislative provisions governing the supply of water services by territorial authorities include the Local Government Act 1974, the Health Act 1956 and the Commerce Act 1986.

The Local Government Act empowers territorial authorities to construct or purchase waterworks for the supply of water, provide drainage, and undertake disposal of effluent (SS375-392).

The Act sets out requirements to ensure local authority businesses are accountable. An authority is to set clear objectives for each of its activities and policies; its performance is to be regularly measured against its stated objectives; and its regulatory functions are, as far as practicable, to be separated from its other functions (S223C). In performing their functions, councils can use their own staff, contract out or form a LATE. The LATE provisions establish a framework comparable to the state-owned enterprise framework (S594).

Auckland's water supplier, Watercare Services Limited, has been established as a LATE through special provisions in the 1992 amendment of the Local Government Act. The Act restricts (among other things) the prices Watercare can charge, its funding of capital requirements, its ownership structure, the payment of dividends and areas of business (S707ZF).

The Act also requires the Wellington Regional Council to ensure that its water supply operations are separated from its regulatory functions (S223CA).

The Health Act empowers the Minister of Health to require a local authority to provide water and sewerage works (S25).

The pricing and competitive behaviour of water businesses is governed by the provisions of the Commerce Act.

2.6 Summary

Water is used in a number of competing activities including in-stream uses such as electricity generation, recreation, and the sustenance of flora and fauna; land use including irrigation and livestock consumption; and household, industry and commercial consumption including the disposal of effluent.

Regional councils and unitary authorities are responsible for controlling the taking, use, damming and diversion of water and for the control of discharges into water.

The value of freshwater for waste disposal, water supply, recreation and commercial fisheries has been estimated at around $1.5 billion per annum.

Territorial and unitary authorities generally provide water supply and wastewater treatment services to urban and rural areas. Approximately 13 percent of the population relies on private domestic suppliers. Industry obtains about 33 percent of its requirements from public supply systems and 66 percent from its own sources.

The accumulated investment by local government in water supply and sewerage services is of the order of $6 billion. This is larger than the investment in Telecom Corporation of New Zealand's network and roughly comparable to the national investment in the electricity transmission and distribution system.

Section 3.0 Reform of Institutional Arrangements for Water Allocation

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3.1 Introduction

Water is a key input for the piped water and wastewater utilities which constitute the major focus of this study. Any inefficiencies in the market for water allocation will feed through into the piped water and wastewater disposal markets, regardless of the efficiency of institutions in those markets. Water is also an important input to other industries, notably electricity generation and farming, and provides recreation, cultural and conservation benefits when left in-stream. Where the resource is limited and there is competition between the various possible uses, the institutional arrangements for allocating water may be important in ensuring efficient outcomes.

Sections 3.2, 3.3 and 3.4 compare administrative and market-based methods of allocating water and discuss arrangements for a tradeable water permits regime. The implications of the competing claims to ownership of water rights by the Crown, Maori groups and existing users are reviewed briefly in Sections 3.5 and 3.6. Section 3.7 considers the constraints the Resource Management Act imposes on water allocation. Concluding comments are provided in Section 3.8.

3.2 Administrative Allocation of Water

3.2.1 Introduction

Responsibility for managing fresh water rests with regional councils and unitary authorities guided by broad principles set out in the RMA. Generally, the process of deciding which resource uses are appropriate and which are inappropriate, who may carry them out, and how competing interests may or may not be traded off or reconciled is a political one based on planning, consultation and rule-making.

Most councils allocate water permits on a first-in first-served basis, with quantities based on 'specific realistic needs'. Most councils consider water efficiency and actual usage when allocating water. When renewing permits, allocations are generally restricted to efficient and actual water use. For surface water, councils typically set minimum in-stream flows at 30-60 percent of dry year flows, subject to public input. Higher minimum flows are set for rivers with important conservation or recreational values. Central government may place extensive restrictions on a waterway through a water conservation order that restricts the council's water allocation powers.

The assessment of allocation limits for groundwater is more complex, relying on detailed study by councils of the amount of water that is available without contamination or long-term depletion of the aquifer and taking into account the impact on connected aquifers and underground and surface streams. The principal methods of rationing in water-short catchments involve the proportional reduction of water, use of water allocation committees, rostering of use and voluntary reductions through public notification. Priority water permits and a last-on first-off approach are used by few councils. Permits generally have a term of five to ten years. Permits in water-short catchments frequently have common expiry dates, allowing past usage to be reviewed and permits adjusted to reduce total water allocations to the allocation limit or to change existing permits to realistic usage.

The current administrative method of allocating water to end-users is inefficient in some circumstances, particularly when water is scarce relative to demand. Once the resource is fully allocated, those with permits for low-valued uses have few incentives to transfer them to higher-valued uses. The lack of incentive to transfer existing water permits has led to capital investment in irrigation schemes and other abstractive investments that would be delayed or avoided if the transfer of water permits were allowed. This effect has been exacerbated by the high level of government subsidy paid to the development of irrigation schemes in the past.

3.2.2 Administrative Compared with Market Allocation

The principal problem with the current control-oriented approach to resource allocation relates to the costs, capacity and incentives of central and local planners to make efficient resource-use decisions that also reflect the interests of people affected by them. There are a number of dimensions to this criticism.

First, obtaining all the relevant information to allocate water to different uses can be a daunting and expensive task whatever institutional arrangements are adopted. Councils generally have better information than users on the overall characteristics of the resource, such as quantities available and the variability of in-flows through time. But, in the absence of market prices, planners have less information than users on users' preferences and the value of water in different uses. Centralising the collection and processing of such information in a planning approach may be more costly than relying on decentralised decisions of users buying and selling permits.

Councils can give consideration to the relative value of different uses through water management plans. They can reserve water for specific future purposes or needs, for example for future urban development. Councils can specify priorities for use, for example by giving preference to higher-valued uses.

In determining highest-valued uses, planners have only limited knowledge both of the ways in which resources such as water interact with others such as land, and of the needs and preferences of people, present and future, affected by resource-use decisions. The planning approach focuses on the collection of certain kinds of information, leaving out some of the complex details and nuances. Because users do not have to pay for a permit if it is allocated to them by a council, they have few incentives to reveal their true valuation of the resource. Users have few incentives to allow the reallocation of excess allocations of water if they do not obtain financial compensation. Council officers do not have to bear the full costs of any poor-quality decisions on water allocation and thus their incentives to make optimal allocation decisions may be weakened despite the constraints imposed by the RMA.

On the other hand, a market in tradeable permits provides a means of aggregating information on preferences and opportunities and coordinating economic activity. Prices, reflecting underlying conditions of supply and demand for water and other goods and services, would be generated by transactions in the economy. Prices reflect an aggregation of information held by many individuals, without any one individual needing to have full knowledge of the resource. The price mechanism coordinates individual actions and can resolve many of the problems of interdependence. A market in water permits would make individuals accountable for their stated value judgments and preferences. It would force people to face the costs and benefits of their decisions to use natural and other resources. It would eliminate the opportunity for someone to profit by overstating their preferences for a particular outcome and provide incentives for individuals to reallocate resources to those who might value them more highly. (A more detailed discussion of the efficiency properties of markets is contained in Appendix A. Potential difficulties with applying a market approach to water allocation are examined in Section 3.3.)

Under either an administrative or a market approach, valuing in-stream water for conservation, cultural and recreational purposes is problematic, given the difficulties in determining peoples' preferences and valuing those

alongside economic uses of the resource, and the lack of scientific knowledge of minimum flows to support ecological systems and recreational uses.

A difficulty with a planning approach is that the incentives of those ultimately responsible for resource plans to make 'good' resource allocation decisions may be somewhat weakened by the environment in which they work. Regional and district planning, and the formation of national policy statements and resource management law, are ultimately political processes, driven in part by political motives such as the desire for votes and campaign support, and by responses to active interest groups. At least some of the time, political and interest group pressure will drive decisions on how resources can be used in ways that do not maximise the value of water use. Individual officers, working within a political environment, will have incentives to meet the political objectives of councils which may or may not be consistent with maximising the value of water use.

Some protection against poor decision-making is provided by the requirements of the Act, including the consultation required in preparing resource management plans, the relatively strong scientific basis for many decisions on water allocation, the scrutiny that the public decision-making process is subject to, and monitoring by various central government organisations. The ability to appeal council decisions to the Planning Tribunal provides further protection. Nevertheless, apart from the ability to appeal decisions, these protections are ultimately enforced through the ballot box, which constitutes an indirect, weak and generally impractical method of signalling dissatisfaction about particular policies or actions of a council.

In contrast, in a market-based regime, permit holders who are able to trade their permits have strong incentives to maximise the value derived from water use and to transfer permits to those who value them most highly. Individuals who are not satisfied with current permit allocations can buy or sell permits to satisfy their needs. User groups could collectively buy or sell permits to achieve in-stream or other requirements (although only with an amendment to the RMA or clarification from the Planning Tribunal). However, as discussed in Section 3.3.6, reliance on a market approach may lead to under-provision of conservation, cultural and recreational uses of water. Regulation of minimum flows or government funding of these allocations may be necessary in a market regime. A tradeable permits regime at least provides information on the opportunity cost of water left in-stream.

The planning process discriminates against the less articulate and less well-resourced. In practice, what appears to be a very democratic process can produce elitist results, where those who know how to play the system, and have the resources, do best. While the allocation of water would be determined by willingness and ability to pay under a market process in the same way as other market goods and services, those using water would pay for the quantities used.

The incentives and capacity of planners to monitor the activities of resource users to ensure that they are in accordance with plan permits and proscriptions, or to enforce desired patterns of use and penalise offenders, may be weak. In areas where the demand for water exceeds supply, users are likely to apply strong pressure on councils to ensure a high level of monitoring of the water taken by other users, particularly during times of restriction.

Finally, few resource-use decisions are simple, and most have repercussions that extend beyond the time and the resource directly concerned. Because most resources are scarce, they are subject to competing interests and competing demands. The best way of using a resource is unlikely to remain constant over time. Decisions on water use cannot be taken in isolation from decisions on other resources. The instruments available to a planning approach are not particularly well suited to handle such complexity. Plans and resource consents, for all the conditions they might contain, ultimately give inflexible answers to resource-use questions. If trading is not possible, then possible changes in the future need to be incorporated into consents issued today, or allowance must be made to revise consents through time. The result is that under a planning approach inflexibility may be combined with ultimate uncertainty about how resources may be used and developed over time.

On the other hand, a market approach provides a means whereby resource use can change flexibly through time with changing preferences and opportunities being accommodated by trading in permits. Although a market approach increases flexibility, it does not necessarily completely overcome the uncertainties over future resource availability. For example, councils still need to set allocation limits based on technical considerations (for example, seawater intrusion to aquifers, health of fish life in rivers) and political factors. These limits may need adjusting as resource information improves and societal values change. With a tradeable permits approach,

a council could adjust in-stream flows to reflect new information by buying or selling permits, but other adjustments may need to be made administratively.

Whether or not trading of permits is allowed, it is inevitable that there remains a substantial role for a centralised body to research the extent of the resource, decide on the amount that can be allocated, decide on the initial allocation (or process for allocation) of permits, monitor the resource, define permit rights, and enforce compliance with permit conditions. In the absence of the more radical reforms proposed in Section 3.3.6, environmental values are likely to require protecting through regulatory means. In the foreseeable future, councils are likely to fulfil these roles.

Where there are few competing demands for water relative to supply, the information required to allocate water to different users is likely to be low and, given the overall approach to resource management embodied in the RMA, allocation of water permits by planners on a first-in, first-served basis is likely to be reasonably efficient.

However, when there is substantial competition for water either for abstraction or for in-stream uses, an administrative approach is unlikely to be efficient.

The trading regimes that are possible under the current legislation could offer some flexibility, and a number of councils are investigating the opportunity to make better use of tradeable permits. The use of a tradeable permits approach to water allocation is discussed in more detail below.

3.3 Tradeable Water Permits

3.3.1 Introduction

Trading in water permits provides a market alternative to administrative allocation of water. A tradeable permits regime requires the councils to determine the term of permits and any other conditions constraining the associated rights to abstract water (such as a requirement to take into account third party effects). The councils would set the maximum level of water abstraction through their definition and allocation of permits. Actual levels of abstraction and in-stream flows would be determined by users either exercising or not exercising their rights to abstract water. The initial allocation of permits could be based on potential beneficial use, historic use, or willingness of users to pay for a permit (e.g. as established in an auction). Permits could be traded, within the constraints established by the councils. Transfers could be either long or short term (and include, for example, leases) and may involve a change in use or location. Transfers of permits with the sale of land could continue as at present. Councils would enforce permit conditions and register transfers.

In the discussion below, we assume that the tradeable permits regime operates within the constraints of the RMA, but recommend amendments to the RMA that could improve the efficiency of such a regime. In particular, the efficiency of a tradeable permits regime would be significantly improved by the following: allowing individuals and groups to obtain water permits to leave water in-stream; establishing perpetual terms for permits; and allowing councils to sell permits. These would require amendment of the RMA.

3.3.2 Potential Benefits of Tradeable Water Permits

Introducing tradeability of water permits for allocating water can potentially:

• Establish the opportunity cost of water in different uses and locations, and within the constraints of transactions costs facilitate reallocation of water from lower-valued to higher-valued uses and from lower-valued to higher-valued locations;

• Allow decision-makers who are directly affected to decide how and where water should be used;

• Encourage conservation of water since excess permits can be sold for cash and the right to use additional water must be bought;

• Encourage transfer of permits when this is more economic than supply augmentation, thus preventing or deferring uneconomic investment;

• Facilitate decisions on whether water should be abstracted or left in-stream. Provided conservation, recreation and cultural groups are adequately funded, these groups could buy permits and leave water in-stream;

• Allow flexible ongoing responses to changes in the value of use of water e.g. a fall in the value of irrigated crops, a rise in the value of dairy farming; and

• Reduce the conflicts over allocation of water that can arise under the current adversarial system and reduce transactions costs associated with the resource consent process. A water user needs only to meet specified conditions and pay for a water permit to obtain access to water rather than rely on a consent hearing and subsequent appeals.

The extent to which a tradeable regime is superior to an administrative regime in these respects is a matter of degree, rather than an absolute difference. As discussed below, there are a number of features of water which make the allocation and reallocation of water to highest-valued uses difficult whatever regime is adopted.

Water scarcity is only a problem in some catchments, although water is scarce in most catchments at some time. Where water is not scarce, people will buy permits for their option value only (i.e. for their possible value in the future). More elaborate regimes facilitating allocation and reallocation of permits are likely to be justified only when all suitable water supplies are scarce and allocated to beneficial uses. As development of water uses occurs, there will be increasing pressure on water supplies and greater benefits from tradeability of permits. Even with scarcity, trading may still not occur because willingness to pay for water may not be particularly high at the margin, and transactions costs to negotiate purchase contracts, accommodate third party effects, and clarify rights may be large relative to the benefits. Unless transactions costs can be reduced by improving institutional arrangements, limited trading in these circumstances would not signal inefficiency.

3.3.3 Definition of Rights

The nature of the right to use water will affect the incentives for efficient water use. An efficient regime provides secure, flexible and certain property rights. A secure property rights regime affords protection against legal, physical and tenure uncertainties, enabling users to make long-term investments based on continuing access to the resource. A flexible regime allows the transfer of water between areas, uses and users over time to accommodate changes in demand and opportunities as they emerge. A certain regime ensures the rules and conditions applying to permits are easily understood and equitably enforced and that permit conditions (for example rationing of usage based on minimum flows) and constraints on transfer do not change unexpectedly.

Permits can be defined in terms of rights to use water, with the underlying water remaining unowned (as is currently the case), assigned to the Crown or Maori. Use rights may be defined as a proportion of in-flows or as volume entitlements which may have different priorities and levels of security. Restrictions on site-to-site transfers may be necessary to minimise third party effects.

Under the RMA, permits have a maximum term of 35 years. Amending the Act to allow perpetual permit would improve efficiency. Perpetual permits would better ensure that the permit holder faces the costs and benefits of decisions on the use of the resource and would avoid the uncertainty and distortions that arise as the term of a permit is reached. (The efficiency benefits of full private ownership are discussed further in Appendix A.)

In establishing a tradeable permits regime it is desirable that councils have sufficient knowledge of the availability of the resource and the environmental effects of different uses. Determining the availability of water involves research over a number of years and knowledge of the resource is likely to increase through time. It would be desirable to use improved knowledge to improve resource management. This could be achieved by allowing conditions applying to water permits to be reviewed periodically, but has the disadvantage of increasing uncertainty. Alternatively, councils could buy existing permits, or allocate additional ones if the quantities of water available change in the future. Amendment of the RMA to allow councils to sell permits is desirable.

3.3.4 Initial Allocation of Permits

A number of market and administrative approaches to the initial allocation of water permits are possible. These include historical and potential beneficial use (e.g. Colorado, United States), honouring existing rights (e.g.

Chile) or auctioning to the highest bidder (e.g. Victoria, Australia). The initial allocation of permits is likely to be a major area of conflict. Allocation mechanisms are not explicitly provided for in the RMA, which specifies only the use of the resource consent process.

As long as permits are transferable, any method of allocation (such as first-come, first-served, land-based, or outright sale of permits in perpetuity) without strings attached will allow the efficiency benefits of private ownership to be achieved, within the constraints of transactions costs. If transactions costs are high, the initial allocation may have efficiency implications. The initial allocation will have substantial wealth implications, particularly in water-short areas.

In devising any regime for the initial allocation of water permits, Treaty of Waitangi issues and the rights of existing permit holders need to be recognised as does the potential for the government to extract some of the value of private sunk investment if existing permits are auctioned.

Outright sale of water permits (assuming amendment of the RMA) would be consistent with a desire to expeditiously put control of the resource directly into the hands of those who can put it to the best use, given the likely correlation between amounts bid and the benefits bidders expect to derive from the resource. Annual tendering, on the other hand, would involve substantial uncertainty for resource users and would be less efficient than a once-off allocation.

A sale process for government assets should be designed so as not to extract value from private sunk cost investments that depend on continuing access to water. This is because governments deter future investment if they are seen to be expropriating a portion of the return to past investments after the event. The extent to which any bidding process extracts value attributable to past sunk investments depends on the status of the bidder responsible for the marginal bid. Where water permits are relatively scarce and permits for use already exist, the marginal bidder is likely to be someone with sunk cost investments. It is worth their while bidding away up to all of the value associated with their sunk cost assets since the assets may be worth little if they do not obtain water. If the marginal bid for water is made by someone who does not have investments dependent on obtaining access to a particular water supply, then the tendering process should not extract value associated with sunk investments.

The difficulty of avoiding expropriation of the value of sunk investment is one reason why auctioning of existing permits may be undesirable and 'grandfathering' of existing permits preferable (i.e. allocation at no charge). An auction arrangement is particularly suited to allocation of additional or unallocated supplies of water where complications associated with existing use do not arise.

Auction theory has been well-developed in recent years and much experience has been gained with auction techniques with such diverse commodities as offshore minerals (in the United States), government bonds, radio spectrum, fish quota (in New Zealand), and water rights (in Victoria, Australia).

In some situations the price obtained by a sale process may be influenced by the selling technique chosen, which might or might not affect economic efficiency. This could occur, for example, when there are few bidders and a significant gap between the reservation prices of the top two bidders. Successive governments have demonstrated on many occasions that assets can be successfully sold when there are just a small number of competing buyers. Importantly, no open, competitive sales process forces a bidder to accept an unfavourable return.

Before the sale of permits is allowed, the government needs to resolve whether the funds should be retained by councils or returned to central government. Allowing councils to retain the income may strengthen their incentive to minimise unnecessary restrictions on permits, to fully allocate the resource and to allocate it to the highest-valued uses. The ability to retain proceeds would provide strong incentives for councils to properly consider tradeable permit regimes. However, the same incentives may lead councils to ignore the rights and sunk investments of existing permit holders or to under-value in-stream uses. Accountability of councils might need to be strengthened to ensure that any money raised is used efficiently.

Public auctioning of water has been undertaken successfully in Victoria, Australia to sell new allocations of water to irrigators. For example, after completion of the Dartmouth Dam, 35 million cubic metres of water were available to private users. During 1988 and early 1989 the Rural Water Commission offered 31 million cubic

metres per annum of water for sale in six auctions. The auctions of fifteen-year licences were limited to private irrigators only and the maximum volume to be purchased by a single land holding was limited to 10 percent of the total volume being offered. Because the arrangements were designed to protect the position of smaller farmers by excluding urban consumers and public irrigation districts, overall economic efficiency was sacrificed to ensure acceptance of the process.

Amendment of the RMA may be necessary to enable councils to auction permits. Under current provisions, it appears that a council could not directly auction permits but it would be possible for a council to issue a permit for all of the sustainable water in an aquifer to a single entity (for example a cooperative) which could then auction rights to use.

3.3.5 Potential Difficulties with Tradeable Water Permits

The complex relationship between the different uses of natural water, and the 'public good' elements of consumption of water amenities, create potential difficulties for a tradeable permits regime. In-stream water can be used to:

• Provide cultural benefits;

• Preserve or conserve the natural environment, including indigenous fauna and flora for present and future generations;

• Support commercial fishing or farming of fresh water fish;

• Generate electricity;

• Provide recreation and tourism outputs, including provision of natural or near natural surroundings for people's enjoyment; habitat for indigenous and exotic species which are valued for fishing; and in-stream quality, flow and levels suitable for recreation and navigation; and

• Carry effluent including mining, timber milling and farm wastes.

Water can be abstracted to:

• Supply household, commercial and business consumption including farm irrigation; and

• Carry piped effluent including household and industrial liquid wastes.

A number of contracting problems can arise which may complicate the introduction of tradeable permits:

• The 'public good' nature of in-stream use of water for cultural, environmental and recreational uses may lead to under-provision for these uses in a full market regime;

• For abstractive users and for electricity generation the location of use can affect other users' access to the water e.g. simply shifting an existing use upstream can reduce quantities available for other users;

• The effect of abstractive and electricity generation uses on recreation, cultural and conservation outputs depends on the location and nature of each of the uses;

• Water supply and demands are stochastic in nature (because of factors such as weather);

• There is uncertainty about the rights and obligations of the Crown as to the ownership of water, having regard to the Treaty of Waitangi;

• Existing users have property rights which, particularly where sunk investments depend on continued access to water, should be recognised in the transition to a new regime. Other individuals may oppose existing owners enjoying the windfall gains that might arise if rights are enhanced;

• A single party might purchase all of the permits to a water system, reducing or preventing others' access to the resource or charging monopoly prices for access;

• Monitoring problems may weaken the incentives of councils to ensure that permits are enforced, and transactions recorded at least cost; and

• Councils may be concerned that a tradeable permits regime might reduce their influence relative to a control-driven regime.

The institutional arrangements adopted for tradeable permits need to deal with these complexities. These potential problems and possible solutions are discussed in more detail below.

3.3.6 Free Riding on Conservation, Cultural and Recreational Values

The public good elements of water use may be problematic for a tradeable permits regime. Public good concerns arise where non-paying users cannot be readily excluded from benefiting from the provision of an output, or where outputs can be used by one person without commensurately diminishing the scope for use by others (i.e. use is 'non-rival'). A possible result of these effects is under-provision of the amenity in question if it is privately provided.

When it is impractical to exclude non-paying users, people are not presented individually with the choices that would force them to reveal their personal valuations of the amenity. They have little incentive to honestly state what the output is worth to them, particularly if this is then used as the basis of a charge for the output. Without objectively verifiable information on users' valuations, it is difficult to judge the optimal quantity of the product to supply. A private supplier of the good may be unable to induce consumers to pay an amount equivalent to the benefit they derive.

In the case of water it may be difficult to exclude non-paying users from enjoying cultural, recreational and conservation outputs. It is possible therefore that, without a regulatory minimum in-stream requirement or government funding, reliance on private provision of in-stream flows may lead to an under-provision of conservation and other outputs. The difficulty of measuring the demand for conservation, recreational and cultural outputs makes it problematic for users or the government to choose optimally between conservation and other uses of water, although there are valuation techniques that can help with this problem. Valuing conservation, recreational and cultural outputs is a problem with or without a tradeable permit regime.

Private provision of some conservation, recreation and cultural outputs would be possible (assuming amendment of the RMA to clarify the issue of permits for in-stream use). Individuals and groups could purchase permits for in-stream water, increasing the quality of water for all. An attempt to free ride on the provision of environmental outputs would reduce outputs below the level preferred by the free-rider. At the margin, individuals may be forced to reveal their preferences and provide funding, if they want more in-stream water for conservation, recreation or cultural purposes.

Conservation, cultural and recreational outputs are produced by leaving water in-stream. Thus, private provision is possible only if permits can be obtained to leave water in-stream. The RMA provides that a resource consent lapses after two years, or after such shorter or longer period as is expressly provided in the consent, unless it is exercised. Thus, it appears that if a council specifies a period significantly in excess of two years within which permits must be exercised, private conservation groups could obtain water permits and not exercise them. There is uncertainty as to whether permits can in fact be issued for in-stream uses given the development of case law suggesting that permits cannot be issued for non-active uses. Amendment of the RMA or clarification from the Planning Tribunal is necessary.

The impact of not exercising a permit would depend on how permits are defined. If permits are defined as a proportion of in-flows, permits held by conservation groups (and not used to abstract water) would increase in-stream flows in all circumstances. Where permits are defined as different priority volume entitlements, the non-

exercise of permits that increased in-stream flows would increase the security of flows and allow other abstracters to appropriate the allocation left in-stream unless special provisions for conservation users were made. Under current arrangements, a plan change would be required to increase or decrease minimum flows. Since a plan change is a time-consuming and inflexible process, procedures would need to be changed to facilitate protection of conservation values.

Where under-provision by private interests is likely, the government can either provide the outputs itself, or fund other groups to provide the outputs. In the first option, the government could retain the ability to issue conservation orders and councils could set minimum in-stream flows. Alternatively, councils could fully allocate the flows but a government agency or the councils would hold the permits for minimum flows. In the second option, permits for in-stream flows could be allocated to private groups, or private groups could be subsidised to purchase in-stream flows. Private groups could purchase additional water permits to increase in-stream values under either option.

If minimum in-stream flows are established by regulatory means, both developers and environmentalists have incentives to overstate their preferences because they do not face the opportunity cost of the resource. If water permits are tradeable above the minimum flow level set by the regional council, the government and councils will at least obtain information on the value of water in non-conservation uses and therefore the opportunity cost of water left in-stream. If permits can be purchased for in-stream flows, conservation and other groups could increase in-stream flows above the minimum set by the councils but flows could not be reduced below the minimum.

Permits could instead be allocated for the total flow of a river, with councils or a central government agency being assigned permits equivalent to minimum flows. They could then trade the permits to maximise in-stream amenities across rivers. For example, in areas of relatively low environmental significance, all water permits could be sold, reducing the environmental amenities and allowing other uses of water to increase. The funds released could be used to purchase water permits in other rivers with more valuable environmental or other amenities. Conservation outputs could be maximised by purchasing permits in high conservation areas where competing uses of water were limited rather than high conservation areas where the value of water to other users was also high. A market approach would make much better use of information available on the competing uses for particular water resources.

Allowing the trading of entitlements would help ensure that the overall conservation value of in-stream flows was maximised and that water was allocated to the use creating the most value. This trade-off approach was adopted by the Department of Conservation and Electricity Corporation of New Zealand in the Waitaki catchment under the current regime. Electricity Corporation of New Zealand enhanced the environment in the Ahuriri River which provides black stilt habitat in exchange for having no minimum flow on the Pukaki River. The concept of a mandatory minimum in-stream flow would preclude such a mutually preferred outcome.

One option would be for the government to allocate permits to all minimum in-stream flows (and possibly all other unallocated water), and all other government-owned environmental assets such as national parks and the conservation estate, to a Crown-owned entity which could trade water permits and other assets and invest the proceeds in environmental amenities. The Crown-owned entity would have an obligation to maximise the environmental benefits derived from its ownership of environmental assets. The organisation could buy and sell permits in different catchments to maximise environmental values. It would have a national rather than a regional focus and could maximise national environmental values. Ongoing funding could be provided by the government and by groups that receive services and access to facilities managed by the Crown-owned entity.

A major difficulty with a Crown-owned entity holding all environmental assets would be in assessing its performance in achieving environmental outcomes. Given the absence of market measures, determining the marginal environmental value of different options is likely to be a complicated process. The incentive, monitoring and funding problems which are intrinsic to government ownership would be exacerbated by difficulties in measurement and could lead to substantial inefficiencies. (However, similar problems would arise if councils held permits for in-stream use. Current arrangements are problematic as well.)

An alternative to allocating permits for in-stream flows to councils or a central government agency would be for the government to fund groups purchasing in-stream flows for conservation, cultural and recreational purposes. The agents qualifying for government funding could include conservation groups, research and philanthropic foundations, Maori organisations, and possibly commercial entities such as tourism operators.

An arrangement in which a government subsidy matched funds that were privately raised could increase the accountability of conservation and other groups since organisations would receive private and government funding only to the extent that they met the needs of their constituents better than competing organisations.

A risk for groups relying on government funding is that the government might force them to compromise some of their principles in order to obtain funding. Unexpected changes to funding arrangements might adversely affect long-term management of resources. In addition, special interest groups will not necessarily reflect all of the public interests in water but may reflect their own particular preferences and uses. Councils concerned about this could themselves participate in the market although they may themselves reflect the values of particular interest groups.

Matched contribution arrangements (or taxation where externalities are involved) are used routinely for the supply of some goods. We are not aware of any situations in which these arrangements have been used for conservation-oriented water rights. Nevertheless, such an approach is one possible option for reform.

As with the option of a Crown-owned entity, there would be major difficulties assessing the performance of private groups in providing conservation, cultural and recreational outputs. Ensuring that private groups were accountable for the government funding they received could be a problem. It may be difficult, for example, to prevent a group taking over a private organisation, selling the organisation's assets and pocketing the proceeds.

The level of funding provided privately and by local and central government would determine environmental standards. An assessment of the appropriate level of government funding of conservation, cultural and recreational uses is difficult, taking into account the existing provision of national parks and other government-sponsored environmental amenities, as well as private collective provision, and the fact that conservation values may be preserved (incidentally) by other users of water (e.g. those involved in the tourism industry).

A market approach is sometimes opposed because of objections to, or measurement problems with putting a monetary value on water used for recreation, scenic appreciation, cultural sustenance or conservation.

However, there is a measurable opportunity cost to water left in-stream (i.e. the alternative value in abstractive uses) so that a monetary value for water left in-stream is at least implied. In deciding whether or not to leave water in-stream under current arrangements, the councils need to trade-off the strength of preferences for in-stream values against the opportunity value of water in alternative uses.

Determining the value of water left in-stream to those who benefit is, however, not straightforward. Unless given the option of participating in the market, individuals will not be accountable for their stated value judgments and will have incentives to overstate their preferences for particular outcomes.

The option discussed above, in which the government provides some funding to conservation and other groups and allows them to buy water permits to leave water in-stream, allows these groups to directly express their preferences by buying or selling permits. It provides incentives for these groups to make explicit trade-offs between in-stream and development values although it does not prevent them lobbying government for additional funding.

3.3.7 Water Quality

Water in streams and underground can be used to carry effluent from industrial and farming activities. The use of water to carry effluent competes with other uses of in-stream water and abstractive use. Abstraction of water reduces the ability of surface water to assimilate waste. Poor water quality is inconsistent with some conservation, recreation and cultural uses of water. In establishing water quality standards, the value of water for in-stream or abstractive uses *vis-à-vis* carrying effluent needs to be considered. If water standards are set too high, industries discharging to a waterway may invest too much in pollution control, output may be constrained and some abstractive uses may be prevented. If standards are set too low, environmental damage may result and cultural and recreational uses may suffer.

Under a tradeable water permit regime, water quality standards can continue to be set by administrative means. This requires councils to determine the assimilative capacity of a waterway (within the quality constraints imposed by the RMA) and issue discharge permits and water permits up to this limit. Councils generally do not

require discharge permits for non-point discharges such as fertiliser, animal waste, pesticide, contaminated stormwater and sediment in run-off because of the administrative cost of such an approach. Instead non-point discharges are generally handled by administrative tools such as restricting land-based activities, siting potentially polluting industries away from waterways, ensuring they operate to minimise pollution, and encouraging the planting of riparian strips.

The advantages of setting water quality through defined standards include the following: standards provide certainty to dischargers and abstracters; they indicate the suitability of a water body for particular uses (e.g. bathers know whether or not they can swim); and they can define minimum levels of water quality and quantity above which permits can be traded.

There are two major difficulties with setting water quality standards by administrative means: first, an administrative approach may not encourage the least cost reductions in pollution and, second, it may be difficult for an administrator to establish the trade-off between using water to carry effluent *vis-à-vis* competing abstractive or other in-stream uses.

Other difficulties (applying to administrative and other regimes) include the lack of knowledge as to how an ecosystem might respond to particular concentrations of pollutants; the arbitrariness of declaring as unacceptable a particular level of pollutants given that higher or lower values may not yield a significantly different impact; the observation that establishing a particular standard tends to result in water being degraded to that level; the difficulty of handling non-point source discharges that have a significant impact on water quality; and the difficulty of monitoring of standards.

The use of economic instruments may assist in minimising the cost of reducing pollution given an administratively-established water quality level. The scope for using tradeable discharge permits, or a pollution charge for controlling pollution, is discussed in Section 3.4.

Integrating effluent disposal into a tradeable water permits regime poses some problems. An option would be for councils to define the amount of water necessary to assimilate a certain quantity of pollutant or combination of pollutants, and then require dischargers to purchase water permits to leave in-stream the quantity of water needed to carry the pollutants. Others who purchased water for in-stream uses (e.g. for conservation or aesthetic purposes) might be prepared to allow their allocation of water to be used to assimilate some waste, and could on-sell the assimilative capacity to other users. Since polluters would have to purchase water permits in competition with other users, this approach could allow the value of water in different uses to be traded off. However, it does not avoid the need to define administratively the quantity of water needed to assimilate pollutants. In effect, councils would define the lowest acceptable quality of a water body through the definition of the quantity of water required to assimilate pollutants. If all permits for in-stream water were used to assimilate pollutants, the lowest acceptable quality of water would prevail. If permits were obtained to leave water in-stream for reasons other than effluent disposal, water quality would be higher than the minimum. Thus the overall quality of water would, at least in part, be determined by competition for water permits for different uses. The proposed approach would not handle non-point discharges that are responsible for many quality problems. A further difficulty would be that for every pollutant, the quantity of water needed for assimilation would vary.

The costs of improving water quality may be very high. Extrapolating from United States' experience, the costs of ensuring that all coastal and inland waters are swimmable and fishable could be in the order of $5 billion over the next 20 years.

3.3.8 Effect of Transfers on Third Parties

Transfers of tradeable permits to different locations or uses may affect third parties. For example, the availability of water may vary according to the location of take. Generally, a river has more water in it the further downstream the location. A transfer of permits upstream may result in a greater proportion of total water being appropriated at the upstream point. Moving the location of water extraction upstream reduces in-stream flows between the new and old extraction points or return points. If water is used to carry pollutants, the reduced in-stream flows might result in a higher pollution concentration and a lower quality of water for intermediate users. It may reduce conservation amenities between the two sites. Abstraction of groundwater may affect surface water flows and abstraction of surface water may reduce the recharge of groundwater supplies in ways

that vary according to the location of the abstraction. The third party effects are further complicated by the variability of in-flows. A shift in extraction downstream may be constrained by channel capacity in the case of artificial channels or races (particularly important when water can be released from storage). A change in location or use of water can change return flows to a river, affecting the availability of water to other users. At an extreme, the transfer of water out of a catchment will reduce return flows to zero.

Satisfying the burden of proof that other permit holders would not be affected by a transaction, and assuring both buyer and seller of the exact quantities involved, may in many cases, be difficult. These issues must be faced whether or not permits are tradeable.

Third party effects also arise with groundwater extraction but may be difficult to assess because the water is underground. For example, aquifers with buried stream channels are hard to map. Therefore, someone who puts a new bore into an invisible buried stream channel upstream of another user could have a significant and unexpected effect on the existing user's bore yield. Groundwater pumping may also have a substantial impact on surface water flows.

When third party effects arising from the transfer of permits are difficult to predict and provide for through general rules, it may be efficient to adopt additional precautionary restrictions.

Possible options include the following:

• The areas within which permits are traded could be restricted (e.g. to specified reaches of a river) although this limits the number of parties able to trade permits and therefore the potential benefits from trade;

• Transfers could be accompanied by side payments to those adversely affected (this is already provided for by the RMA); and

• Changes in use or location that reduce return flows could be handled by defining entitlements to water in terms of net rather than gross extraction (i.e. only the water extracted net of changes in return flows in the different situations might be traded). Giving credits for return flows would provide incentives to maximise such flows which can be used by others. However, this approach may not be appropriate for groundwater extractions where return flows may bring leached pollutants.

In many cases detailed scientific information may be needed to determine third party effects and to allow them to be dealt with effectively. In some cases, the transactions costs associated with third party effects may be sufficiently high to outweigh any potential benefits from tradeability.

3.3.9 Other Third Party Effects

A number of third party effects exist irrespective of the transfer of permits and are not exacerbated by tradeability. For example, third party effects must be considered in the initial definition and allocation of permits. Catchment management affects water quality and availability. A change from pastoral farming to forestry can significantly reduce the amount of water flowing into a river. The impact of changes in land use in a catchment on water flows could be handled by under-allocating permits and/or imposing restrictions on land use. Alternatively, a land owner could be required to obtain a water permit prior to changing land use in a way that reduced water in-flows (although this is not provided for in the RMA), and could receive a permit if land use changed in a way that increased water in-flows. Another option would be to implement a two-tiered system of permits, with lower priority permits being terminated if water in-flows reduced.

Groundwater quality may be affected by land-based activities such as timber treatment plants, old rubbish tips and gravel pits used for waste disposal and septic tank discharges. Where groundwater contamination is a risk, the location of high risk activities could be restricted or standards established for discharges. Draw-down of water in an aquifer by one abstracter can, by lowering the water table, affect the ability of others to extract water. When wells are sited close to one another localised interference between pumped wells can occur. Restrictions to prevent pumps being located close to one another and overall restrictions on abstraction can reduce these third party effects.

The risk of flood and erosion will be affected by the behaviour of permit holders, particularly where they operate storage facilities on a river. For example, the release or retention of water in a dam during a period of high rainfall could have a significant impact on flood damage although the scope to alleviate flood damage only exists if storage facilities are partially empty before flooding occurs. Consideration may need to be given to providing incentives for permit holders and operators of storage facilities to minimise flood damage.

Flood control measures can affect aquifer recharge positively or negatively, potentially reducing or increasing quantities of groundwater available for abstraction.

Third party effects arise with most property rights and are commonly handled through the definition of rights, regulatory restrictions on use, and resort to the courts to resolve disputes.

3.3.10 Variability of Supply and Use

Both water supply and use vary day-to-day, within a season and between seasons. The result is that there are varying amounts of water to meet varying demands at different points in time. Coping with the variability of supply and use is an issue both with administrative and trading regimes and moving to a tradeable regime does not overcome or exacerbate the associated difficulties. Already, sophisticated techniques are in place for defining entitlements that take account of flow variability, so definition for a tradeable regime should not present any greater problems. Possible options to cope with the variability of in-flows include:

• Defining permits as a proportion of in-flows (in the same way that fishing quota rights, for example, are defined as a percentage of the total allowable commercial catch). This approach needs to be tempered by the practical difficulties associated with constantly changing allocations and the associated monitoring and enforcement requirements; and

• Defining permits in terms of volume entitlements which may have different priorities and levels of security and may vary throughout the year. During periods of low in-flow high priority permits may still be satisfied but lower priority permits might not receive any water at all.

In defining permits, councils may limit abstractions to the total volume available, or over-allocate taking into account the likelihood that individual variations in peak use would keep demand to the quantities available. For example, in Nelson weekly irrigation water usage on the Waimea Plains was never more than 68 percent of total allocations during the one in ten year drought of 1989-90. Demand excesses could be controlled by periodic restrictions.

The definition of rights does not change the uncertainty that is an inevitable result of variable in-flows but the choice does alter the distribution of risks between parties and may affect transactions costs.

Where water storage facilities are available, and for some groundwater resources with a significant storage capability relative to through flow, management of the resource and definition of permits must take into account additional factors. With storage, a water user can choose to conserve water now and take it in the future. This requires a system of accounting for individuals' decisions, taking into account evaporation during storage, storage capacity and any constraints on channel capacity that might prevent individuals accessing their stored water. A system of continuous accounting of water use (as compared with a system in which entitlements must be taken within a year) encourages conservation where storage facilities are available.

Limited capacity of the river channel downstream from a storage facility sometimes limits delivery, complicating storage/release decisions and the definition of permits. Where channel capacity is a constraint it is necessary to have channel operating rules or a priority system which an operator can take into account in taking orders and organising dispatch.

Variability in individual users' demands relative to supply can be handled by trading or leasing permits on a short-term or long-term basis.

3.3.11 Monopoly Concerns and 'Speculation' in Water Permits

A possible concern with tradeability of water permits is that a single party could buy up a sufficiently large share of permits in a catchment or neighbouring catchments to deprive other parties of water or derive monopoly profits by restricting supply to other parties. Where parties have sunk cost assets which depend on continued access to water, there is a prospect that a monopoly supplier of water could 'hold up' asset owners and extract some of the value of the assets through the price charged for water.

In many areas there are alternative sources of water (groundwater, rainwater) or adjacent catchments, so that no party could gain sufficient market power to create concerns. For those areas where the sources of water are limited, the Commerce Act, or similar limitations to the exercise of a dominant position, could provide a possible means of regulating potential monopoly problems.

In addition, it should be noted that monopoly ownership of all water in an aquifer could overcome the third party problems that otherwise exist with the transfer of water from one use or location to another, i.e. the efficiency benefits of better handling third party problems might outweigh the costs of inefficient monopoly pricing of water.

There is sometimes concern that 'well-resourced' parties would buy up all permits at the expense of other potential water users. However, if the well-resourced parties are profit maximising, they would buy permits only if they could earn a commercial return from additional water use. Generally, a party's willingness to pay more than others indicates that the marginal return from access to water for that person is higher than to others. One cannot presume that water would always yield a higher return to a large operation such as a brewery, for example, than to, say, a small dairy farmer. Existing users with substantial sunk cost investments that rely on continued access to water (for example, electricity generators), may be prepared to pay substantial sums to obtain continued access to water. Their willingness to pay reflects the high value of water in this use given the existence of the sunk cost assets. Where electricity generators do not have sunk cost assets on a river system, their willingness to pay for water will be lower. It is important to note that under a tradeable permits regime no party is able to increase its water permit holdings unless other holders voluntarily sell at a price that is more attractive than continued ownership.

A further concern is that parties might 'speculate' in water by buying permits now and not exercising them, in the hope that profits could be made by selling them in the future. Speculation can occur whether or not permits are tradeable. When no payment is required for access to water, users may request excess volumes of water to secure possible future requirements. In areas of scarcity this may be overcome by requiring an allocation to be used in a particular period if it is to be retained. Under a tradeable permits regime, if water is valuable in a current use, there would be an opportunity cost to the speculator holding a permit and not exercising it, reducing the likelihood of speculation. There are likely to be strong incentives for the speculator to lease the water to other users in the interim. In the future the permits must be sold to realise any gains from holding the permits. Thus, if water is valuable, other users are likely to continue to have access to it throughout the period. Under a preferential permits regime, non-exercise of a high priority permit would have the effect of increasing the security of lower security permits. Even if a permit is not exercised, the water left in-stream would provide conservation and recreation benefits.

3.3.12 Institutional Arrangements

Any water allocation regime requires arrangements to define and allocate the rights to water, monitor and enforce rights, maintain a register of owners, collect information on water resource dynamics, supply, return flows, seepage losses etc, and to operate any headwater storage works (correlate all the different demands, make decisions on release from storage and convey information to users). Under a tradeable regime, trades need to be registered and third party objections to transfers heard.

Under current legislation, these functions (other than operation of headwater storage works) are generally performed by councils and, at this stage, it appears sensible for councils to retain these functions under a tradeable permits regime.

Councils' accountability for these tasks has been substantially improved by local authority reforms implemented since 1989. Councils are now required to adopt clear objectives, attempt to resolve conflicting objectives and conflicts of interest, separate regulatory functions from other functions to the extent possible, measure performance against objectives and inform local communities and, where appropriate, central government of

performance. Regional councils are required to prepare an annual plan and report describing objectives, activities and budgets.

Monitoring of the compliance of councils with annual statutory documents is the primary responsibility of the Office of the Controller and Auditor-General. The Office also undertakes broader audits of the effectiveness of other functions undertaken by councils. The Ministry for the Environment has some monitoring responsibility in terms of the RMA; Internal Affairs has some responsibilities for local government activities; and the Ministries of Agriculture, Commerce and Treasury have some interest in the efficiency with which resources under the control of councils are used. These latter monitoring arrangements appear to be informal and intermittent. The managers of councils are accountable to elected councillors who in turn are accountable to the public. Interest groups and consent holders are other parties that might monitor the performance of councils but have few avenues for correcting any poor performance that is identified. Resource management decisions made by councils can be appealed to the Planning Tribunal, which provides another level of constraint.

However, there is no agency that undertakes comprehensive monitoring of councils in performing water allocation and other functions and which also provides feedback on performance. The absence of a monitoring regime and feedback mechanism is likely to weaken the incentives for good performance by councils. Council performance might be improved by ensuring that a single agency had overall responsibility for monitoring.

Corporatisation

Alternatively, the accountability of councils might be improved by separating and corporatising the councils' water allocation functions if a more market-oriented approach to water allocation were adopted. The requirements for successful corporatisation are described in general terms in Appendix F. In most successful corporatisations, a single objective of operating as a commercial business is established and accountability arrangements are strengthened. Corporatisation of the councils' water allocation functions is likely to be more difficult than for a purely commercial operation, and because of the limited functions involved may not be worthwhile. In addition, there are interrelationships between the allocation of different resources, which may mean it is sensible for all resource management functions to remain with a single organisation.

The councils' water allocation role would involve both commercial and regulatory functions. If perpetual permits or long-term permits were established and allocated, and conservation and other groups sufficiently funded to participate in a market regime, councils' ongoing water allocation role would be limited. Councils could be responsible for researching the resource and maintaining data bases, establishing the maximum effluent-carrying capacity of water, assessing the quantity of water available for allocation, monitoring and enforcing compliance with permits, possibly hearing challenges over transfers of permits, and issuing new permits in areas where the resource is not yet fully allocated. If permits are issued for limited terms, councils would have an ongoing role in reallocating them as they expire. Policy issues could arise given the current incomplete knowledge of the resource and possible changes in technology (for monitoring the water resource, for example) in the future.

Establishing commercial charges for the services provided by a corporatised council would be problematic given the effective monopoly position of regional councils (a problem which exists with current institutional arrangements as well). The government would also need to determine whether the funds raised from selling permits could be retained by councils or accrue to central government.

Devising effective arrangements for monitoring the performance of corporatised councils in carrying out their enforcement and monitoring role would be a challenging task. Monitoring has been one of the most difficult elements of the reforms of state enterprises, particularly for organisations such as Crown Research Institutes and Regional Health Authorities which have not been organised on strictly commercial lines. Improving the monitoring of the councils' performance in undertaking their water-allocation roles is likely to require a body (or bodies) explicitly responsible for monitoring, with the necessary analytical skills backed by the political commitment required to rigorously assess performance. Commercial boards have been used to improve the monitoring of many local and central trading organisations and could be considered for the councils' water operations.

Private Sector Control

A more radical reform option would involve transfer of the rights to all sustainable water (ground and surface) to private sector organisations (including Maori groups and cooperatives of users), which would then be free to decide what to do with their entitlements.

Private control is possible, at least in part, under the current regime. A council could issue a permit for the whole sustainable water supply available in an aquifer to a single company or cooperative. That organisation could then allocate the resource through an auction or tender process. This already happens where councils allocate water to an irrigation scheme which then allocates water to its members. Trading of entitlements within such schemes is already possible (depending on the rules adopted by the private organisations involved). In the Opihi River in South Canterbury, it is proposed that a private dam company have the right to sell access to stored water. Only those holders of water permits that are tagged as being associated with the dam company will be allowed to access the released water.

Private owners would have strong incentives to ensure that water was directed to its highest-value uses, since that would yield the greatest return to the users. They would also have strong incentives to manage waterways to maximise yields and to obtain control over land in the catchment area to the extent that land use had an important effect on water values. The private owners would determine the nature of water permits, their allocation, in-stream flows and so on. Although facing the same management problems described above (i.e. third party effects etc), a private organisation is likely to have stronger incentives than a regional council to discover solutions to such problems. Regulatory oversight of rights transfers and the issue of new rights would need to be separated from the private owners, since the private owners would have a financial interest in the outcome of objections. Private owners could levy charges on land users polluting the waterway or aquifer. Enforcement of property rights and resolution of third party disputes could be pursued through the courts. The issue of liability for flood damage may need to be resolved prior to private sector involvement given the potentially large risks involved.

Management of water permits could be subject to the constraints of the Commerce Act. Some competition would be provided by other water bodies managed by other parties, and the ability of parties to relocate. Depending on the initial allocation process, transitional arrangements would be required to protect the interests of existing permit holders, and particularly those with sunk cost assets dependent on continued access to water.

3.3.13 Transitional Arrangements

In any fundamental restructuring of water permits, the position of current stakeholders would need to be protected, otherwise the resistance to change is likely to be insurmountable. Many people have invested in the expectation that current arrangements will continue. Changes to these arrangements may transfer wealth unfairly. Efficiency would be affected to the extent that individuals were more reluctant to invest in the future because of possible changes to institutional arrangements.

The protection offered to existing permit holders could take a variety of forms including transformation of existing permits into tradeable permits, buy-out of existing permits, or allowing existing permits to have a reasonably long term, say 20 years.

3.3.14 Summary

A tradeable permit regime requires the definition of rights and institutional arrangements to manage the regime. Similar functions are required whether or not permits are transferable.

Permits must specify:

- the right to water in terms of abstraction rates and priority (or as a percentage of in-flows), quality, location and return flows;

- the term of the permit (if it is not in perpetuity);

- constraints on trading to handle third party effects;

- any constraints on holdings to deal with monopoly concerns; and

- where storage facilities exist, permits could include a share of storage capacity. Permits for storage could be continuous to avoid a year-end incentive to use up entitlements. Limitations on storage capacity must be recognised.

Institutional arrangements are required to:

- allocate or sell initial permits to conservation groups and others;

- define and enforce water permits;

- enable trades;

- hear appeals;

- maintain a register of permit holders;

- collect and disseminate the information needed to operate the system;

- operate storage facilities;

- manage the catchment;

- undertake flood and erosion protection; and

- manage conservation amenities.

3.3.15 Overseas Experience with Tradeable Water Rights

United States

Transferable water right regimes have developed in the United States in the western and southwestern states where water is scarce relative to demand. Each state has its own water law and there are a multitude of agencies involved in water management and conservation.

The arrangements for transferable water rights in the United States generally require the prospective purchaser to petition the relevant adjudicating body - either the district court or an administrative agency - for permission to effect a transfer. In case of objections, the petitioner must either provide evidence of no damage resulting from the transfer, or assess the probable extent of damage to third parties. The adjudicating body rules on the type of transfer, if any, that is permissible, having regard to the evidence submitted, established precedent, and/or statutory law. Applicants usually need to prove beneficial use of the water and may lose rights if they do not use them within 10 years.

Buyers such as cities commonly buy water rights 30 years in advance of their requirements, leasing back the rights to agricultural users until the water is required for urban use.

The transactions costs associated with transfers of water rights in the United States are high. Complex legal requirements and processes constrain transfers and slow the process of transfer. The right must be fully defined before transfer is allowed. Users are required to establish their historic level of water use including historic consumptive use and return flows. In some states such as California and Arizona, surface and groundwater are managed under different regimes which has led to expensive court cases defining the boundaries between the two. The high transactions costs, and in particular the institutional constraints designed to avoid externality effects, result in the transfer or lease of only the most valuable water rights.

Australia

Most Australian states have introduced transferable water entitlements for surface water. In some cases water can only be transferred temporarily, although in others (South Australia, and on regulated rivers in New South Wales) permanent transfers are allowed. Most regimes only permit transfers within the same supply system between irrigators and include restrictions to mitigate negative effects on third parties and the environment. Such transfers are akin to transferring allocations within irrigation schemes in New Zealand, which is more easily managed than transfers outside the schemes. Water transfers in most regions have generally involved only a small proportion of total water allocated - usually less than 5 percent. In the government schemes in New South Wales, more than 20 percent of allocations were transferred in 1987-88. Initial water rights have generally been allocated free of charge, although some new allocations in Victoria and Queensland have been auctioned.

A system of tradeable water rights operates successfully in New South Wales' regulated river valleys (i.e. those with storage facilities) and irrigation areas. The introduction of tradeable rights was a response to the increasing scarcity of water relative to demand. Water users used to have virtually unlimited access to water. Now rights are defined according to a set maximum volume for a non-drought period. New users must purchase existing entitlements. For most river systems two types of rights exist - high and normal security. Except in droughts, high security holders receive all of their allocations. Normal security holders receive what water is available after allocations to high security holders and reservoir carry-over for possible future dry periods has been determined. Irrigators can temporarily alter the reliability of their supply by 'borrowing' from their water allocation for the following year. Limits are applied to the distance over which transfers occur reflecting both technical and political constraints. The costs to the government of running the river systems are recovered in part through user charges.

In many of the regulated river zones water has been transferred from hilly upper-valley reaches to more productive downstream areas with a resultant improvement in efficiency of water use.

3.3.16 Recent Developments in New Zealand

Water is scarce in many regions in New Zealand particularly during dry periods. For example, the Canterbury plains are particularly prone to drought. When water is scarce, there can be strong competition for water allocations from different activities (e.g. irrigation, hydro-electric generation, forestry, livestock and urban uses) and/or between competing users within any individual activity and in-stream flows for environmental purposes. Although permits can be transferred through the consent process, a market for trading of water permits is unlikely to develop without councils specifying the conditions for trading in a regional plan. Regional plans are able to reflect the specific circumstances of a catchment or groundwater system that are relevant in developing a tradeable permits regime and potentially make it easier for transfers to occur as permitted or controlled activities.

Several local authorities are actively investigating tradeable water permits. These include: the Auckland Regional Council (Omaha); the Manawatu-Wanganui Regional Council (the Oroua area near Fielding); the Marlborough District Council (the Wairau); and the Tasman District Council (the Waimea area).

The Oroua management plan, which encompasses the Oroua River and the connecting Kiwitea Stream in the Manawatu, was developed because of concerns that abstraction results in unnaturally low flows in the river during dry periods and exacerbates the problem of unacceptable water quality at low flows because of insufficient assimilative capacity for authorised waste discharges. Water is required for irrigation, abattoir and urban purposes and to assimilate treated sewage and industrial waste. No permits are required for livestock or personal use (as provided for under the RMA).

The plan protects the rights of seventeen existing permit holders. Further (new or additional) permits could be issued but would have a lower priority than original permits.

The plan sets limits on abstraction during low flow periods. If total river flows fall below a first threshold (based on 30 percent of mean monthly flows), no amounts could be abstracted by new users. Existing irrigators would have their individual entitlements restricted so that the aggregate usage was controlled. At pre-announced minimum flows in either the Oroua River and the Kiwitea Stream all permit-based abstractions for water would be suspended except that the Manawatu District Council would have the right to take water for urban purposes, but at a restricted rate.

The plan allows limited transfers of permits to abstract water for irrigation purposes. Permits can be transferred only:

(i) between irrigators;

(ii) during periods of flow restrictions after which permits revert to the original holder;

(iii) within the same catchment area (in the case of rights to water from the Kiwitea Stream) or within the same reach of the river (in the case of the Oroua River); and

(iv) if the Council is informed of the transfer in advance.

The first two restrictions were imposed at the insistence of the existing irrigators; the third reflected uncertainty about the availability of the resource. Only two written submissions on a draft plan, from the Ministry of Agriculture and Fisheries and from the Ministry for the Environment, supported a greater degree of transferability, but such moves attracted no support at the public meeting held by the regional council.

In the Waimea Basin of the Tasman District, the possibility of tradeable water permits was first raised with water users in 1991 during drafting of the third water management plan for the river and groundwater resources of the catchment. In 1992 the summer water resource became fully allocated and no further water permits were available for summer use. In a number of zones, new water permits have not been available for the past ten years. Potential water users can obtain water permits only when existing permits are relinquished or reduced by the council and reallocated.

The surface and groundwater resources of the Waimea Basin are well understood, providing sufficient information for setting constraints on transfers. Mechanisms for monitoring usage are well established so that enforcement arrangements which currently exist are likely to be adequate for a new regime.

While the Tasman District Council has some reservations about implementing tradeable permits in all parts of the Waimea Basin, it proposes to write provisions for transferability of permits into the management plan by 1996, which coincides with the expiry of water permits in some management zones. Transferability is regarded as less appropriate at this stage in zones where the resource is over-allocated, and in coastal areas where the sustainable limits for allocation before sea water intrusion occurs have not been definitely established.

Tasman District Council has reviewed the possible implementation of tradeability within two other water management plans in the Tasman District but has decided not to proceed because of a lack of adequate knowledge of the resource, including in-stream minimum flow requirements, and over-allocation of the resource. However, in the Motueka/Riwaka water management plan, short-term transfers between water permit holders taking water from the Riwaka River are possible. The plan requires that aggregate allocation limits be met but leaves determination of the mechanism for achieving these to the user committee.

Progress with the other management plans appears to be slower. In some instances, the local geography is more difficult. In others, difficulties of process and approach have arisen which may have impeded acceptance of the merits of tradeability.

Some of those most involved in the debate over the introduction of tradeable water permits report that the prime difficulties are generally political rather than technical. Farmers see the need for a better allocation system, but may have committed themselves to considerable investments whose value depends on the continuance of past water availabilities. This makes the initial allocation, and/or transitional arrangements, a potentially critical stumbling block. Second, farmers may fear that any new arrangement could in some way increase their exposure to the risk that local governments will unfairly favour another political constituency (e.g. urban users). For example, some may fear that farmer ratepayers' money will be used to buy permits for urban users.

Another major concern is that the sale of permits will increase costs to existing users (which would be the case if existing permits were not grandfathered in the transition to a new regime). On the other hand, those who do not currently have permits object to the apparent windfall gains that existing permit holders would realise on the sale of permits although these values are already capitalised into land values. In addition, existing users are often

organised into user committees that have regular contact with the local council whereas those without permits are generally not organised into an interest group.

There are also reports that some local authorities have been inhibited by legal advice concerning their liabilities in respect of moves to a tradeable water permits scheme. Hence they may be reluctant to be the first to introduce a tradeable permits system. It is also clear that the RMA does not facilitate the adoption of tradeable permits as well as it might.

Given the difficult and prolonged reform process which is taking place in the local government sector, of which the complexities of the RMA are just one element, it is understandable that many authorities are finding it difficult to progress the debate concerning tradeable permits. It is noteworthy in the Oroua case that the tradeable permits were not proposed until the Ministry of Agriculture and the Ministry for the Environment combined forces to oppose the local council's initial proposal to use emergency administrative provisions to address a structural water allocation problem.

In short, while current arrangements are not ideal, neither do they impose such high transactions costs that no change is possible. More progress towards tradeable permits is likely.

3.4 Use of Economic Instruments for Wastewater Disposal

3.4.1 Tradeable Discharge Permits

Transfer of discharge permits is not currently permitted by the RMA. Tradeable permits could potentially be used for the disposal of effluent into waterways although a number of serious problems are likely to limit the scope for such a regime.

In theory, trading in permits allows those producers who can reduce pollution at least cost to do so. Producers with relatively high costs of treating their effluent could gain by buying permits rather than treating their waste. Producers with relatively low abatement costs could treat their own waste and sell permits to those whose treatment costs are higher. The result is that the cost of meeting the standard is lower than if non-tradeable discharge limits are set for each producer.

A permit system would involve councils setting a quality standard for a waterway, determining its assimilative capacity, and issuing or auctioning permits entitling the holder to discharge waste or effluent, with the total number of permits being set at a level to ensure the overall standard is met. Councils could impose more stringent standards in the future by purchasing permits and retiring them, or lower standards by issuing more permits.

As with tradeable water permits, the total volume and quality of effluent allowed must be determined, discharges must be monitored, and rules established for trading.

Most industries discharge a complex mix of pollutants and different industries discharge different pollutants. Defining permits which allow effective trading is therefore likely to be difficult. The discharge of any single pollutant is likely to be insufficient to support a market in permits. Dairy farm and possibly dairy factory discharges to a river may be sufficiently similar to support tradeable permits. Transferable permits could possibly be used for septic tank discharges, where discharges pose a threat to groundwater.

A successful regime also requires adequate monitoring of discharges (although this is true of any system whereby discharges are controlled). Problems may arise where the point of discharge is not concentrated (e.g. in the case of run-off from farms). In that situation it can be difficult to identify polluters and require them to obtain a permit.

While major benefits might not be realised from a tradeable discharge permit regime in the short term in New Zealand, there seems no good reason to block the development of such a mechanism. Experimentation will not be possible as long as a tradeable discharge permit regime is not allowed by the RMA.

3.4.2 Pollution Charges

Pollution can be controlled by taxing discharges. The tax could be set at a level expected to achieve required quality standards. Different tax rates may need to be established for different pollutants. Adjustments to water quality could be made by changing the tax rate.

A pollution tax, as with a tradeable permit regime, results in discharges being reduced at least cost. The likelihood of continual adjustments in tax rates by authorities may increase uncertainty for polluting industries. A charge approach offers more certainty about price but less about quantity than a permit approach.

At a high level of abstraction, a permit-based approach might be preferable to a charge-based approach if the benefits from abatement rise faster than the uncertain marginal costs. For example, if a pollutant being released into a waterway is non-toxic up to a certain level of concentration at which it becomes lethal, whereas the cost of abatement is relatively steady, then a permit-based approach to avoiding lethal concentrations could be more efficient. If the costs of abatement increase at a greater rate than the costs of damage, a tax-based approach would result in a smaller loss from an erroneous specification of tax rate than a permit approach from an erroneous specification of quantities. As with a tradeable discharges regime, councils may face problems in determining the desired quality standard, monitoring discharges and handling non-point discharges.

3.5 Rights to Water Resources

There are some uncertainties as to the property rights of the Crown, Maori and existing users in relation to water. While it is beyond the scope of this paper to determine the relative merits of such claims, uncertainties over these issues, and how claims might be exerted, need to be taken into account in designing any reform of the industry.

3.5.1 Ownership by the Crown

The Water and Soil Conservation Act 1967 extinguished the previous common law rights of riparian owners to water and substituted an administrative regime. S21 stated "Except as expressly authorised by or under this Act ... the sole right to dam any river or stream, or to divert or take natural water, or discharge waste into any natural water ... or to use natural water is hereby vested in the Crown". The regime established an overall assumption that water was unowned and that all rights to the use of water were reserved to the Crown. The RMA continues this regime (S354 provides that the Crown's existing rights to resources are to continue) and overlays a control regime for uses of water.

At present the Crown does not obtain income from its assumed ownership of the water resource either through the sale of rights or through the imposition of a resource rent.

3.5.2 Treaty of Waitangi Claims

There is uncertainty as to the rights to water that Maori have under the Treaty of Waitangi. Any uncertainties as to future rights will tend to diminish the value of water permits held by other interests and the incentives for efficient management and enhancement of the underlying resources.

Until the Crown settles Maori claims to water resources, there may need to be interim restrictions on the ownership rights that are allocated to other water users. Existing water permits could run their allotted durations (although consideration might need to be given to reasonable expectations of renewal) and new permits allocated prior to settlement could be for a maximum period of, say, 35 years (i.e. the current maximum under the RMA) to maximise certainty for permit holders. Permits for a proportion of flows, say, 20 percent, could be for a shorter period, for example five years, so that permits would be available in the short term to settle Treaty claims. Another option would be for councils to auction off medium- or long-term rights to water to the bidder who offered to pay the highest annual lease payments, which could be paid to Maori groups as part of a settlement. This payment would be similar conceptually to a resource rental (discussed in Section 3.6). Any restrictions on ownership have an impact on the incentives to efficiently manage the resource, particularly as the term of the entitlement is reached.

An option for reducing the uncertainty for private holders would involve the Crown undertaking to compensate permit holders in full for any unforeseen costs arising from Treaty of Waitangi claims. To the extent possible,

the means of settling the amount of compensation should be agreed in advance although uncertainties as to how compensation would apply in practice would inevitably remain.

3.5.3 Existing Water Permit Holders

Existing holders of resource consents have rights and expectations which need to be recognised in any reform of institutional arrangements for allocating water. The value of existing permits is demonstrated by the premium which is paid in water-short areas for land which has a water permit.

Replacement of existing permits with enhanced rights (e.g. with tradeability, or perpetuity) would not violate the property rights of existing holders. In principle, the Crown might be justified in seeking some payment from permit holders to reflect any enhancement in the value of the rights achieved. However, designing a regime to capture only the value of any enhancement of rights is likely to be problematic.

3.6 Realisation of Value for the Crown

It is sometimes suggested that the Crown should realise value from its assumed ownership of water resources. Under an administrative allocation of permits, the Crown could achieve a return by levying a resource rent tax on permit holders. With tradeable permits, it could define water permits to include the obligation to pay a resource rent (i.e. the Crown would obtain a return through time), and/or it could sell the tradeable permits. (If the permits are defined to include an obligation to pay resource rents, the initial sale price will be lower than if there is no obligation to pay resource rents.)

3.6.1 Resource Rent as User Charge

The government could control water use by charging for water abstraction, rather than deciding on the total amount available for abstraction and issuing permits. The government would need to decide the allocation limit in setting the price at an appropriate level. By setting the price sufficiently high, the government could achieve whatever level of abstraction it desired. The charge could vary with demand and supply conditions if transactions costs allow. The charge would provide an incentive for firms to economise on water use and would assist in ensuring that water was allocated to those who value it most highly. Under Section 36 of the RMA, regional councils are able to levy administrative charges. The Auckland Regional Council reports that, since levying such a charge, a large number of users have reassessed their requirements and reduced their allocations.

Where there is reasonable certainty over the water available for allocation it is likely to be more straightforward to allocate rights to that quantity rather than to experiment with different levels of charge to achieve the same quantity outcome.

Resource rentals could also be used to fund the costs of managing and enforcing a permits regime. This approach would differ to some extent from other industries where enforcement of property rights is funded through general taxation. However, even in these industries a substantial private contribution is often made towards the protection of property rights (e.g. through securing property, burglar alarms and so on). Whether or not water users fund these costs or they are funded through general taxation is largely a fairness issue.

3.6.2 Resource Rent as Tax

It is sometimes suggested that water permit holders should pay a resource rental tax to the government. Such a tax could be levied on water permits, whether tradeable or not, and would not be designed to control the consumption of water. Proponents of resource rental taxes suggest that the tax is a tax on pure profits generated from a water permit and would not affect efficiency because it would not change the supply of the resource (i.e. the supply of the resource is not sensitive to the return received).

However, the assumption that the amount of rent generated from an asset is unaffected by the stewardship of the resource is false. Resource rent taxes impose ongoing costs and inevitably have the potential to alter behaviour. Any practicable, non-corrective, positive resource rent tax produces inefficient resource-use decisions compared with the absence of such a tax.

The quality of water and water use can be degraded or enhanced through poor or good management. To the extent that the return from enhancing the resource through good management, research or other entrepreneurial effort is captured by the government through a special tax, incentives for private owners to undertake such enhancements are reduced. The greater the prospect that returns to private effort will be expropriated, the larger are the disincentives to undertake future investment that might enhance the resource. Efficiency may be further threatened by disputes over the level of tax and through perverse incentives to increase costs rather than pay excess returns to the government.

Rents associated with water permits are likely to be capitalised into the market value of water permits when permits are tradeable or into land values when trading is restricted and the permit is location-specific. Also impounded into the value of tradeable permits or land are the quasi rents associated with sunk cost investments, the expected revenues from favourable price movements in activities using water, and new technologies that reduce abstraction costs. Offsetting these factors are any future costs, including resource rental taxes levied on the industry or any cost recovery for management of the water allocation regime. Because the price for water permits impounds the quasi rents from sunk cost investments, a positive value for water permits does not necessarily mean that the water industry is earning supernormal profits.

Arbitrary changes to existing permits through new resource rent taxes are potentially costly and inequitable. Many holders of existing permits have acquired them through purchasing land with associated water permit. The price they paid would have included the capitalised value of expected rents. Any proposal to levy resource rent taxes would diminish the value of water permits. The initial impact is a loss of wealth for existing permit holders. In the longer term, efficiency may be affected because holders of water permits will be less confident about the security of their rights and therefore more reluctant to invest in increasing the value of such permits.

Water users with investments in sunk cost assets (for example, irrigation schemes, public water supply systems and hydro-electric generators) are particularly vulnerable to the opportunistic application of resource taxes which capture the quasi rents from their investment. Uncertainty about future levels of rents will inhibit future investments in capital specific to the water industry because of the risk of the government 'holding up' the industry for the quasi rents created.

On the other hand, increased rents are likely to be generated if the government creates more robust property rights in water e.g. by extending the term of the permits or facilitating tradeability. Economics provides little guidance as to the government's entitlement to share in any benefits from creating more robust water rights. However, the difficulty of distinguishing between additional rents created by the government and by private effort suggests the government should be cautious about seeking to extract a return. The government's approach to the rents created by enhancing private rights in the past has been inconsistent - for example, although it tendered the rights to the radio spectrum, the rights of access to export markets subject to quota were gifted e.g. to the New Zealand Dairy Board for access to the UK dairy market. The case for the government capturing some of the possible increases in rents arising from the quota management regime in the fishing industry has been strongly debated since its implementation.

Other arguments sometimes suggested for the Crown levying resource rent taxes include:

• The possibility of risk sharing between the Crown and private parties;

• Resource rents may protect parties against opportunistic behaviour by the Crown; and

• Resource rents could be used to fund conservation groups to support minimum river flows.

It is sometimes argued that resource rent taxes can be used to share risk between the government and private parties in high risk activities such as mineral exploration. While a case for government involvement might be made in a highly risky activity (and even then such a case is not clear cut), a similar argument is unlikely to apply to water resources.

Once sunk cost investments in water-related assets have been made, opportunistic political pressures may arise for the government to use its coercive powers of taxation or regulation to expropriate some of the quasi rents generated. Typically this appropriation would be defended by the assertion that the private returns result from an unfair appropriation of a national resource, the rights to which had 'obviously' been allocated too cheaply.

The Resource Management Act provides further avenues for such *ex post* opportunism when resource consents and planning approvals are required.

Resource rentals are suggested as a possible way of reassuring the public that the government is obtaining a 'fair' share of any returns from ownership of water, thus reducing the pressure for opportunistic interventions. However, any benefit in terms of reducing opportunistic interventions in the future must be weighed against the adverse incentive effects of resource rent taxes and alternative ways of credibly preventing the Crown from acting opportunistically in the future.

Resource rentals could possibly be used to fund conservation and cultural values. However, this approach could only be justified if resource rentals were a more efficient way of raising taxes than general taxation. If so, there would be little reason for tagging the revenue for one use over another. Instead, funding of conservation outputs should be considered along with other possible uses of government funds.

3.7 Constraints Imposed by the Resource Management Act

The RMA imposes constraints on permits and allows only limited development of economic instruments for dealing with resource allocation. The structure of decision-making under the Act gives a greater weight to local rather than national issues. A number of other constraints are imposed by the Act which might affect water allocation. These are discussed below.

3.7.1 Constraints on Permits

Efficiency is compromised by constraints on the terms of consents and uncertainty over the conditions applying during the life of a consent. The duration of any consent to dam a river, take water, or discharge a contaminant is fixed by S123 at a maximum of 35 years. During the term of any consent, provision is made for councils to review the conditions of the consent. A review may be specified at any time in the consent or for the following purposes: to deal with any adverse effect on the environment; to require a discharge permit holder to adopt the best practicable option to remove or reduce any adverse effect on the environment or any other purpose that is specified in the consent.

The uncertainty associated with the limited life of resource consents may affect the willingness of water users to invest in sunk cost assets. Consents should, to the extent possible, match the life of such investments. The relatively short-term nature of resource consents (particularly if granted for less than the maximum period) and the provisions for a review of consent conditions are a potential problem for investments such as hydro dams or geothermal power stations where a long pay-back period for investment would normally be expected. Although the maximum period of the consent appears relatively long at the outset, economic behaviour will be adversely affected as expiry approaches. Asset owners will have lower incentives to invest or to maintain assets that have no value if a permit is not renewed.

Limited terms and review clauses allow the councils to adjust permits in the light of additional information on resource availability or individuals' preferences. Adjustments to the quantities of water could possibly be achieved through buying or selling tradeable permits. However, changes to rationing rules, for example, may not be able to be addressed through such mechanisms.

Although there generally is a presumption that a water permit once granted will be renewed, no backing for this assumption is provided for in the RMA. There is limited scope for existing capital investment and infrastructure to be taken into account when considering an application for the renewal of resource consents given that there is no specific provision in the RMA for the renewal of a resource consent. When the term of one consent expires, an application must be made for another consent. On considering the application, the same considerations apply as applied to the original consent and no allowance is made for the existing capital investment and infrastructure. Amendment of the RMA to support the presumption that a water permit would be renewed would be efficiency-enhancing. It is feasible for councils to protect existing consent holders by writing provisions into regional plans. For example, the Canterbury Regional Council's Opihi River Regional Plan provides that renewed permits do not lose their priority status, and that permits transferred in whole or part similarly do not lose their priority status.

It appears that consents could be issued for in-stream use by councils defining a long period within which a permit must be exercised. However, to remove any doubt that permits can be issued for in-stream use would require a declaration from the Planning Tribunal or amendment of the RMA. Whether or not an unexercised permit would result in additional water left in-stream would depend on how permits are defined (the result might be to increase the probability that other allocations are met).

3.7.2 Scope for Use of Economic Instruments

The RMA provides for the use of a limited number of economic instruments including tradeable permits, a requirement for monetary contributions from developers, direct negotiation with those affected by a resource-use decision, possible charges on effluent, user charges and penalties for breaches of the Act. To date, only a limited number of councils have adopted economic instruments. In some cases, economic instruments have been considered and deemed inappropriate, but many councils have not yet made a full examination of the potential role of such instruments.

The use of tradeable water permits is entirely at the discretion of the regional councils, with specific rules to be determined by the councils. The efficiency of any tradeable permits regime depends on the rules adopted by each regional council. Given that the rules for trade are generally established in regional plans which can be changed, the regime will continue to be subject to uncertainties arising from the political pressures to which the regional councils will be subject. The regional plans controlling water allocation and use are the primary method for protecting third parties from the impact of permit transfers. Limitations on the terms of the permits and review conditions also reduce the efficiency of any tradeable permits regime.

S108 empowers councils to impose conditions on the granting of resource consents. S108(1) specifically authorises conditions requiring financial contributions, bonds, registered covenants and payment of special administrative charges for purposes specified in a plan. Financial contributions provide compensation to a community from a beneficiary of a consent, to avoid, remedy, or mitigate and/or offset environmental effects of a proposed activity. Financial contributions can be required of a developer to ensure positive effects on the environment to offset any negative effects (an attempt at internalising externalities). It is too soon to determine the manner in which councils are exercising this power.

S104(6) prohibits councils from having regard to the effects of a proposed activity upon a "person who has agreed to the proposal". This has enabled those affected by a consent application to directly negotiate with the applicant for compensation for any adverse effects rather than rely upon the council to either decline the application or impose conditions to their satisfaction. This approach has been used successfully to reduce the delays that would otherwise be imposed by appeals.

It is not clear whether it is possible under the RMA to impose on water users charges that are based on effluent quantity and quality and abstraction quantity. The RMA allows charges based on management effort. If management effort relates to the quality of water allocated then charges could be levied. Amendment to the Act might be necessary to facilitate such charging.

The Act allows councils to recover reasonable administrative costs in relation to functions and services provided. The power to recover costs for processing applications for resource consents is given by S36 of the RMA. The Act gives councils considerable discretion as to the charges that can be applied, the method of application and the ability to waive all or part of any fee. Of concern is the lack of pressure on regional councils to contain costs given the statutory requirement for resource consents. There is no right to appeal the charges levied. On the other hand, there are also concerns that general ratepayers' funds are subsidising the resource consent processes which should be more fully borne by developers.

Penalties involving mainly fines or imprisonment provide an incentive to observe regulatory standards (SS338 and 339). The courts can require a person to pay someone else for any actual or reasonable costs and expenses which that person has incurred or is likely to incur in avoiding, remedying or mitigating any adverse effect (S314).

3.7.3 Local Versus National Issues

The structure of the decision-making process under the Act, in which administration is vested with local government and decisions must be made in the light of local plans and policies, risks giving a greater weighting to local rather than national issues during the consent process. Such an outcome is of concern to nationally-based organisations such as those involved in electricity generation and transmission, telecommunications operators and transportation networks such as rail.

Councils, which are accountable to local electors, might be expected to be more sensitive to local, rather than national interests. In addition, the impact of a national organisation's activities on local interests may be concentrated, providing strong incentives to object, whereas beneficiaries (users of the national service) may each be affected by only a small amount so that each individual has little incentive to take an interest in the consent process. Councils may lack the information needed to take into account national interests.

The Act provides for national interests to be addressed by the establishment of national environmental standards, the making of national policy statements, the issuing of a New Zealand coastal policy statement and the making of water conservation orders. Where a regional or district council is viewed as an inappropriate body to rule on a matter of national significance, S140 of the RMA allows that proposal to be transferred to the minister for consideration. This approach was adopted for the hearing of the air discharge permit application for the proposed ECNZ thermal power station at Stratford, given the implications for the government's climate change policy and New Zealand's obligations to reduce greenhouse gas emissions. To date, central government has made sparing use of the powers available to it under the Act.

Councils are not limited in their consideration of the effects of a proposal to the physical boundaries of their region. However, there is no guidance in the RMA as to the weight councils should give to national issues. An important weakness of current arrangements is that the instruments available to the government to ensure consideration of national issues are not required to be used.

The Planning Tribunal in its decisions has had regard to the trade-off between national and regional issues, although it is not clear to what extent decisions are affected by the balance of representation at a hearing. It is not clear how subsequent appeal courts might weigh national issues.

Given the cost of obtaining information, and the importance of representation in a political process, it seems likely that, overall, greater weight will be given to regional rather than national considerations. However, it is too early to reach firm conclusions on the potential seriousness of this bias.

3.7.4 Unitary Authorities

In some areas, the functions of regional and district councils are combined into 'unitary' authorities which may combine the responsibility for policy making, regulation and the delivery of services such as water supply.

The resultant structure potentially raises concerns about conflicts of interest and the suspicion that the authority may favour its own water-using functions over others in the granting of water permits. A similar problem arises with the Wellington Regional Council, which allocates water permits under the provisions of the Resource Management Act and is the bulk water supplier for Wellington. The potential conflict of interest in the latter case is reduced by a careful separation of the regulatory and business functions within the Regional Council (enforced by provisions of the Local Government Act). A similar approach could be adopted for unitary authorities.

3.8 Summary

Water is generally allocated through administrative decisions made by regional councils and unitary authorities. Where there are few competing demands for water relative to supply, the information required to allocate water to different users is likely to be low, and allocation of permits by regional councils is likely to be relatively efficient. The current administrative method of allocating water to end-users is, however, likely to be inefficient when water is scarce relative to demand. Under an administrative regime permits are often allocated on a first-in first-served basis and once the resource is fully allocated those with permits for low-valued uses have few incentives to transfer them to higher-valued uses.

Where water is scarce relative to demand, allocation of permits through a market approach may be more efficient than allocation through a planning regime. Greater use of tradeable permits can increase the extent to which individuals face the costs and benefits of their decisions to use water, and can harness the powerful information and incentive mechanisms of a market price system.

Whether or not trading in permits is allowed, it is inevitable that there remains a substantial role for a centralised body to research the extent of the resource, decide on the initial allocation of permits, monitor water flows, define permit rights, and enforce compliance with permit conditions. In the foreseeable future, regional councils and unitary authorities are likely to fulfil these roles.

As long as permits are transferable, any method of initial allocation without strings attached is likely to be efficient within the constraints of transactions costs. Auctioning of existing permits may be undesirable because of the potential to expropriate the value of private investments. 'Grandfathering' of existing permits may be preferable. Auctioning of permits is particularly suited to the allocation of additional or unallocated supplies of water. The sale of water permits is currently constrained by the Resource Management Act.

Adoption of a tradeable water permits regime (as with other regimes) requires resolution of a number of public good and third party effects. Experience with tradeable water rights in other countries indicates that these problems can be overcome sufficiently to enable net benefits to be achieved from a tradeable water permit regime when water is scarce.

Reliance on a private market without a regulated minimum in-stream flow may lead to the under-provision of in-stream water for conservation, recreation and cultural purposes. This could be addressed by councils setting minimum flows or retaining permits for in-stream use or allocating such permits to a government agency or to conservation and other groups (along with additional government funding). The permits could then be traded to maximise conservation and other in-stream amenities across water systems. Allowing groups to trade entitlements for in-stream water would help ensure that the overall conservation value of in-stream flows was maximised and that water was allocated to the use creating the most value.

Limited tradeable permit regimes are possible under current legislation. Several regional or unitary authorities have or are actively investigating or implementing tradeable water permits. These include: the Auckland Regional Council (Omaha); the Manawatu-Wanganui Regional Council (the Oroua area near Feilding); the Marlborough District Council (the Wairau); and the Tasman District Council (the Waimea area).

Progress in other areas is slower. In some cases, water is not scarce or the local geography is less conducive to a tradeable permits regime. In others, difficulty of process and approach have resulted in resistance to reform, and some councils have not examined the potential for a tradeable permit regime.

The potential gains from a tradeable permits regime could be strengthened by amending the Resource Management Act. Desirable changes include:

• Removing the 35-year restriction on the term of water permits (assuming resolution of Treaty of Waitangi issues);

• Clarifying that permits can be obtained to enhance in-stream flows (i.e. that it is not necessary for permits to be exercised to remain valid);

• Explicitly allowing councils to tender permits; and

• Ensuring that national and local issues are properly weighted.

Section 4.0 Efficient Pricing of Services

4.1 Introduction

In this section we examine the potential efficiency gains from greater use of marginal-cost pricing in the water industry. We begin in Section 4.2 by outlining current pricing arrangements and discussing problems of using a fixed charge for services. Section 4.3 describes how a marginal-cost pricing regime could be applied to the water industry and the possible benefits of marginal-cost pricing. Section 4.4 discusses possible reasons for deviating from marginal-cost pricing principles in the water industry. Alternatives to the use of prices for controlling consumption are briefly examined in Section 4.5. A summary is provided in Section 4.6.

4.2 Current Pricing Arrangements

4.2.1 Overview

A variety of pricing policies exists at both the retail and bulk levels of water supply. Watercare currently charges its territorial authority customers on a per unit of water consumed basis. Watercare has developed a marginal-cost based tariff, adjusted downwards to limit Watercare's income to cost recovery as currently required by the Local Government Act, but has yet to gain acceptance from its customers. The Wellington Regional Council recovers the estimated costs of bulk water supply through a charge based on the proportion of the total water consumed by each of the four territorial authorities.

Territorial authorities commonly levy fixed charges on their domestic customers with no usage charge. The cities of Auckland, Manukau, Waitakere, Papakura, North Shore and Rodney base their residential charges on metered consumption. Christchurch has almost completed the installation of meters city-wide and is expected to introduce charges based on metered consumption in the next three to five years. A number of other authorities are investigating the possibility of metering, although political resistance to change is sometimes high. Most suppliers meter their industrial and major commercial customers and charge for water consumed, with an annual supply charge sometimes applying as well. However, even when charges are based on usage, the full costs of supply, including the opportunity cost of capital, are sometimes not taken into account.

Sewerage charges are generally capital-value based or fixed. Where trade waste charges are levied, they are generally at least volume based and sometimes both volume and quality based. Drainage charges are rarely charged for separately.

4.2.2 Implications of a Fixed-Rate Regime

The advantages of a fixed-rate charging regime are that it is easy to administer and easy to understand; it provides certain revenues to the utility; and often requires little policing. A fixed charge, particularly if based on the capital value of a property, may reflect the fire protection value of a system.

However, where prices for the marginal use of water or sewerage services are set at zero as is the case with fixed charges, or where the full opportunity costs of consumption are not taken into account, there is little incentive for users to take proper account of the costs of supplying water or sewerage services. Consumption of the services will be excessive with consumers facing no penalty for wasting water. There is little incentive for individuals to identify the true cost of water and sewerage services when there are no opportunities to save money by taking responsibility for reducing water consumption.

One result will be that capital investment is undertaken too soon. For most cities significant headwater works are needed to collect and store water and treat it for human consumption. The cost of bringing forward capital expenditure may be high for both owners of utilities and their customers. If investment is not brought forward, excess demand has to be handled by rationing of demand through non-price means.

Excess consumption may have substantial adverse environmental effects. Increased storage facilities result in the inundation of land with consequent environmental impact. Abstraction of water from streams will reduce in-stream flows, potentially threatening stream ecology. Excessive draw down of underground aquifers can have a major impact on the sustainability of the resource, can result in salt water intrusion and can damage the structure

of the aquifer. Inefficient water pricing in industrial applications can lead to excess use of water to dilute effluent. Prices set below costs for effluent disposal may lead to pollution of waterways.

4.3 Marginal-Cost Pricing

4.3.1 General Considerations

In simple terms, when prices reflect the marginal cost of a particular good or service they encourage efficient resource use by ensuring customers pay an amount equal to the cost they impose on the economy.

Marginal-cost prices for water and sewerage services should include the costs of depleting natural resources, the opportunity cost of using water, the cost of operating, maintaining and replacing the supply system, and the opportunity cost of capital. A failure to include the opportunity cost of capital into marginal cost will tend to result in over-investment in facilities. Where there are a number of dimensions to the provision of a service, marginal-cost prices should be established for each dimension. Thus, establishing efficient prices may require separate calculation of the marginal costs of connecting a new customer to the system (with, in principle, capacity and deliveries held constant); the costs of increasing deliveries by one unit; and the cost of adding another unit of capacity to meet peak demand.

One-off customer connection charges and meter installation should, in principle, be priced at their marginal cost and levied as a capital sum. Continuing fixed costs incurred per customer should be charged as a fixed charge per customer per billing period and may vary by customer group, size of connection etc. Administrative and cost considerations will dictate the extent of averaging that is desirable across customer classes. Usage costs should include both the direct costs of providing water (largely power and chemicals) as well as any capital costs brought forward by the demand (i.e. the present value of all of the avoidable or incremental costs, whether they are incurred today or in the future, that are attributable to today's demand).

When old and new customers are jointly using facilities, there is no economic reason for distinguishing between them. If increased demand results in a need to expand the supply system, then both classes of customer should contribute to the costs. The old customer's 'last' (marginal) unit of consumption is as much responsible for system expansion as the new customer's 'first' unit.

Common costs are a feature of network industries because the unit of production (the provision of part of the network) is typically greater than the unit of sale (each customer may use only a portion of the network capacity). Common costs also arise when the same inputs are used to produce more than one product, for example water pipelines provide water both for fire protection and for domestic consumption. The fact that services are provided in common does not necessarily mean that definable shares of the common costs cannot at least in part be causally attributed to each. When producing one product uses capacity that could be used to produce another, the production of the first product involves the marginal opportunity cost of producing the other, and can be estimated as the amount the alternative user would pay for that capacity. If there are common costs which cannot be attributed to the marginal cost of a particular service, then marginal-cost pricing may not allow total costs to be covered.

If there are true economies of scale in the provision of water and sewerage services, pricing at marginal cost may not allow total costs to be covered. Where marginal-cost pricing does not allow a firm to recover its total costs, prices must average above marginal cost. The economics literature suggests two broad approaches which are relatively efficient: Ramsey pricing and multi-part tariffs. These are discussed in Appendix D.

While there may be some economies of scale in the water industry associated with pipeline construction and treatment plant, overall economies can be easily overstated given the increasing costs associated with new investment in water storage facilities and in expanding the distribution system, and the environmental costs of water usage.

Actually establishing marginal costs for pricing purposes is not straightforward because of the difficulty of identifying and measuring the relevant costs. In particular, marginal costs are forward looking and take account of changes in future costs and the costs of unmet demand.

In practice, it is difficult if not impossible to calculate with any precision the marginal cost of producing a unit of almost any good or service. Hence it is generally not efficient for firms to attempt to price exactly at marginal cost because the information costs of doing so would be excessive. Moreover, if marginal costs vary markedly over time or among different units of output, comparable fluctuations in prices may disrupt consumers' consumption and investment plans. Consumers may prefer to pay for greater price stability.

For these reasons, pricing at average variable cost or average long-run incremental cost is likely to be a practical alternative to short-run marginal-cost pricing. The principles of efficient pricing are discussed in more detail in Appendix C.

The objective of adopting marginal-cost pricing is to improve the use of resources; it is not an objective in itself. In assessing the advantages of moving towards marginal-cost pricing, the benchmark is not some 'perfect' form of marginal-cost pricing but feasible alternatives including current arrangements. After all, setting prices with precision at the margin is difficult in most industries, yet reasonable proxies for marginal cost are generally developed.

Marginal-cost pricing of water and sewerage services can only be implemented if individual consumption is measured. This requires a substantial investment in metering of individual properties. In determining whether there are benefits from reforming pricing, the measurement costs of metering water and sewerage should be taken into account. It is possible that the benefits of marginal-cost pricing are outweighed by the costs of measurement for some supply areas. In making this assessment, one must also take into account the additional benefits of more accurate monitoring of the distribution network that is achieved by metering. In particular, a major benefit of metering is that it substantially improves the ability of the utility to monitor the condition of its pipes and to identify substantial losses of water from the system. In the Wellington metropolitan area around 26 percent of the total water supplied is unaccounted for (i.e. lost from the system). More accurate metering can identify leakages which if repaired could reduce this loss to below 20 percent. Putting a price on environmental values retained as a result of constraining demand for water may also make the introduction of metering more attractive.

For services such as disposal of trade waste and drainage, it is often technically infeasible to quantify precisely the volume of services consumed by a household or business enterprise. Even if technically feasible, it may be too costly to measure the volume and composition of sewage discharged from dwellings. Once water is metered, metered usage could be used as a proxy for wastewater treatment services. Changes in technology are likely to reduce the costs of metering of water, and of sewage.

4.3.2 Marginal-Cost Pricing of Water Supply

Capital costs dominate the provision of water services. The industry is capital intensive, requiring extensive investment in storage and water extraction systems, pipelines for the delivery of water, as well as treatment plants for purification of drinking water. Costs are incurred in the loss of value of land that is inundated during the creation of storage facilities and in the construction of bores for abstraction of ground water. Because of economies of scale in system enhancement, investments are generally made in discrete lumps providing capacity in excess of what is required in the immediate future. There are few alternative uses for the assets once an investment has been made. This exposes the investor to the risks of 'hold-up' following investment.

When there is surplus capacity the marginal cost involves mainly pumping and water treatment costs and the opportunity cost of capital. As the system becomes more constrained, marginal costs include the impact of current demand on the future need for capacity, or the costs imposed on alternative users who are crowded out (i.e. the opportunity cost of demand that is not met).

Marginal cost may vary during the day or between different seasons. For example, if a person takes a shower the direct costs involve the pumping and treatment of water and sewage. However, these direct costs may be a relatively small part of the marginal cost of the shower. There may be other components of marginal cost, depending on the time of day. If it is taken at a time when demand for water is at its peak, then the decision to shower will bring the water pipeline system closer to its maximum capacity and may bring forward the time at which the system has to be augmented to cope with demand. Bringing forward such expenditure is costly and should therefore be part of the marginal cost. On the other hand, a shower taken during non peak times may

have no effect on the date at which various parts of the system need reinforcement, and therefore the future capital cost component of marginal cost will be zero.

Demand for water increases during the summer, which is often the period in which water is most scarce. A failure to price summer water adequately is one of the factors contributing to pressure to augment supply systems. Empirical studies also indicate that the price elasticity of demand for water during these peak times is greater, indicating a higher proportion of discretionary use of water during peak summer periods. Increasing charges during peak periods may therefore be appropriate, or during periods of water in-flow shortage.

Seasonal charging, or differential charging during periods of shortage, would require that meters be read before and following the different seasons, or that the meters record such information over time, thereby increasing the costs of metering. Charging for peak use during the day would require more sophisticated meters than those required for charging a single per unit rate irrespective of time. Whether or not such additional sophistication is worthwhile will depend on the relative costs of supplying in the different seasons and the impact that differential pricing is likely to have on demand.

The same facilities serve a number of different customers (household, commercial and industrial) and services e.g. drinking quality water and water for public fire protection. In those circumstances it may be difficult to attribute the costs of expanding the system to particular customers i.e. there are 'common costs' so that marginal-cost pricing may not allow total costs to be covered.

A two-part or multi-part tariff can be used to smooth pricing fluctuations or ensure total costs are recovered if economies of scale or common costs are important. The use of two-part tariff regimes may be limited by their unpopularity with customers if fixed charges are high relative to usage charges. Two-part tariff regimes are commonly used in the electricity and gas industries, and in the water industry where consumption is metered.

The increasing scarcity of water and the high costs of enhancements to the distribution systems mean that the long-run marginal cost of supply is often increasing. In many such circumstances, pricing at marginal cost will ensure that total costs are covered or nearly covered.

Water is provided for public fire protection. The value of the latter service to 'users' is not so much related to the water used but to the value of the properties protected. To provide fire protection, water utilities must invest in more plant capacity than is required to supply direct users. This investment could be compensated by the fire service, insurance companies, local councils, or individual property owners. When a two-part tariff is used, the fixed charge could be based on the capital value of the property providing a proxy for the fire protection received.

4.3.3 Marginal-Cost Pricing of Sewerage

It is likely to be excessively costly to measure the discharge of effluent from residential and smaller commercial properties. Since there is a reasonably strong correlation between the household's water consumption and the volume of effluent discharged into sewers, it may be efficient to base the sewerage charge on water usage. Any shortfall in revenue could be made up through an annual access charge. Demand for sewerage services may be less influenced by prices than the demand for water because there is less discretionary use of the associated services (c.f. for example, the use of water for gardening). There appears to be only a weak linkage between the number of plumbing fixtures and usage.

Calculation of the percentage of water presumed to be returned to the sewerage system may prove contentious. Hunter Water Corporation (an Australian company) implemented a sewerage charging regime based on a discharge factor reflecting the amount of water entering a property that is discharged as sewage. Sample metering of inside and outside taps of residential properties established that approximately 50 percent of total water consumed was discharged to sewers. In the United Kingdom, Anglian Water International base their sewerage tariff on an estimated 90 percent return of water.

The use of water metering as the basis for sewerage charging would require minor changes to the Rating Powers Act and/or the Local Government Act.

For industrial properties where the volume of effluent discharged is large, it is likely to be efficient to levy specific usage charges based on the volume and concentration of effluent discharged.

4.3.4 Marginal-Cost Pricing of Drainage

The drainage system involves transportation of stormwater to numerous discharge points in streams, and the sea. Generally in New Zealand, stormwater is not treated prior to discharge and is not therefore piped to a central point prior to release to the environment.

It is likely to be infeasible to measure directly the quantities of drainage services used by property owners. However, that does not preclude the use of proxies for marginal cost such as the proportion of a property built over and the distance to the point at which wastewater is returned to the environment. Properties subject to flooding could be subject to additional charges. Such charges could oblige consumers to take into account the cost of providing drainage in their decisions on land use and building design. The result may be to encourage more intensive use of land and less use of flood-prone land, thereby reducing the total area to be drained.

4.3.5 Welfare Benefits of Marginal-Cost Pricing

Estimating the gain from more efficient marginal-cost pricing is difficult, partly because of the difficulty of measuring marginal costs and partly because it depends on the position and shape of the demand curve which is also difficult to determine. Nevertheless, there can be allocative efficiency gains by moving prices towards marginal cost, even if they cannot be set precisely at marginal cost.

The extent of any gain from marginal-cost pricing will depend on the responsiveness of individuals to water and sewerage charges. If price elasticities are, and are expected to remain, quite small, then the case for marginal-cost pricing is weaker, since the distortions from non-marginal-cost pricing are lower.

The effect of a given price increase on consumption of water in a given supply area depends on the responsiveness of the demand for water to prices (i.e. the price elasticity of demand). Overseas studies indicate that for domestic users, the price elasticity of demand is typically in the range -0.2 to -0.4. (If the elasticity is -0.3, a ten percent increase in price would result in a three percent reduction in consumption.) For industrial users the equivalent range is -0.4 to -1.0. For agricultural users there is higher variance (-0.4 to -1.5). Estimates of income elasticities for all classes are in the order of 0.5 to 1.0. While individual studies vary in their estimate of elasticity, they generally point to the demand for water being inelastic (i.e. the percentage change in quantity is less than and inversely related to the percentage change in price.) Nevertheless, responsiveness appears to be sufficient to suggest that gains from pricing reform are achievable.

The elasticity of peak demand appears from research to be 30-100 percent higher than non-peak demand i.e. the elasticity of demand for water in summer is higher than in winter. This difference arises because in summer there is greater outdoor use of water which is generally more discretionary than the indoor winter use of water. Water demand is also affected by income and climate, with water conservation campaigns appearing to have little impact unless backed with higher prices. It appears that households are sensitive to the total water and sewerage bill, as well as to marginal prices.

The impact of raising usage charges is likely to be greater in the longer term than in the shorter term. This is because it takes time to develop substitutes for water and to incorporate them into physical assets. For example, an increase in water usage charges may result in attempts to design washing machines that use less water and it would take time for people to replace older washing machines with more water-efficient machines. The rate of adjustment of water use over time appears to be slower for peak use, reflecting the greater stock of water-using assets used during peak times.

Because water consumption responds to pricing, a move to explicit charging is likely to lead to changes in water and sewerage service consumption patterns. A reduction in consumption of water reduces the direct costs of constructing storage and distribution facilities. In addition, reduced water consumption reduces environmental costs by delaying the inundation of land by new storage facilities and postpones or prevents damage to rivers, streams and the ecology of valleys downstream from water storage. Reduced water consumption and sewage production may alleviate problems of controlling pollution of waterways and the ocean. However, a reduction in

hydraulic loadings in sewerage systems can increase sedimentation, hydrogen sulphide generation and clogging and must therefore be planned for.

Watercare and the Auckland City Council investigated the impact of metering on demand by comparing consumption by a section of Auckland city domestic consumers who were not metered with those who were. The results of the trial indicated that non-metered domestic consumers used around 35 percent more water than metered consumers. A study prepared for the Wellington Regional Council by Works Consultancy suggested that residential metering would reduce residential consumption by 20 percent and lead to a reduction of up to 50 percent in peak daily consumption, if the experience of other New Zealand cities that have introduced residential metering is applicable to Wellington. Around half of the savings would result from reductions in household use and half from the discovery and repair of leaks on both private property and in the supply pipe between the street main and stopcock. The water meters were estimated to increase costs by 6 percent. It was predicted that 60 percent of ratepayers would pay less and 40 percent would pay more for their water. However, it was concluded that while water meters could be a very significant demand tool, the relatively abundant supply of water available in Wellington and the falling consumption over the past four years had contributed to reducing the urgency of installing water meters.

Hunter Water Corporation's experience suggests that introducing metering reduces discretionary rather than non-discretionary use of water; in particular, high users reduce their consumption markedly whereas small users make little saving. Significant savings are also achieved in reducing the ratio of peak week to average week consumption during summer. Overall summer peaks served by Hunter were reduced to around 50 percent of those recorded prior to metering.

Metering also significantly improves information on water flows which allows utilities to reduce the unaccounted-for water component. Hunter Water Corporation reduced its unaccounted-for water component from 28 percent to 18 percent between 1986 and 1992 through metering. Similar savings are anticipated in New Zealand. For example, it is believed that metering could reduce Wellington's unaccounted-for water, estimated at 26 percent across the Wellington supply area, to 16 percent.

Few empirical studies have estimated the magnitude of the efficiency gains that could be achieved by moving to a more efficient structure of prices for water. Crew and Kleindorfer estimate that the welfare gain from a hypothetical utility moving from time invariant average-cost pricing to marginal-cost pricing could improve welfare (consumer surplus) by around one percent. This contrasts with Brown and Sibley's results which suggest static efficiency gains in the order of three to ten percent, with the lower gains being achieved by Ramsey pricing and the higher ones by multi-part tariffs. Renzetti, in a study of a major water utility in Canada, found that welfare gains of around four percent were possible with a move to seasonally differentiated pricing. In this study the cost of introducing differentiated pricing (i.e. metering etc.) is included in the calculation of the surplus achieved, and the benefits from increased leak detection and any impact on sewerage services are ignored.

Despite the advantages of marginal-cost pricing, it must be realised that there are limits to the benefits that can be achieved through pricing.

• The elasticities of demand for water for some customers may be low so that sophisticated charging mechanisms are not worthwhile. If customers are unresponsive to prices, then the distortions created by prices that deviate from marginal cost would be relatively small;

• The more complex the charging regime, the higher the proportion of customers that do not understand it and therefore do not react to the signals it provides;

• Given the need for a supplier of piped services to deliver a single quality of product, there are limits to the way pricing can allow consumers to signal preferences about the quality of water; and

• During periods of drought, prices could in principle be raised until demands equal supplies, thereby rationing by price. However, a community may be unwilling to accept this because of the resulting hardship for poorer consumers.

4.3.6 Increasing-Block Tariff

The increasing-block tariff is sometimes proposed on income distribution grounds, based on the assumption that wealthy people use more water than poor people, or to ensure that all customers have access to a basic minimum quantity of water. This tariff arrangement is quite common in developing countries, but is less common in developed countries. Initial blocks of water are charged at zero or low prices with higher prices charged for additional blocks. The increasing-block tariff can be designed as a variant of marginal-cost pricing. If the highest rate is set at the marginal cost of production, and a reasonable number of consumers face this charge, then an increasing block tariff may be more efficient than a fixed levy.

This increasing-block tariff arrangement involves efficiency costs to the extent that significant numbers of customers consume only within the low price blocks. For example, if prices are zero for the initial block, and a consumer's consumption is within that block, he or she will have no incentives to conserve water usage within that allocation. For efficiency to be maximised, the price for each consumer's marginal consumption should be set at marginal cost. It is irrelevant (in efficiency terms) whether the consumer's consumption is large or small.

The arrangement increases the potential for politicisation of rate-setting and may result in perverse results if applied to industry. For example, a merger of two companies may increase the overall charges borne *vis-à-vis* their separate operations. Customers that do not use all of their low cost allocation for their own consumption may attempt to on-sell water to other consumers if the costs of connection do not outweigh the benefits. This might increase the number of consumers whose decisions are influenced by the marginal cost of consumption (a unit of water not consumed could possibly be on-sold at a price close to the marginal cost) but may be contrary to equity objectives.

Under an increasing-block tariff arrangement a utility may fail to cover total costs and need to make up those costs through other charges. Depending on the approach adopted, charges levied to cover total costs may also involve efficiency costs.

4.4 Possible Reasons for Deviating from Marginal-Cost Pricing

4.4.1 Measurement Costs

Usage charges make sense only if the use of water and sewerage services can be metered cost-effectively. Metering of water to households has become increasingly economic as a result of technological change, but direct metering of sewerage and drainage is not yet economic.

Analysis carried out for the Wellington Regional Council indicates that metering is one of the best options for balancing the supply of and demand for water in the Wellington region. The benefits of metering were found to exceed the costs even though the beneficial impact on the capital works required for the reticulation system was not taken into account. Because distribution systems are designed to handle peaks, and pricing is expected to reduce peak flows, metering is likely to reduce the need to upgrade mains where capacity constraints are faced.

While metering of domestic sewage is rarely carried out because the benefits do not outweigh the costs, proxies for consumption of sewerage services (a percentage of total water consumed) and drainage services e.g. areas of properties, proportion of properties that have been built over etc. can be used. Some of the capital costs of drainage and sewerage systems may be paid by property developers.

Measurement costs are no longer so high as to justify a zero usage charge for services, but do justify a policy of not attempting precise measurement of some elements of the services provided. For example, there are numerous factors that affect the marginal costs of providing water and sewerage services to particular properties, such as the amount of pollutants discharged with wastewater, the lengths, physical characteristics and state of various segments of pipelines and sewers servicing the property, whether the water is used internally or for watering gardens and the geography of the region. It is too costly to determine the precise marginal costs for each property and therefore there will be divergences between usage charges and marginal costs. Metering costs are likely to continue to fall through time, improving the economics of more accurate metering.

4.4.2 Public Goods and Spillover Effects

A possible argument against the proposed commercial pricing of water and wastewater services is that the services have some public good elements so that it might not be possible or desirable to fully recover costs (i.e.

it is not possible to force consumers to pay for the benefits they receive) and insufficient services will therefore be provided. Public goods have the characteristic that it is not possible to exclude others from deriving benefits from them and also that consumption by one person does not preclude consumption by another.

Urban water is largely a private good, with few non-contracted effects. Consumption is excludable (a person who does not pay cannot obtain the service) and consumption by one person will prevent consumption by another. Environmental costs should be factored into the marginal cost of services. Public benefits arise to the extent that a high quality water supply prevents transmission of disease. However, individuals are likely to value a high quality water supply that is disease-free and be prepared to pay for it. Regulation of water quality (discussed in Section 6) provides an additional instrument for handling this potential externality.

Sewerage services are largely private. However, the disposal of sewage once it leaves a property has some public good elements in that discharges of effluent from a private property directly into the environment would impose health and other costs on neighbours. This externality is probably best handled by regulating to require sewage to be discharged to sewers or septic tanks. Externalities may also be involved in the treatment of sewage prior to disposal to the environment. These externalities are handled by the requirements of the RMA.

Drainage of private property is also a private service. Some aspects of the drainage system have public good characteristics, for example drainage of the streets and roads. It may be sensible for the latter services to be funded by rates levied by the local authority rather than to attempt to identify beneficiaries of drainage services. Drainage services used by one person may provide positive or negative externalities by reducing or aggravating flooding for others, complicating the efficient pricing arrangements.

4.4.3 Equity Considerations

It is sometimes suggested that marginal-cost pricing should be modified on equity grounds. A number of concepts of equity exist, with each having different implications for the approach to pricing that might be adopted. The OECD, for example, noted the following equity arguments:

• First, customers may have made irreversible decisions on the basis of charges and costs as they were in the past. Changes in tariff arrangements may impose unfair wealth losses;

• Second, water supply and waste disposal are basic human needs and no consumer should be prevented by income considerations from enjoying the benefits of water;

• Third, customers should pay the same per unit of water regardless of its cost, or should pay the same total amount regardless of the amount they actually use; and

• Fourth, people should pay according to the economic costs which their demand imposes on the system.

The first argument concerning the impact of pricing reform on the distribution of wealth between members of the community, particularly given the sunk cost nature of much investment in the water industry, is likely to be an important political consideration in any price reform. Any change in institutional arrangements can affect the future stream of income generated from assets and the entitlement of individuals to share in those returns. Pricing reform may result in some customers gaining and others losing, or all customers losing with ratepayers gaining.

A study of the impact of changes to water tariffs on households undertaken for the Wellington Regional Council concluded that "of those houses that would be worse off [from a change to usage-based charging], an assessment of the relationship to household expenditure suggests that for most households the cost increase would be affordable". The study suggested that "1.5% of total households in the Wellington metropolitan water supply area could face real hardship if they were charged increased water costs".

Thus while the structure of prices in the water industry may affect wealth distribution, few low income households would be made worse off by a change to more efficient pricing.

In relation to the second argument, it is true that a small portion of water consumed is essential for survival. However, other products such as food are equally important for survival yet provision is not subsidised. If there are real concerns about the ability of some families to pay for water, this should be addressed directly through income support, rather than through sacrificing the cost saving and environmental benefits achievable by reform of pricing arrangements.

The third concept of equity suggests it is fair to shift costs from one group to another. However, apart from the efficiency costs, this can have perverse effects. For example, if costs are shifted to industrial consumers the result could be reduced output, lower employment (unless wages are forced down) and/or higher prices for products. These outcomes may also be inequitable. Equalisation of prices or total changes may lead to other undesirable effects, for example failing to charge more to distant consumers could contribute to urban sprawl. Where charges are below the cost of service there may be pressure for over-provision of services. Prices that are too high for other consumers would result in consumers being forced to forgo consumption when they would have been willing to at least pay the costs to the economy of providing the water or sewerage services.

The concept of equity that suggests it is fair to pay according to the amount consumed and the costs imposed on the community by that consumption is consistent with economic efficiency. This approach also gives the customers the ability to influence the amount they pay by changing the amount or pattern of their consumption.

4.5 Alternative Approaches to Controlling Water Consumption

In the absence of usage charges, water consumption can be controlled through quantitative restrictions such as prohibitions on the use of sprinklers for watering gardens and mandatory installation of dual flush toilets. The problem with such restrictions is that they do not take into account individuals' preferences. For example, a keen gardener might put a high value on access to water, whereas others might be quite indifferent. The costs of such restrictions, in terms of satisfaction, are therefore unequally distributed. In the absence of pricing for water, there may not be strong incentives to use a dual flush toilet once it is installed. In comparison, rationing by higher prices minimises the burden of adjustment because those who value marginal units of water lowest will curtail consumption first.

Local governments often adopt publicity campaigns to persuade people to conserve water. Such campaigns may have some effect on water conservation particularly in the short term but are largely ineffective except during a crisis situation such as the recent drought in Auckland, during which savings in water consumption of up to 25 percent were achieved. Nevertheless, conservation is more likely to be effective when usage charges are set appropriately. The reason is that with an appropriate pricing regime people have not only better information about ways to conserve water, but also have a financial incentive to apply this knowledge. This observation is borne out by experience with electricity savings achieved during the 1992 shortage in New Zealand. Savings achieved with the introduction of a rudimentary spot market and the associated financial incentives resulted in much greater savings than achieved in the past. Greatest savings were achieved by the Dunedin supplier which was the only organisation to pass savings directly to individual customers.

4.6 Summary

Most utilities in New Zealand do not meter water for domestic or small commercial customers. Service charges are usually fixed, with no charge per unit of water used. Large commercial and industrial customers are usually metered and charged on the basis of usage. Sewerage charges are generally fixed.

Where prices for the marginal use of water or sewerage services are set at zero (as is the case when only fixed charges apply), or the full opportunity costs of consumption are not taken into account, there is little incentive for users to take proper account of the costs of supplying water and sewerage services. The result is that too much water is consumed, capital expenditure is brought forward, and greater environmental damage incurred.

When prices reflect the marginal cost of a particular good or service, they encourage efficient resource use by ensuring that at the margin customers pay an amount equal to the cost they impose on the economy.

Marginal-cost prices for water and sewerage services should (within the constraints of measurement) include the costs of depleting natural resources, the value of water in alternative uses (i.e. the opportunity cost of water), the cost of operating, maintaining and replacing the system, the opportunity cost of capital and the capital costs

brought forward by demand. The capital costs should be calculated as the present value of all of the avoidable or incremental costs, whether they are incurred today or in the future, that are attributable to today's demand.

Marginal-cost pricing requires metering of usage or adoption of a proxy for usage. It is possible that the benefits of user charges may be outweighed by the costs of installing and monitoring meters in some supply areas for some customers. In assessing the viability of metering, account should be taken not only of the benefits of reduced demand, but also of the improvement in the utility's ability to monitor the condition of its pipes and to identify substantial losses of water from the system.

The cost of metering usage of water services has reduced to the point where it is economic at least in some areas, with a few major centres already metering domestic use. Measuring the discharge of effluent from residential and commercial properties is likely to be too costly at present. Since there is a reasonably strong correlation between water consumption and the volume of effluent discharged into sewers, it may be efficient to base the sewerage charge on water usage.

An increasing-block tariff is sometimes proposed on income distribution grounds. Initial blocks would be charged at zero or low prices with higher prices charged for additional blocks. If the maximum rate were set at marginal cost, and a large proportion of customers faced this charge, then an increasing block tariff may be more efficient than sole reliance on a fixed levy.

However, an increasing-block tariff involves efficiency costs to the extent that significant numbers of customers consume only within those blocks for which price is below marginal cost. For efficiency to be maximised, the price for each consumer's marginal consumption should be set at marginal cost. It is irrelevant (in efficiency terms) whether the consumer's consumption is large or small. In addition, a utility's charges may be insufficient to enable it to cover total costs and additional efficiency costs could be associated with making up any shortfall.

Section 5.0 Regulation of Market Power

5.1 Introduction

In Section 5.2 we define the nature of the problem of market power, before examining in Section 5.3 the extent of market power that suppliers of water and wastewater treatment services might have. The case for regulation is summarised in Section 5.4. Possible regulatory responses to market power problems are discussed in Section 5.5, with a comparison of the four main regulatory options, namely light-handed, rate-of-return, price-cap and franchise regulation, being presented in Section 5.6. A summary is provided in Section 5.7.

5.2 The Nature of the 'Market Power' Problem

A decision on whether or not to regulate the water industry depends on the extent and implications of any 'market power' that organisations in the industry might possess. A number of conditions must be met before the allocative efficiency losses associated with market power are significant enough to raise concerns. Market power is unlikely to be a problem if any of the following conditions hold: there are reasonably similar alternative suppliers or substitute products that could satisfy consumer needs at a similar price; potential new suppliers could enter the market reasonably readily; or there are no significant 'sunk' cost or legislated barriers to entry into the market. In the section below, we consider the constraints imposed on water and wastewater service providers by substitute products or suppliers. Constraints on market power imposed by regulation and the threat of regulation are discussed in a later section. The nature of the market power problem is discussed in more detail in Appendix D.

5.3 The Market Power of Water and Wastewater Service Suppliers

5.3.1 Supply of Water

Competition for the abstraction and supply of water to a pipeline system for distribution is feasible but is limited by the available sources of water and competition from alternative water uses (including in-stream uses). Competition could occur if water is available from different rivers or catchments or different sources (ground water versus surface water) or if different parties have rights to abstract from a single water source. For example, a competitor to Watercare could pipe water from the Waikato River to Auckland.

The scope for competition in water distribution is more constrained.

Piped supply operators in New Zealand face little competitive threat from entrants intending to duplicate all, or large parts of, the distribution network. Economies of scale are likely to exist in pipeline construction, operation of treatment plant, obtaining of resource consents and rights of way. Costs are therefore likely to be minimised if piped water is supplied by a single organisation in each area. The sunk cost nature of the investments in assets means that the threat of entry is unlikely to be a powerful constraint.

In a few countries where high quality water is a scarce resource, potable and non-potable water may be carried in two pipelines, most commonly in industrial areas. Competition might be possible if the pipelines were owned by different companies. Such duplication is unlikely to be economic in New Zealand.

Some competition between existing utilities might be possible at the boundaries of current distribution networks with constraints increasing the greater the fragmentation of the industry. A utility might extend its network to connect major water-using industries that are close by in an adjacent network but competition for domestic users is unlikely to be economic in most cases. The physical separation of major concentrations of population (and hence distribution assets) in New Zealand is likely to limit this form of competition.

Some competition between utilities is generated by the ability of industries and individuals to choose location on the basis of the relative cost of water supply.

Moderate competition to distribution utilities is provided by individuals and industries using alternative supply options. Industry obtains only around 33 percent of its water requirements from public supply systems and 66 percent from its own sources. Some large industrial users are able to economically recycle water and remove waterborne wastes, particularly for uses where water quality is not important (for example when used for cooling). Such users are able to effectively substitute for the established piped suppliers' water catchment, storage, treatment and distribution services.

The options for households are more limited. In many rural areas water is supplied to households via tankers when rain water tank supplies are exhausted during dry periods. Such suppliers could substitute for piped suppliers in towns and cities if prices are high enough. To be viable, households would have to have water storage capabilities.

Households can collect and store rain water. Rain water is a major water source in rural areas that do not have reticulated supply. The water could be used for other than drinking if purity is perceived as a problem.

Other substitutes include private bores (where groundwater is available), and bottled water for drinking (although the cost is relatively high). In relation to the latter, in the United States approximately one out of every six households consumes bottled water instead of tap water, despite the price of bottled water being around 450 times more than tap water. The consumption of bottled water can be high even in low income countries such as Vietnam, largely because tap water is of low quality. The proportion of households using bottled water in New Zealand is likely to be very much lower than in the United States.

For the majority of household customers, recycling options are not feasible at current prices. Subject to hygiene constraints, households may use washing water to water gardens and flush toilets. To use recycled washing water on a regular basis a household may need to invest in a small holding tank, and possibly a filter. Public regulations developed in response to historical public health concerns are themselves major obstacles to the more efficient management of water supplies (for example by preventing grey-water recycling). Grey water makes up a large proportion of the water treated by wastewater plants so that minimisation of grey water may reduce the need for expensive investment in increased sewerage treatment capacity.

Wastewater can also be collected from the sewerage system, treated and then reused. Consumer resistance to consumption of treated wastewater has tended to limit its use to irrigation where human contact is minimal.

Other possible substitutes for piped water include the use of air rather than water as a coolant in manufacturing processes. Substitutes in consumption include water conservation measures such as dual flush toilets, gardens that do not require watering (i.e. drought resistant plants), showers instead of baths and dirtier cars.

A number of constraints are imposed on water distribution utilities by alternative suppliers and substitute products. The constraints are greatest for industrial customers, with 66 percent of industrial customers relying on private supply. Nevertheless, it seems likely that a piped water supplier could increase profits by raising prices above competitive levels. Even so, there is a price limit for a profit-maximising monopoly supplier, which is determined by the interaction of supply and demand at the point where the supplier's marginal revenue equals marginal cost.

In the long term, technological developments are likely to erode the market power of piped water providers (with the best hope for large scale supply being improvements in water recycling technology).

While the market power of water utilities is potentially of concern, the extent of the problem needs to be kept in perspective. According to estimates in the United States, less than five percent of average household use is for drinking, cooking and other indoor activities requiring high quality water. Outdoor uses such as watering lawns, washing cars, or filling swimming pools constitute a large proportion of the balance of domestic water use. In New Zealand around ten percent of water consumed is used for drinking and cooking. Thus, for households, where the monopoly problem is potentially the most severe, only a small portion of water is for uses where substitutes are few or significantly more expensive than piped water. The fact that for the bulk of water consumed there are substitutes reduces, but does not eliminate the potential monopoly problem.

In many cases, the problem with current water suppliers is not that suppliers are charging monopoly prices but rather that water is supplied at a charge that does not cover its cost (including its opportunity cost), and particularly the opportunity cost of water during periods of shortage (such as that experienced by Auckland).

5.3.2 Sewerage and Sewerage Treatment

As with water, the piped sewerage network is likely to be supplied at least cost by a single operator in an area, with the threat of entry or duplication of the pipeline system imposing only a weak constraint on market power. Only limited constraints are likely to be imposed by adjacent utilities, or by the threat of customers relocating to another area.

Some substitutes to piped sewerage exist although these may be limited by hygiene considerations. As noted above, grey water could be recycled and used to flush toilets or water the garden. Septic tanks and composting toilets are a possible substitute for piped sewerage disposal for households although they may be prohibited by council by-laws in some areas.

Opportunities for economically feasible by-pass of public sewerage collection and treatment exist in the area of trade waste. Industry users may have their own pre-treatment facilities, and may treat and recycle water. Some industrial users contract to private sector water treatment disposal specialists or dispose of their waste directly into rivers or the sea, given a permit for such discharge.

These substitution possibilities are likely to impose a modest constraint on the piped supplier's market power. This suggests that a sewerage service provider might be able to increase prices above marginal cost.

5.3.3 Drainage

Competition for the provision of drainage may be feasible for customers located adjacent to streams and the sea. In these situations, direct discharge through privately provided pipes would be possible. In addition, where rain water is collected and used by households, drainage requirements are reduced. Where discharge points are distant, the economies of a single collection system are likely to preclude significant competition.

5.4 Summary: The Case for Regulation

Water supply is potentially competitive given the existence of more than one suitable source of water.

The transmission component of the water industry (for water, sewerage and drainage) poses some market power problems, in large part because of the sunk costs associated with investment in a pipeline system and the possible economies of scale in treatment plant and construction of pipelines. Overall, the constraints imposed on piped water and wastewater service providers by substitutes appear moderate. While these market power problems are important, they should not be overstated.

Competition for the supply of water to major users is significant with 66 percent of water used in industry being sourced privately. Other customers can turn to alternative water sources such as rain, bore or tankered water. They can recycle water, conserve use, and relocate (if major users).

Substitutes for piped sewerage services for households include the use of septic tanks and composting toilets, and the recycling of grey water (within the constraints of public health regulations). Major industries can treat their own effluent or rely on specialist private suppliers, or treat and discharge to waterways directly. Water and wastewater businesses therefore face limits in their ability to exploit customers - whether by charging prices well in excess of costs, offering poor service quality, failing to pass on a share of any benefits achieved by efficiency gains, or failing to respond to technological advances or shifts in demand.

In assessing whether government ownership or regulation is an appropriate response to a perceived market power problem, it is important to recognise that, while the abuse of market power can reduce the well-being of consumers, regulatory interventions can also have adverse effects, by altering the pricing, purchasing, and investment decisions of the regulated entity in ways that do not serve customer interests. The latter may happen because the regulatory agency cannot secure adequate information to perform its tasks effectively, or because regulators are motivated by factors other than improving the efficiency of the regulated industry. For regulation to be beneficial two conditions must be met:

• The relevant business's activities in the absence of regulation must involve some genuine detriment to consumers; and

• Regulation must reduce this detriment not only in theory but also in practice - despite, for example, any problems in setting precisely targeted regulatory rules, or controlling the activities of regulatory agencies.

The efficiency of alternative options depends on their comparative strengths and weaknesses in dealing with these problems. In assessing options it is important not to assume away any important constraints or to reject an option because it compares unfavourably with unattainable theoretical benchmarks.

Whatever option is chosen, the following guidelines should be observed: the regulatory regime should be decided in advance of any change in ownership; the regulatory rules should be transparent; the role and limits of any regulatory agency should be clearly defined; any obligations on operators should be precisely defined; regulatory agencies should be as free as possible from political influence; the regulatory agency's decisions should be subject to appeal; and the regulatory agency should be focused on efficiency and not distributional issues.

5.5 Regulatory Options to Address Monopoly Concerns

In Appendix E we consider regulatory options that might be applied to the water industry. The discussion assumes that the water businesses are commercially operated with a profit maximisation focus i.e. if they remain in public ownership they are corporatised under the LATE provisions of the Local Government Act. The most promising regulatory options considered include:

• Rate-of-return regulation;

• Price-cap regulation;

• Franchise arrangements; and

• 'Light-handed' regulation (reliance on Commerce Act and common law requirements for charges to be 'fair and reasonable', along with a disclosure regime).

Other possible options include;

• Ring fencing monopoly components;

• Benchmark comparisons;

• Long-term contract arrangements;

• Common carrier provisions;

• Auctioning of capacity shares; and

• Government ownership.

5.6 Comparison of the Major Options

The costs and benefits of the four most promising regulatory models can be considered in four categories: customer protection, incentives to reduce costs, incentives to invest, and regulatory burden.

5.6.1 Customer Protection

With price-cap regulation, consumers are protected by explicit price controls imposed by regulators. The price-cap system offers the most price protection in the short run, but may create long-run problems with service quality unless quality is tightly regulated.

In the long run, political pressures (applying to price-cap regulated utilities) are likely to produce prices that are too low. Lower prices appeal superficially to large numbers of voters who believe they are receiving a favourable deal.

Low prices limit utility profits and discourage investment in product quality and innovation. Suppliers typically decrease product and service quality to avoid the bite of price controls. If the price of water is held too low, consumers will overuse the resource. Costs will eventually become high in the future, because the resource is being used up too quickly.

The price-cap system, however, does not necessarily set prices too low in the short term. In fact, many critics have argued that the margin of allowable water price increases in excess of the movement in an index of retail prices was set too high in England following water industry privatisation. Following privatisation water prices increased more than 50 percent, with further increases expected because of forthcoming investments.

Rate-of-return regulation places no direct caps on price, but instead limits allowed rates of return. Utilities are allowed to justify rate increases on the grounds of cost increases. Rate-of-return regulation offers consumers only moderate price protection. Utilities can only pass on price increases that can be justified on the basis of cost. Consumers are protected from the monopolistic forces that might produce high prices, but not from the cost forces. No strong mechanism exists to keep costs low. Since higher costs eventually translate into higher prices, consumers cannot expect to enjoy cheap water under the rate-of-return model.

Water customers of utilities regulated by rate-of-return controls often face especially high price hikes when new assets are added to the system, or when existing assets are replaced. Most water utility cost accounting systems are based upon historical cost accounting. When substantial assets are replaced, accounting costs, and thus allowable prices, rise considerably, even if true economic costs remain constant in real terms.

In the franchise model, consumer protection comes from the franchising process between local government and the water company. In theory, electoral incentives for the public officials motivate the local government to strike a good deal for the water consumers. Competition for a franchise is aimed at preventing monopoly pricing of water and wastewater services. The franchise contract specifies future prices and quality of service, albeit imperfectly.

In practice, the decentralised nature of the contract negotiations often makes the true extent of customer protection difficult to discern. Franchising is likely to provide benefits (which could be passed on to customers) in the early stages of operation but these may reduce through time as the local authority becomes increasingly reliant on the private water company

Contract renewal is likely to favour the interests of water suppliers at the expense of customer protection. Recent revelations in France, where franchises are common, have indicated that the likelihood of 'capture' of the local authority by private interests is considerable. The French government is now conducting investigations into whether the major water companies have tried to 'buy' French politicians through financing political parties in excess of the legal limits.

The light-handed regulatory regime relies on the operation of the Commerce Act and the threat of regulation to protect customers. There are no direct caps on prices or explicit controls on rate of return.

The light-handed regulatory regime protects against substantial abuses of market power, since the close scrutiny of organisations subject to this regime makes major abuses unlikely. However, some scope for monopoly pricing remains. Utilities subject to light-handed regulation have few incentives to skimp on quality except to the extent that they are subject to implicit rate-of-return or price controls.

In summary, price caps and franchise arrangements appear to offer the greatest protection for customers in the short run, but may fail to protect customers in the long run. The light-handed regulatory regime protects against major abuses of market power. The rate-of-return regime provides no protection against the failure of the utility to control costs.

5.6.2 Incentives to Reduce Costs

Price-cap regulation aims to provide incentives for utilities to reduce costs by allowing them to keep cost reductions as profits.

Price-cap regulation offers better incentives for cost control in principle than in practice. Although in theory cost reductions can be kept by the utility as profit, in practice the level of the price cap is not set independently of cost. Politicians are unwilling to allow utilities to reap extra-normal profits, nor are they willing to see utilities go bankrupt (see the discussion of England in Section 9 for an example). The difference between price-cap and rate-of-return regulation is one of degree rather than one of kind.

The approach also attempts to introduce competitive pressure on costs by comparing the performance of utilities in different geographic regions. Most consumers have little choice but to purchase water from the utility that serves their region. Comparative information may motivate investors to improve performance, but such pressures are independent of any direct competitive threat.

Despite these reservations, price-cap regulation does provide stronger incentives for cost reduction than rate-of-return regulation, and in the United Kingdom reductions in costs have been observed. For example, substantial employment reductions have been implemented to meet the efficiency targets set by the regulator.

Rate-of-return regulation creates incentives to increase costs since the water utility is able to reimburse its costs through price increases.

In rate-of-return regulated firms with legally stabilised rates of return, equity holders have a role closer to that of bondholders. Bondholders, with their desire to ensure a stream of steady payments, favour cautious and conservative courses of action, not risky innovations.

One study, undertaken in 1982, found very high levels of inefficiency in the regulated private companies in the United States. The companies resembled government bureaucracies in many regards. The study even noted that "there were no statistically significant differences between the observed cost functions (and underlying production functions) of government and private water utilities."

The franchise option introduces competitive pressures at the initial stage of awarding the franchise. Companies preparing their bids must pay heed to the price and service quality promises that other companies are likely to submit. For the early stages of projects, the franchise model offers relatively strong competitive pressures, compared to the price-cap, rate-of-return and light-handed systems.

As project life ages, however, the competitive pressures of the franchise option decline considerably. Once a company has been awarded an initial franchise contract, it is likely to receive a renewal. The incumbent company has the expertise of running the system and maintaining the assets. The incumbent has also developed close contacts with the politicians of the local authority. Furthermore, as the initial contract moves towards expiration, the local authority may wish to give the incumbent company favoured status for renewal to encourage it to continue to make long-term investments.

For all these reasons, incumbent companies can obtain considerable monopoly power, even if the initial franchise contract was contestable. The competitive pressures under the franchise model will not return to their initial strength, and will only weaken over time.

In principle, the incentives to minimise costs in the light-handed regulatory option are strong since the company can keep the income generated by cost efficiencies. In practice, the incentives are weakened to the extent that the companies are subject to implicit rate-of-return control imposed by the threat of regulation.

Overall, the incentives to minimise costs are highest in the light-handed regulatory regime. Pressures on costs are high during the initial stages of a franchise but weaken through time. The price-cap arrangement provides some incentives for cost control. Cost control is weakest for rate-of-return regulation.

5.6.3 Incentives to Invest

A price-cap regime may distort investment incentives. To the extent that price-cap regulation moves towards implicit rate-of-return regulation, the problems associated with rate-of-return regulation will arise. To the extent that strict price-cap arrangements are adopted, the water companies will try to reduce quality, and thus investment, as a means of effectively raising the price of water. The price-cap system copes with this 'moral hazard' problem only by imposing an onerous regulatory burden. For example, in the United Kingdom regulators require water companies to produce detailed asset management plans; these plans are audited, evaluated and subject to periodic regulatory review to ensure companies do not cut back on maintenance for short term profits. Companies must show that they are undertaking adequate capital expenditures to ensure high quality service in future periods. The quality of service provided by companies is monitored against targets and comparative statistics are published. Companies that are performing poorly in comparison with others have incentives to improve their performance to avoid adverse publicity and the imposition of more stringent requirements imposed at price review periods.

Rate-of-return regulation produces two conflicting forces. First, rate-of-return regulation gives utilities an incentive to overcapitalise their facilities. At the same time, political pressures on the regulators tend to keep prices low, and thus starve utilities of capital sources. The net result of these two opposing effects is difficult to estimate. Many United States water suppliers, for example, are undercapitalised, even though they might in principle wish to overcapitalise. At least in small rural networks, which are common in the decentralised United States system, the problem of capital starvation appears to be more severe. Many water systems do not have resources available to comply with standards for water quality and wastewater treatment. The National Council on Public Works Improvement noted "it is the conclusion of [three major] studies that the [capital] shortfall exists primarily due to the artificially low water rates".

Early criticisms of the form of regulation in the United States focused on the incentive for utilities to inflate their rate base through overcapitalisation, the so-called Averch-Johnson effect.

Some United States regulators have refused to add ill-advised investments into the cost base of utilities, thus placing some of the pecuniary burden on shareholders, rather than on the utility. Refusing to count bad investments in determining allowable rates of return, however, reduces the incentive of the utility to fund improvements. If the investment turns out to be bad, the utility bears the cost, but it does not receive proportional extra profits if the investment turns out well. Long-term investments, especially where the final outcome of a project is uncertain, are penalised by this procedure.

The franchise model also gives rise to serious problems with investment incentives. The life of water supply assets often exceeds the length of contracts, which distorts incentives in several ways.

To the extent that the franchise contract is short (management contracts and some leasing contracts), the water company has only weak incentives to maintain or improve the value of the long-term assets. The company realises the contract may not be renewed, in which case the value of its maintenance work would be passed on to other parties, usually competitors. This problem can be limited by lengthening the contract, or by ensuring renewal, but either of these options creates other incentives for mis-investment. While the contracts sometimes stipulate specific maintenance levels in the final years, the mechanisms for discovering violations and enforcing the contract are highly imperfect.

Most importantly, longer franchise agreements limit the competitiveness of the market for water services. Water company investments in long-term system improvement can be encouraged only by granting a long franchise contract to the utility, or by assuring the incumbent utility that the existing contract will be renewed. Strengthening the incumbent's position will necessarily weaken other performance incentives. The fear of losing the franchise disappears, removing the incentive for the utility to improve product and service quality. The franchise system promises both incentives to invest and competitive pressures on suppliers, but in fact can deliver only one of these ends at best.

The franchise model has performed relatively well in France in the area of research and development. The French water companies are internationally recognised for their innovations in technology and management. The technology of ozonisation, for instance, was pioneered by the French. Ozonisation is a means of purifying water that is safer than chlorination, and is expected to replace the use of chlorine over the next few decades. The French company Lyonnaise des Eaux-Dumez has the largest research centre in the world for water and wastewater treatment.

The incentives to optimise investment under the light-handed regulatory regime should be strong since the regulated firm can keep the income generated from sound investments. In practice, the incentives for efficient investment may be weakened by the uncertainty of the regime and the threat of regulation.

The light-handed regulatory regime is the least likely to distort incentives to invest, doing so only to the extent that the threat of regulation constrains behaviour. Distortions to investment are serious with all three of the heavy-handed regulatory options.

5.6.4 Regulatory Burden

The price-cap system requires detailed monitoring of the private water companies. The primary form of regulation covers prices, which are relatively easy to monitor. The true regulatory task is to ensure that companies do not skimp on quality in response to the price controls. For example, English regulators have taken a definite hands-on approach to monitoring levels of service and quality. Water outputs and their quality are often hard to measure, so regulators have started to monitor water company inputs as a proxy for service quality. Inputs also face regulatory scrutiny because of the long lag between capital expenditures and improvements in product quality. The regulators wish to ensure that product quality improvements will arrive in the future, and they therefore insist upon proposed capital improvements today.

Under rate-of-return regulation, regulators must frequently monitor the level of water company costs to judge if proposed price increases are reasonable.

The regulatory burden of the franchise system is the least transparent. It varies considerably, depending upon the nature and terms of the contract chosen. The regulatory burden takes the form of case-by-case contract enforcement, rather than the implementation of a set of publicly visible regulations. With all forms of franchise

regulation the regulatory authority must take action to ensure that the value of the long-term assets is maintained. Public ownership of such assets implies that the private sector participants have only weak incentives to look after them.

The light-handed regulatory regime as established in New Zealand has reduced ongoing direct regulatory costs, but has been characterised by prolonged negotiations between customers and facilities as well as costly litigation. In part, this reflects the historic lack of long-term contracts which might be expected for high sunk cost industries and is therefore a transitional issue. In addition, users of infrastructure facilities have an incentive not to agree to access proposals from owners of those facilities as long as they judge that the probable returns from prolonging the dispute are greater than the likely costs. Better returns may result from successful litigation or government intervention at the expense of the supplier. Thus, the threat of regulation may in part be responsible for the failure of some parties to reach a negotiated solution.

In summary, the regulatory burden of all options is substantial although, in the longer term, the light-handed regime offers the best prospect for savings in regulatory costs.

5.7 Summary

The transmission components of the water industry pose some market power problems. Overall, the constraints imposed on water and wastewater service providers by substitutes appear moderate.

Choices between regulatory regimes for monopoly industries are choices between imperfect alternatives. No regulatory regime can provide a monopolist with incentives for cost minimisation and efficient investment without also providing incentives for monopoly pricing.

With either private or public ownership under a sustainable commercial structure, a light-handed regulatory regime involving reliance on information disclosure and the provisions of the Commerce Act appears likely to impose the least costs while providing a constraint on the market power that monopoly suppliers of water and wastewater services might have.

The advantages of the light-handed approach include the benefits of retaining incentives for managers to optimise the efficiency of their organisations, the lower level of resources involved in the regulatory process and the consistency across different industries that it achieves. The regime does not, however, eliminate the possibility of monopoly pricing although it eliminates the prospect of major abuse. Uncertainty as to the precise nature of the regime is likely to reduce as guidelines emerge from decisions by the Commerce Commission and the courts. Concerns about monopoly pricing warrant continued monitoring of the regime. Only if monopoly problems become obviously costly or an *ad hoc* regulatory structure emerges would we advocate departure from the light-handed regulatory approach. Experience to date suggests that a light-handed regulatory regime will, in the long term, impose fewer costs than the heavy-handed alternatives.

Franchising appears to offer some benefits compared with price-cap and rate-of-return regulation, at least in the short term, and may be an option for increasing private sector involvement while retaining public ownership of infrastructure assets. Franchising, rate-of-return and price-cap regulation all require substantial government input, distort incentives for the regulated organisation to operate efficiently and require substantial resources for setting and monitoring prices. Rate-of-return regulation is the least desirable of the major regulatory options.

Section 6.0 Regulation of Quality

6.1 Introduction

This section examines possible reasons for government regulation of the quality of services supplied by water utilities, and options for regulating drinking-water quality. Issues relating to the quality of water in the environment are addressed in Section 3.

6.2 Justification for Regulation of Quality

6.2.1 Provision of Quality by an Unregulated Monopolist

The quality of service delivered by a water utility has a number of dimensions including the standard of drinking-water supplied, the reliability of supply, the pressure at which water is delivered, the response time to fix faults and so on.

High quality and low prices are both desirable attributes which consumers, within the limits of their knowledge of quality, are generally prepared to trade off against one another. When price and quality are set in a competitive market, the cost to suppliers of additional units of quality (and the price to consumers) is likely to be balanced against the strength of consumers' quality preferences and their willingness to pay for quality. In a competitive market, consumers would be able to choose from a variety of price/quality options. Consumers, for example, are prepared to pay a substantial premium for bottled water which offers aesthetic and taste advantages compared with piped water. Although consumers would be unlikely to accept unsafe drinking-water, they might be prepared to accept lower quality water for, say, garden watering, at a lower price, if it were available. Consumers might be prepared to trade off other quality dimensions, for example response time to fix faults, against the price of supply.

Firms with considerable market power have incentives to supply high quality services if the benefits to consumers, and hence their willingness to pay, exceed the cost of supply. A monopolist that can discriminate on the basis of quality and price to suit its customers' different needs would be likely to offer a variety of prices and qualities.

However, a monopolist such as a water supplier is faced with the constraint of a single pipeline and may be forced to choose a single level of quality. Given that constraint, a monopolist maximising profit with respect to quality will not generally provide the optimal level of quality, instead setting the level either too high or too low. This arises because a profit-maximising monopolist responds to the valuation of quality established by the marginal consumer, rather than inframarginal consumers. (A welfare maximiser would respond to inframarginal consumers.) If the average valuation of quality at the margin exceeds the valuation by the marginal consumer, then the monopolist will set quality too low (and vice versa).

For example, if, at the margin, water is used to water the garden, wash the car or for industrial cooling purposes, users may not be prepared to pay for an increase in quality for those purposes. Nevertheless, households may derive significant health benefits from the improvement in inframarginal units of water which they drink. On the other hand, if the marginal demand for water comes from new housing subdivisions or industrial users for which quality is important, then it is conceivable that the monopolist could provide higher quality than is socially desirable. However, where marginal consumers use water for both drinking and watering the garden, they may be able to contract with their supplier to ensure that their overall preferences are met.

Where water is provided by a single pipeline, consumers are restricted in their ability to express preferences for a particular quality by turning to alternative suppliers so a monopolist may face difficulties in assessing what quality consumers prefer. Those consumers who desire a higher standard can possibly achieve this through additional home treatment (e.g. using water purifiers), or through bottled water. Those who prefer a lower standard have no option but to pay for the standard imposed. Anyone supplying mains water has little option but to provide the same quality of water to all customers.

A limited number of utilities in the world provide dual-supply systems in which low quality piped water is provided through a duplicate set of pipelines. Non-potable water is usually supplied for industrial and non-residential urban applications (such as watering of public parks). The supply of low quality water for domestic use is rarer, possibly because of the cost or health risks. There is little information available on the effect of different tariff structures and levels in signalling consumer preferences for water of different qualities.

As long as consumers are willing to pay at the margin for the higher costs of higher quality, the problem of inappropriate quality is unlikely to be large.

6.2.2 Effect of Price Regulation on Incentives to Provide Quality

A regulatory regime that limits prices can lead to a deterioration in quality. If a firm cannot recoup the costs of higher quality from higher prices, its incentives to provide high quality will be limited. A regulated firm that increases the quality of its product would expect demand to increase. If it cannot increase its prices, then it will capture only some of the gain from the increased demand. As a result, the regulated monopolist has an incentive to choose sub-optimally low quality levels. The magnitude of the bias increases the less quality-elastic is demand.

Viewed another way, a monopolist subject to price regulation has incentives to reduce quality since by doing so it can reduce its costs and increase its profits. In a competitive market a decline in quality would decrease the volume of sales, as customers switch to other suppliers and substitute products. Where there are few substitutes, the penalties from a reduction in demand as a result of reduced quality are likely to be limited - thus a water supplier that faces relatively inelastic demand and is subject to price constraints has incentives to reduce quality.

The nature of the regulatory regime therefore affects the incentives of a utility to provide services of a particular quality. A regime that allows a monopolist to increase its profits by reducing quality is likely to lead to lower quality standards. Thus, quality problems are likely to arise under 'incentive' regulation such as price-cap or franchise regimes, and are less likely in cost-plus regimes such as rate-of-return regulation.

Where the quality of required output is readily observed, a regulator can set both quality and price restrictions. Quality issues are therefore of major concern only when quality is difficult to measure and where reputation effects do not provide strong constraints on the monopolist.

In a cost-plus regime, a regulated utility would have no incentive to cut back on quality. However, as discussed in Section 5, such a regime would push up prices to consumers by removing the utility's incentives to minimise costs.

6.3 Regulation of Drinking-Water Quality

6.3.1 Case for Regulating Drinking-Water Quality

The potential risks to health posed by substandard water provide a possible reason for regulating the quality of drinking-water (rather than other elements of quality). These risks can include epidemic outbreaks from bacterial contamination, or increases in the rates of cancer caused by consumption of water contaminated by chemicals.

Within the constraints of determining what consumers prefer, a water supplier has incentives to meet the preferences of its customers for drinking-water of a suitable quality if customers are prepared to pay for quality. Other incentives include the impact on its reputation of poor quality, the costs of dealing with customer complaints, and possible legal action against the company supplying water that is harmful. Where it is difficult to signal the quality of drinking-water, a utility could use independent agencies to certify water quality. Nevertheless, if customers are unaware of the risks of a supplier's product, and it is costly for them to obtain the necessary information, there may be an economic disincentive for a supplier to provide information on the product's quality.

The quality (and particularly safety) of water can be difficult for consumers to ascertain and the consequences of inadequate standards serious.

Because of the potentially serious consequences of poor quality water, the difficulty of customers monitoring quality and problems with expressing their preferences through market choices, it may be efficient for the government or an industry body to establish water quality standards (either voluntary or compulsory), and possibly to monitor compliance. Where the supplier has clearly committed itself to particular quality standards and consumers or the government can sue it for breaches of those standards, direct government setting of standards may not be necessary.

Mandatory standards are appropriate where the consequences of low standards are serious and difficult for customers to verify, where it is not easy to sue the supplier for poor outcomes from lower standards or where *ex ante* prevention is preferable to *ex post* penalties. Voluntary standards are more appropriate when information is difficult to obtain, but the consequences of failing to meet standards are not particularly serious.

It may be appropriate for customers to accept different standards throughout the country given differences in the cost of achieving a certain quality level and customers' reasonable desire to trade off cost and quality. In particular, in some rural areas the costs of achieving particular standards may be higher than in urban areas because the small scale of operations means a supplier is unable to achieve economies of scale in treatment plant and reticulation. Rationalisation of smaller water suppliers may help address quality problems among the smaller utilities.

A risk with mandatory standards is that a regulator may impose standards that are higher than those which consumers would voluntarily contract for. A regulator may be risk averse and introduce standards that are too high, because the consequences of inadequate standards will be obvious and blame for outbreaks of disease quickly attached to the regulator, whereas the costs of standards that are too high will be much more difficult to observe. Where the standards are voluntary, a supplier can choose to implement lower standards than the recommended levels.

Establishing the desired level of quality requires trading off the costs and benefits of improved quality. The costs are those associated with improving water treatment and management. Many of the financial benefits arise from savings due to the prevention of illness which can rarely be predicted in advance. It is difficult to reasonably quantify the probability of an event occurring, the magnitude of the event and its cost in monetary terms.

6.3.2 Regulation of Drinking-Water Quality

A number of Acts and Regulations contain provisions potentially affecting public health aspects of drinking-water. The principal Acts include the Building Act 1991, which has as one of its purposes to ensure that buildings are safe and sanitary; the Food Act 1981, which requires that drinking-water or water used or associated with food be wholesome and free from harmful contamination; the Health Act 1956, which provides for the protection of water supply sources, provides for the protection of water from treatment plants and requires that buildings have an adequate and convenient supply of wholesome water; and the Local Government Act, which details the reponsibilities of territorial authorities in the supply of drinking-water.

The Ministry of Health is in the process of reviewing the regulatory regime applying to drinking-water. The Ministry has identified a number of weaknesses with the current regulatory regime:

• No agency is expressly charged with the responsibility for ensuring that communities have adequate and safe supplies of water, monitoring the safety of community water supplies, or providing the community with information about the community's drinking-water supply;

• Generally there is no consistency in the terminology used in the different legislation which describes and defines drinking-water quality;

• Penalties for polluting drinking-water are inconsistent with sanctions in similar legislation. The maximum penalty for polluting a water supply is $500 under the Health Act 1956 (S 136);

• Legislation affecting public health is primarily directed at those water supplies that are under the control of a territorial authority. Public health requirements of privately-owned drinking-water supplies are not as adequately protected as those of publicly-owned supplies;

• No legislation appears to effectively cover the public health implications of temporary supplies such as water supplied to festivals and the sale of drinking-water from tankers during drought;

• Maintenance of sanitary conditions in the treatment plants and water-distribution systems of community drinking-water supplies is not well covered by the legislation;

• There is no clear legislative empowerment for health agencies to protect public health by setting drinking-water quality standards or carrying out public health grading of drinking-water supplies, although the Department of Health (and Ministry of Health) has graded water supplies since 1960 and produced *Drinking-Water Standards for New Zealand* in 1984 and 1995;

• There appear to be gaps in the protection afforded against contamination of supply by backflow (when a contaminant is sucked back into the water supply); and

• It is unclear who is responsible for safeguarding the aesthetic qualities of drinking-water supplies.

The Ministry of Health recently revised its recommended drinking-water standards. *The Drinking Water Standards for New Zealand 1995* list the maximum concentrations of chemical, radiological and microbiological contaminants acceptable for public health in drinking-water. The standards give top priority to health risks arising from microbiological contaminants. For community drinking-water supplies, the standards also specify the sampling protocols which must be met to demonstrate that the water complies with the standards. The standards are applicable to water intended for drinking irrespective of its source, treatment, distribution system, or where it is used. The exception is bottled water which is subject to different standards set under the Food Regulations. Guidelines for achieving aesthetic values are also provided by the Ministry of Health, but it is not necessary for a supplier to meet these values to achieve compliance with the standards.

The current regime in New Zealand relies on voluntary compliance with the standards. Sampling is generally undertaken by the water suppliers or Crown Health Enterprises and is monitored by local Crown Health Enterprises and the Ministry of Health. Information on the achievement of the standards by utilities throughout New Zealand is compiled and published by the Ministry of Health.

The most recent survey (based on compliance with the 1984 standards) found that just 57 percent of the population is known to have safe drinking-water. The survey found that 8.5 percent of the population is known to be exposed to potentially unsafe drinking-water with the quality of a further 35 percent unknown because of inadequate monitoring. Supplies that failed to meet the standards were mainly in communities with fewer than 500 people. Centres that failed to meet the quality standards included Hastings, Flaxmere, Havelock North, Alexandra, parts of Dunedin, Kaikoura, Lyttelton, Whangamata, Rotorua's eastern suburbs, Massey, Turangi, Nelson City, parts of Tauranga and Mt Maunganui, Fielding and Geraldine.

6.4 Summary

Whether or not explicit regulation is required to control the overall quality of services provided by utilities depends in part on the nature of any regulation to control market power. Our preferred regulatory option involves reliance on the Commerce Act and a disclosure regime rather than price controls (see Section 5). In that case explicit regulation of quality (other than drinking-water quality) is unlikely to be required whether or not water utilities are privatised.

With cost-plus regulation (such as rate-of-return regulation) the incentives to provide a level of quality consistent with consumers' preferences would be relatively strong although the incentives to minimise costs are weak. Quality constraints are likely to be necessary with price-cap and franchise regulation, otherwise a monopolist can increase its profits by reducing quality.

The regulatory regime applying to drinking-water, which is currently being reviewed by the Ministry of Health, should be clarified and rationalised.

Given the difficulty of customers monitoring the quality of drinking-water and the potentially serious consequences of inadequate quality, a strong case can be made for the government or an industry body at least promulgating voluntary quality standards, checking compliance with them and publishing comparative results.

A single agency should be assigned this responsibility. Responsibility for the physical monitoring of water quality should be retained by the territorial authority owners of water supply systems to avoid repetition of costly analysis.

Under the current regime, some supply systems are inadequately monitored and a number fail to provide an adequate standard of drinking-water. There is little evidence to suggest that these failings could not be addressed under the current voluntary compliance regime.

Section 7.0 Structural Issues

7.1 Introduction

This section examines whether restructuring of the water and wastewater sector would improve efficiency. Section 7.2 examines the preferred process for restructuring the sector. Section 7.3 discusses whether there are achievable economies of scale from horizontal integration of utilities or economies of scope from integrating water supply and sewerage supply, or sewerage and drainage services. Section 7.4 examines whether there are significant benefits from vertically-integrated water supply utilities (i.e. integration of abstraction, bulk water supply and retail supply). Possible options for restructuring the industry in Auckland and Wellington are reviewed in Section 7.5. Section 7.6 provides a summary.

7.2 Implementing Preferred Structural Arrangements

The principal consideration in ensuring the water and wastewater industry evolves towards an efficient structure is to put in place institutional arrangements that will enable the least-cost transition from the current configuration of local government-owned water enterprises to the configuration most likely to be appropriate for the future pattern of demand for water and sewerage services.

Decisions in any industry regarding the optimal structure, organisational arrangements and deployment of resources involve the use of a vast amount of information which is generally diffused among a very large number of individuals, ranging from executives in large corporations through to individual employees and customers. Markets provide a means of harnessing this widely dispersed information in a way that preserves the flexibility and incentive advantages of highly-decentralised decision-making. By harnessing information on production and organisational costs along with information on consumer preferences, markets reward individuals and firms that use and develop efficient organisational arrangements and punish those that do not.

However, while industry structures are rationally devised in this broad sense, as an academic exercise it is generally very difficult if not impossible to accurately 'determine' the optimal way of organising any industry. The reasons for this are fairly obvious. First, as mentioned above, the organisation of an industry should reflect a vast amount of widely-held information concerning different technologies, organisational techniques and consumer preferences. Other than in the simplest case study, no outside observer can hope to gather or analyse all of this information. Second, industrial organisation evolves through a process of trial and error and experimentation. Changes in firm size, product bundling, organisational arrangements, contract design and customer relations which give rise to improved performance sometimes result from one individual's commitment to a seemingly far-fetched idea, or from 'mistakes'. Because the survivorship of new approaches rather than the reasons for their success is the important consideration in a market context, it is often very difficult to understand why an industry is organised in a particular way and even more difficult for a central agency to plan an efficient industry structure.

The water sector in New Zealand is no exception in this regard. The sector is likely to eventually involve a range of organisational forms, of varying sizes and geographic coverage, offering an array of different combinations of services. It is impossible, and therefore undesirable, to anticipate accurately the shape of these arrangements.

For this reason it is essential that, wherever practicable, detailed decisions regarding the organisation of water services be made by the managers of these enterprises in response to consumer demands. These individuals have access to the information and, subject to satisfactory reform of organisational arrangements, the incentives to make efficient organisational decisions.

These arguments highlight the importance of providing owners and managers of these organisations with considerable flexibility and the incentives to restructure their businesses in response to market pressures. It is essential that the water enterprises engage in the full range of transactions that could add value to their businesses. Thus decision-makers should be encouraged to:

• Sell assets or functions whose market value exceeds the return the enterprise expects to achieve if they are retained;

• Contract out services or inputs that can be provided at lower cost by outside parties;

• Expand the scope or scale of an enterprise's businesses when this would enable consumer demands to be met more efficiently; and

• Allow vertical and horizontal mergers where managers believe this will enhance efficiency.

The restructuring of the electricity supply industry, given corporatisation and some privatisation, indicates the scope for significant efficiencies to be realised from an industry when its managers are given commercial incentives and the organisational arrangements do not impede restructuring.

However, since local authorities are unlikely to contemplate widespread privatisation and central government is unlikely to mandate privatisation, managers of utilities are unlikely to have the ability or incentives to contemplate major restructuring. Parochial local government interests are likely to further impede rationalisation. Thus in the absence of privatisation, the process of rationalisation discussed above is unlikely to occur. In these circumstances, a case could be made for central government investigating the preferred shape of the industry.

The Local Government Act requires the Auckland Regional Services Trust to recommend a preferred structure for the industry in Auckland. The Trust has conducted its investigation and presented its findings to the government. In the sections below, we consider some of the issues relevant to decisions on restructuring of the industry.

7.3 Economies of Scale and Scope

7.3.1 Introduction

This section examines whether the merger of utilities would achieve economies of scale or whether utilities could achieve economies of scope by combining water and wastewater services.

7.3.2 Horizontal Merger of Utilities

International research provides contradictory and sometimes inconclusive evidence on economies of scale in the water and wastewater industries. In part, this reflects a lack of comparability of data from different water industries and the location-specific nature of water economics. Nevertheless some implications can be drawn.

There is evidence of economies of scale at the level of both bulk water treatment and sewerage treatment works, but some evidence suggests that there are no economies or diseconomies of scale in distribution. These two factors offset one another so that overall, limited, if any, economies of scale may exist in an integrated bulk water and distribution operation.

Studies that do find significant economies of scale tend to be based on surveys of small non-metropolitan authorities. A study of water utilities by Bruggink found significant economies of scale for water supply and distribution utilities. The largest utility in his sample supplied 605,560 million litres per year, with the mean utility supplying 39,742 million litres of water per year (compared with 117,000 million litres for Auckland and 53,000 million litres for Christchurch).

A study by Kim and Clark suggested a minimum efficient size is achieved at around 30,400 million litres per year with diseconomies beyond that. L|E|K Partnership's analysis of data from the Swedish Water and

Wastewater Association found no economies of scale in the reticulation of water and wastewater and other studies have found diseconomies of scale in reticulation. In the United Kingdom a detailed econometric examination of the industry's costs in 1993 found that there were no overall economies of scale at the level of the businesses operating in the United Kingdom. (These deliver between 9,000 million litres and 760,000 million litres of water per year).

Economies of scale may be most easily realised in management, financial and overhead areas. In Australia, the Victorian government noted that reducing the number of water authorities from 400 to around 120 in Victoria had achieved the following:

• Savings of up to $150 per annum for the average household on combined water and sewerage bills;

• Greater scope for system augmentation and investments to improve water quality (water quality is a concern for some of the smaller supply areas);

• Improved customer services - for example, 24 hour emergency services; and

• A more integrated approach to water resource planning.

Melbourne Water Corporation estimated that the merger of the Melbourne and Metropolitan Board of Works (now trading as Melbourne Water Corporation) with six smaller authorities in 1991 had achieved cost savings of at least $20 million per annum. The savings were achieved through rationalisation of administrative arrangements, information and billing systems, and other activities.

These findings suggest that the larger utilities in New Zealand may have exhausted technical economies of scale (although they are still small by world standards) but that economies might be realised by amalgamating the many smaller scale operations that exist in towns and rural areas. A third of authorities in New Zealand have populations below 20,000. The level of expertise in authorities of this size, particularly in technical fields such as telemetry and asset management, is limited. Amalgamation of small suppliers would increase the availability of expert technical and scientific capability, and improve administrative and operational efficiencies. Technological advances allow remote monitoring of distribution systems, thereby increasing the size of network that could be monitored by a given administrative structure. Savings in management, financial and overhead areas might be possible for amalgamations of both large and small utilities.

7.3.3 Integration of Freshwater and Wastewater Services

There appears to be little research in the academic literature on whether there are economies of scope between the provision of water and sewerage services.

Vickers and Yarrow note that "it is an open question whether the factors such as the interrelated demands for the two services [water supply and sewerage] make the combined activities a natural monopoly". They note "what little evidence on relative performance that there is appears to be consistent with the view that, to the extent that there are economies from the integration of the two principal activities of the industry, the resulting benefits are not of decisive importance. Thus, vertical separation appears to be a viable structural option".

The issue, is of course, whether there are significant savings in transaction and contracting costs from integration since coordination can be achieved through contract. There do not appear to be strong transactions cost reasons for integrating the businesses. There are no major asset-specific investments in the relationship between water suppliers and sewerage suppliers since there is no direct contracting relationship between the water and wastewater suppliers (each instead contracting with the end customer). Economies of scope between water and wastewater will be predominantly in areas of management and administration because operations will necessarily be separate. There are similarities in the operations of the businesses, particularly in the transmission elements, that might allow achievement of management economies. There may also be some advantages in charging sewerage services on the basis of water use although this information could possibly be obtained contractually.

There might be an argument for integrating wastewater and water supply when abstraction and discharge is from and to a river because of the cost of contracting to obtain optimal behaviour. In that case, suppliers downstream

have to abstract water from a river into which upstream towns have discharged waste. Integration of both wastewater and water supply, and management of the river system as a whole, would best ensure that any externalities (i.e. the costs of subsequent treatment by downstream towns) were internalised. This is not generally an issue in New Zealand.

7.3.4 Integration of Sewerage and Drainage Services

Internationally, stormwater and sewerage collection systems are being separated because wastewater treatment facilities operate more efficiently when rates of concentration and flow are even. In addition, separation reduces the likelihood of sewerage overflows during heavy rain.

The interrelationship caused by stormwater overflowing into the sewerage system during heavy rainfall could be handled contractually through penalty or charging arrangements and does not require common ownership.

If the utilities are to be corporatised, a relatively strong case can be made for separating drainage from sewerage and water services. These latter two services can be operated commercially, but the public good nature of drainage services suggests that continued operation as a department of council, or as a business unit, funded by rates might be justified. On the other hand, there may be some management efficiencies from integration given the similar nature of the sewerage and wastewater businesses. However, overall, there does not appear to be a strong case for integrating sewerage and drainage businesses.

7.4 Vertical Integration Issues

This section examines whether there might be transactions cost reasons for vertical integration between headwater and distribution functions and also between wholesale and retail distribution functions.

We also examine the possible problems which arise when two monopolists in a vertical relationship independently set prices to maximise monopoly profits.

7.4.1 Transaction Costs Associated with Specific Investments

Where a party makes 'specific' investments whose value depends on maintaining the relationship between the parties, there is scope for the other party to the relationship to strategically 'hold-up' the firm for the difference in the value of the assets in their intended use and their value should the relationship break down. Haggling over prices and investment returns after relationship-specific investments are in place, and the possibility of a break-down of the relationship itself, may involve serious costs.

To reduce the risk of these difficulties, prior to committing assets the parties to a relationship will seek to design contracts that reduce the scope for opportunistic behaviour. The greater the complexity and uncertainty surrounding a transaction, the more difficult and costly it becomes to design and enforce contracts which tightly control undesirable behaviour under a range of feasible circumstances. Where an organisation is infrequently involved in relationships involving major transaction-specific investments, the importance of a reputation for fair dealing would provide little constraint on opportunistic behaviour. As contracting becomes more problematic, organisation within a firm through vertical integration is likely to become more attractive. Vertical integration enables relationships to flexibly adapt to changed circumstances. However, vertical integration may increase the size and complexity of an organisation and lead to bureaucratic behaviour or other difficulties with internal incentives.

When transaction-specific investments are not a major issue, market procurement has potential advantages over vertical integration because of the more demanding incentives provided. External producers supplying a number of customers are sometimes able to realise economies of scale that they are not able to achieve if they produce an input themselves.

In summary, the potential transaction-cost advantages of integrating two vertical functions within a single organisation depend on the degree of asset-specific investments, the ability of explicit contracts to control opportunistic behaviour and permit efficient adaptation to future circumstances, the reputational constraints provided by repeat business and the potential organisational diseconomies and coordination difficulties of

vertical integration. These issues are examined for headwater and distribution functions and wholesale and retail supply.

Integration of Headwater and Distribution Functions

The specificity of the relationship between headwater works and distribution pipelines is high. If a pipeline was denied access to the water supply, the pipeline assets dedicated to that particular water supply would have little value. If the water supply was denied access to the pipeline, the value of the storage facilities and rights to abstract water would depend on possible alternative uses of the water. The facilities may still have value if the water could be used for other purposes (e.g. generation of electricity, irrigation, wastewater disposal).

There do not appear to be any substantial problems in defining in a contract the quantity of water supplied. Defining water quality and a price for water through time, or for different circumstances (e.g. periods of scarcity), may involve some complexity.

Because of the dedication of the pipeline to the water supply and the limited possibilities for repeat transactions (i.e. for investments in pipeline or water supply facilities), the prospect of repeat business is unlikely to provide much of a constraint on the two parties.

Any increase in the complexity of the business from vertical integration of headwater supply and distribution appears relatively minor.

There do not appear to be any strong public policy reasons for separating ownership of water storage/abstraction facilities and the associated distribution networks. This is discussed in more detail in Section 5.

The overall degree of asset specificity between headwater works and the pipeline appears to be moderately high and constraints imposed by reputational considerations minimal. These factors favour vertical integration. The complexity of specifying contractual terms appears moderate. The costs of vertical integration appear limited and there are no strong policy reasons for forcing vertical separation. As a result, it appears that it would be advantageous to continue to allow vertical integration between water storage/abstraction and distribution, but that this would not need to be mandated.

Integration of Wholesale and Retail Supply

The pipelines of the bulk supplier and each of the retailers are interconnected to enable the uninterrupted transport of water between the two networks. They are designed to carry water and would have limited value in alternative uses.

The uncertainty and complexity in contracting for bulk water appears to be moderate to high. Specifying the quality of the water supplied by the wholesaler in terms of its drinking quality, turbidity, pressure, interruptions, and variability of supply may be complex but not insurmountable. The value of water can vary according to seasonal variations in supply and demand, and because of changes in demand and supply through time so that specifying the long-term price track with adjustments for scarcity is likely to be relatively difficult.

There is little prospect that repeat investments would provide much of a constraint on the contracting parties.

Vertical integration between the wholesaler and retailers would not present any particular organisational difficulties in terms of the size of the resultant organisation and difficulties in monitoring and motivating management.

There do not appear to be any strong public policy reasons for separating ownership of wholesale and retail water supply.

The degree of asset specificity in the relationship between the wholesaler and retailers appears to be moderately high and constraints imposed by reputational considerations minimal. The complexity of specifying contractual terms appears moderate, particularly for pricing over the term of the contract. The costs of vertical integration (apart from transitional costs) appear modest and there do not appear to be any strong policy reasons for forcing

vertical separation. As a result, it appears that on transaction-cost grounds there may be net benefits from integrating the wholesale and retail functions of water supply.

7.4.2 Monopoly Pricing by Vertical Monopolists

Where a downstream monopolist (e.g. water retailer) purchases its input from an upstream monopolist (e.g. bulk water supplier) and where each sets its prices independently to maximise its monopoly profits, prices will be higher and output lower than if there were a single vertically-integrated monopolist operating at both levels of production. This is because each monopolist attempts to set its price at a level at which marginal revenue is equal to marginal cost. The marginal cost of water to the retailer includes the actual cost of supply plus a monopolistic margin. The retailer then sets a monopoly price distorted by the higher costs charged by the upstream monopolist. The result is that total monopoly rents extracted are reduced but greater efficiency losses are incurred compared with a single integrated monopoly. An integrated monopolist would base its production level on the actual cost of its inputs rather than the cost plus a monopoly profit. A similar outcome might be achieved through negotiation between the two parties if not precluded by transactions costs.

7.5 Structure of Wholesale and Retail Supply in Auckland and Wellington

7.5.1 Introduction

In Auckland and Wellington, separate organisations supply wholesale and retail water. In Auckland, Watercare supplies bulk water to six territorial authorities which distribute water to final customers. Watercare transports wastewater from the sewerage systems of territorial local authorities for treatment at the Mangere treatment plant. North Shore City and Rodney have their own wastewater treatment plants. In Wellington, the Wellington Regional Council supplies bulk water to Wellington City, Porirua City, Hutt City and Upper Hutt City and manages Wellington City's retail supply on a facilities management basis. The territorial local authorities supply retail water to customers and provide sewerage and wastewater treatment in their areas.

The Government has directed the Auckland Regional Services Trust, under Section 707ZJ1 of the Local Government Act, to investigate the feasibility and desirability of, and a possible timetable for, integration of bulk water supply and drainage with local reticulation of water in the Auckland region. Similar issues are relevant to the organisation of water and wastewater services in the Wellington region.

We examine below some issues relevant to deciding the most appropriate organisational arrangements in these regions.

7.5.2 Process for Determining Appropriate Structure

As discussed in Section 7.2, we believe it is nearly impossible for a central planner to accurately determine the optimal shape of an industry. Instead it is preferable to give managers of the organisations involved the incentives and ability to seek out efficient organisational structures. However, given continued public ownership of the industry, there may be a case for the government making decisions on structure.

7.5.3 Economies of Scale and Scope

The discussion in Section 7.3 concluded that technical economies of scale might be realised by horizontally integrating smaller utilities but that such economies were unlikely for larger utilities. Some economies in management, financial and overhead areas may be achievable. Thus, limited economies of scale may be achieved from horizontal integration of the operations of the territorial authorities. The research on economies of scope is inconclusive, so it is not clear whether there might be economies from integrating water and sewerage services.

7.5.4 Vertical Integration

The discussion in Section 7.4 suggests that vertical integration of wholesale and retail suppliers might reduce the transactions costs of contracting given the specific assets involved in the relationship between the different businesses. This would help resolve disputes over pricing and assist in ensuring future investments were

efficiently planned. Vertical integration would also remove the possibility of prices being distorted by each monopolist setting monopoly prices.

7.5.5 Other Considerations

There are likely to be substantial gains from corporatisation of the industry (for the reasons discussed in Section 8). It is more likely that a single large entity would be set up as a LATE and operated commercially than would a number of smaller units which may or may not be corporatised by the territorial authority owners (for example, Auckland City's preference is for a business unit). Commercialisation of all existing organisations is unlikely unless required by central government. An integrated entity would be more likely to attract high quality commercial individuals to its board and management, and be subject to more rigorous monitoring than the smaller operations.

A single commercially-oriented unit is more likely to adopt efficient pricing and to base its investment decisions on commercial considerations than more fragmented options, although monopoly concerns may be increased.

Establishment of a single integrated entity would clearly locate responsibility for supply of services with the single company and reduce the 'politicking' over pricing and investment decisions that is a characteristic of the current structure.

Integration may reduce the (in any case limited) scope for competition from alternative headwater suppliers but does not affect the monopoly position of the pipelines. It would also involve a possibly costly transition compared with an option of corporatising all those entities that are sufficiently large to warrant corporatisation. The transitional costs would include the difficulty of integrating all operations under common ownership, and negotiation of the shareholding or consideration each party contributing assets should receive.

7.6 Summary

It is nearly impossible for a central planner to accurately determine the optimal shape of an industry. Instead, it is preferable to give owners and managers of organisations involved in the industry the incentives and ability to seek out efficient organisational structures. However, unless the operations in the water and wastewater sector are privatised, owners and managers are unlikely to have strong incentives to achieve the optimal structure for the industry. Thus, if the utilities are to remain in public ownership, there may be a case for central government imposing structural reform on the industry.

It appears probable that technical economies of scale are exhausted in the larger of New Zealand's utilities, but that savings in costs might be achieved through amalgamating smaller utilities supplying towns and rural areas. Some savings in management, financial and overhead costs might also be achieved by integration.

Integration of headwater supply and distribution, and/or of the wholesale and retail distribution businesses, appears likely to reduce the transactions costs of contracting given the specific sunk cost assets involved in the relationship between the different businesses and would remove the possible distortion to prices which occurs when vertical monopolists independently set monopoly prices. A single organisation would have clear responsibility for the quality of supply, reducing the 'politicking' over problems that is a feature of the current structure.

There do not appear to be substantial economies of scope from integrating water supply with wastewater disposal although some management economies are possible. Interrelationships between sewerage and drainage operations could be handled contractually and do not require integration.

Integration of wholesale and retail operations in Wellington and Auckland may offer some benefits over alternative arrangements. Integration may allow modest economies of scale and savings in management and overheads; it may reduce transactions costs arising from contracting between bulk and retail supply given the relationship-specific assets involved; it may increase the probability that organisations in the industry operate commercially and reduce the politicking that currently distorts pricing and investment decisions. However, integration would reduce the limited scope for competition from headwater suppliers and would involve transitional costs.

Section 8.0 Ownership Arrangements

8.1 Introduction

This section examines possible options for reforming the ownership of water and wastewater businesses in New Zealand. It begins in Section 8.2 by examining current ownership arrangements for water and wastewater businesses and in Section 8.3 discusses the benefits of corporatising the council-owned utilities. Section 8.4 reviews the legislative restrictions applying to Watercare Services Limited. Particular problems with ownership of the wholesale and retail water suppliers in Auckland and Wellington are discussed in Section 8.5. Section 8.6 examines the case for privatisation. A summary is presented in Section 8.7.

8.2 Current Ownership Arrangements

Since the reform of local government in 1989, councils have made significant changes in organising their business activities. For example, 77 percent of councils made exclusive use of council departments for delivering water services in 1977. That proportion had fallen to an estimated 16 percent in 1994. The proportion of councils proving water supply services through a LATE or with *some* private sector involvement increased from 14 percent in 1989 to an estimated 39 percent in 1994. Similar figures apply for sewerage, stormwater and drainage services. By 1 July 1993 only three councils provided water supply exclusively by a LATE and/or other private sector providers. This was expected to increase to five by July 1994.

The major change has been the separation of water and wastewater activities into council business units. Business units are usually organised as semi-autonomous groups within a council and are run along broadly commercial lines. Unlike LATEs, business units are not separate corporate entities but are divisions of councils. The establishment of business units has helped to improve the commercial focus and disciplines of these businesses.

Nevertheless, there are a number of problems with this arrangement, as with the provision of services by council departments:

• The business unit arrangement results in tension between council control and managerial autonomy. The conflicts arise because business units are still an operational arm of council yet are expected to operate like a business. The inherent tensions and conflicts are not conducive to good management even when talented individuals are appointed to positions of responsibility;

• Political objectives are a normal and legitimate consideration of councils. However, a failure to separate political, commercial and regulatory objectives increases the difficulty of monitoring performance and can lead to poor commercial outcomes. Managers of water and wastewater businesses are generally given a mixture of commercial and non-commercial objectives. For example, utility managers may be required to take into account council concerns about the income distribution implications of more efficient pricing arrangements. Managers must make trade-offs between these objectives without the costs of political interventions and requirements being transparent. A study by the Controller and Auditor-General noted that councils were not always aware of the conflicts facing business units and the need to manage them in order to make business units accountable for their performance;

• External monitoring of performance is difficult, and no provision for expert outside monitoring exists under council department or business unit provision (e.g. there are commonly no commercial boards);

• In many cases, there is limited information available on the performance of the businesses and performance measures used are often of limited value; and

• Because managers generally pursue a mixture of commercial and non-commercial objectives, monitoring is weak and limited information is available, it is difficult to objectively measure managers' performance and hold them accountable. The lack of accountability weakens the incentives for managers to maximise performance.

These problems suggest that the delivery of services through council departments or council business units is unlikely to be optimal in efficiency terms. The inevitable tensions and conflicts inherent in these arrangements are likely to reduce management performance.

Within the constraints of continued local government ownership there is considerable scope to improve the institutional arrangements within which council-owned water and wastewater businesses operate. The major option for reform is corporatisation under the provisions of the Local Government Act.

8.3 Corporatisation of Water Businesses

8.3.1 Framework

The corporatisation model and its variants have been applied to state-owned enterprises, local authority trading enterprises, Crown Research Institutes ('CRIs') and electricity supply authorities, among others.

The key elements of the corporatisation framework are outlined in Appendix G. The framework requires: clear management objectives; managerial authority; rigorous performance monitoring; well-designed rewards and sanctions; and competitive neutrality. The first four conditions are required to provide managers with strong incentives to maximise the value of council's investment in its trading activities. The fifth condition, competitive neutrality, requires the establishment of an external environment in which the pursuit of value maximisation by the managers of council businesses enhances the wider community interest.

Experience both in New Zealand and overseas suggests that the success of the model depends on maintaining its overall integrity. In particular, for the model to yield sustainable benefits:

• The objectives set for the organisation involved must be clear and non-conflicting;

• High-quality directors must be appointed to boards and non-performing directors and boards must be expeditiously replaced. Councillors should be elected to a board only when their commercial skills are superior to other possible board members;

• An arm's-length relationship between managers and shareholders must be established and rigorously maintained. Councillors must resist the temptation to interfere with management decisions for political reasons;

• Other agencies must be precluded from impinging on the managerial autonomy established;

• Mechanisms must be established for holding managers accountable for achieving the objectives set for them, and for monitoring their performance;

• Non-commercial objectives must be separated out, and funded separately; and

• All regulatory advantages and disadvantages enjoyed and/or suffered by the organisation *vis-à-vis* actual or potential competitors must be removed.

8.3.2 Gains from Corporatisation

Corporatisation improves management performance by clarifying management's objectives and increasing accountability for performance. The corporatisation model has been applied beneficially in a variety of situations at both the central and local government level. Corporatisation of central government operations has resulted in substantial improvements in efficiency. For example, a review of New Zealand experience with corporatisation reported that:

• In its first year as a state-owned enterprise Postbank returned an after-tax profit of $30.8 million compared with an expected loss of $50 million in the absence of restructuring. Postbank reduced its staff numbers by 30 percent and its retail outlets by nearly 40 percent prior to its privatisation;

• ECNZ reduced real unit costs by 28 percent, reduced real average wholesale electricity prices by 13 percent, increased productivity as measured by GWh/employee by 71 percent and achieved a 187 percent increase in profitability in 1990/91;

• Forestry Corporation reduced staff numbers by nearly 65 percent (in part by contracting out), and in its first year of operation increased output per employee by 18 percent;

• In the first three years following corporatisation of Coal Corp, productivity measured in terms of volume per employee rose nearly 60 percent. Sales turnover per employee grew by 30 percent and real prices fell 20 percent. Coal Corporation halved its staff but increased its annual production;

• Telecom reduced employees by 47 percent in the period 1987 to 1990, increased productivity by 85 percent (measured in terms of lines per employee) and increased profits by around 300 percent. Waiting times for installation of new phone lines were reduced from around six weeks to less than 3 days for more than 95 percent of customers;

• NZ Post reduced staff by 30 percent and increased the percentage of next day deliveries by 17 percent in its first four years of operation; and

• The port companies used 40 percent fewer workers than their harbour board predecessors with no reduction in tonnages handled, reduced stevedoring charges and reduced turnaround times per ship.

The gains resulted, in varying degrees, from the clear commercial focus given to these organisations, the removal of statutory protections, the threat of privatisation and the quality of the private sector expertise appointed to their boards during the commercialisation process.

8.3.3 Opposition to Corporatisation of Local Authority Businesses

Councils sometimes oppose the formation of LATEs for the following reasons:

• LATEs are subject to company tax whereas businesses that are a part of a local authority are not;

• The cost of debt to the LATE may be higher than council debt;

• The price of services to customers may increase under a commercial approach with adverse distributional implications; and

• Councils may lose direct control of business activities.

Although the formation of LATEs may result in efficiency gains, these gains, from the point of view of local authorities, may be outweighed by the tax paid to central government. From the national viewpoint, the taxation of LATEs is a transfer from local government to central government rather than a net cost to the economy. Thus, if local authorities decide not to corporatise because of the tax costs, the overall efficiency benefits which would result from improving the governance structures of local authority would be forgone. Equalising the tax treatment of LATEs and council business units would remove this distortion and facilitate corporatisation when net efficiency benefits could be achieved.

Unfortunately, there are practical obstacles to achieving tax equality. Exempting LATEs from tax would create tax distortions with private sector companies. Subjecting all business units to tax whether or not they have their own corporate form is also problematic. Business unit activities are generally organisationally integrated with their council parents and the boundary of their activities may be difficult to define. As a result, major compliance costs would be incurred in apportioning and auditing the allocation of costs between the unit and the

council. In the case of joint costs, arbitrary rules would have to be adopted. Business units would have little difficulty transfer pricing to ensure they did not make any significant taxable profit.

A possible option would involve central government requiring corporatisation of activities that are readily identified as commercial. This approach was adopted for port and airport companies among others.

A second concern is that corporatisation might increase the observed cost of debt. Although the costs of debt to a LATE would be expected to be higher than local authority debt, the difference reflects the risks borne by ratepayers when the debt is issued by the local authority rather than the LATE. Because these risks are a real cost associated with a LATE's activities it is desirable that these costs, along with other costs of producing outputs, be reflected into prices charged for services, otherwise ratepayers will indirectly subsidise customers. Consumption will then be too high, investments made sooner than economically justified and resources wasted.

Corporatisation may result in LATEs applying commercial charges to output produced, improving the efficiency of resource use. Where prices reflect current inefficiency and excessive (marginal) costs, prices may fall following corporatisation, as they did with ports and many SOEs. Where prices are currently below marginal cost, prices may increase, affecting some low income households (but should correspondingly decrease the burden of rates). If there are real concerns about the ability of some households to pay for services, these should be addressed through income support rather than through sacrificing the cost saving and other benefits (for example environmental benefits in the case of water utilities) achievable through more efficient pricing.

Corporatisation changes the relationship between a trading entity and council but does not mean that a council loses control of it. Control is exercised through the appointment of directors, the negotiation of a statement of corporate intent outlining the council's expectations of the company, and the power to wind up the company. The local authority loses only the ability to directly manage the company on a day-to-day basis.

8.3.4 Experience with LATE Corporatisation

Few LATEs have been established unless required by central government. Where the central government has required corporatisation of local authority businesses using special legislation (as in the case of airport and port businesses owned or part-owned by local authorities), substantial gains in efficiency have been achieved. Most of the companies concerned have achieved large reductions in costs and improvements in performance. Corporatisation has distanced these organisations from direct political control by their local authority owners, removing conflicting objectives. Individuals with commercial expertise have been appointed to boards and the accountability and monitoring of the organisations has improved relative to their previous organisational forms.

Nevertheless, a review by the Office of the Controller and Auditor-General noted a number of concerns with existing LATE arrangements:

• There was a strong potential for a conflict of interest when councillors or chief executives of councils were appointed to the boards of LATEs. Elected council representatives are responsible for promoting community interests which may conflict with the commercial objectives of council companies. Chief executives of councils face conflicting interests as both directors and advisors to councils;

• The local authorities were unable to demonstrate in all cases that they had selected directors in an impartial manner, and that elected council representatives had been selected on the basis of their commercial expertise;

• In many instances local authorities were not scrutinising the statement of corporate intent in a rigorous fashion or specifying their ownership expectations of companies sufficiently clearly;

• Not all shareholding local authorities appeared to have recognised the importance of obtaining complete and regular information about the performance of their companies or the need to be kept informed of company matters which might have a significant political impact; and

• Few councils were receiving sufficient advice on the performance of their companies for them to exercise their obligations as owners.

8.3.5 Application of the Corporatisation Model to the Water Industry

The corporatisation model is most relevant where an organisation is producing goods or services for private consumption (although the model can still be applied for services provided to a council or government); where outputs can be measured and priced; where activities can be operated at arm's length from the political process; and where capital requirements are so large as to warrant separation of ownership from management.

Water services are essentially 'private' in nature. Customers can be excluded from the services they do not pay for. Consumption of water is 'rival' in that consumption by one person precludes consumption by others. Outputs can be measured and priced (more or less accurately depending on the existence of metering). The quality and quantity of water produced can be measured. Thus, corporatisation of water services appears feasible.

Sewerage services are largely private in nature. There are positive external benefits from consumption of sewerage services in that discharge of effluent from a private property directly into the environment would impose health and other costs on neighbours. The most efficient way of controlling this problem is probably through regulation requiring sewerage to be discharged to sewers or septic tanks. Use of sewerage services is rival in that when the system is congested, one person's use precludes use of the system by another. Output by the sewerage service company can be measured and the services provided priced (using proxies where direct measurement of service is not possible). The volume of sewerage treated can be measured reasonably accurately but the 'strength' of the sewerage is less easily measured, particularly for domestic customers. Nevertheless, proxies for outputs can be used and charges levied for the services provided. Corporatisation of sewerage services appears feasible.

Drainage involves both the collection of water from properties (which could at least in theory be measured and charged for) as well as the drainage of public property such as roads. For the latter there are considerable complexities in allocating causal responsibility for particular services, and in identifying who the real beneficiary/customer of urban drainage might be. For example, the drainage requirements of those in low lying areas will depend to some extent on the provisions made by those in higher areas.

Because of the extent of these interdependencies, the provision of drainage services to individual customers on a commercial basis may be problematic and a relatively strong case can be made on public good grounds for the funding of at least some element of these services through local government rates (as occurs at present). However, that does not mean that a government agency itself has to provide the services - rather it means that a case can be made for at least partial funding by an appropriate level of government.

In summary, the public good nature of drainage services suggests that continued provision by local authorities may be justified. Water and sewerage services are commercial operations that could be provided by corporatised entities.

Around 75 percent of the local authorities that serve a population of less than 50,000 may be too small to justify separate corporatisation. In many cases the number of board members of a LATE would exceed the numbers employed by the local authority to deliver the water and wastewater services. One option would be for the formation of joint LATEs between authorities. Currently, parochial or political interests might impede such developments.

8.4 Watercare Services Limited

A number of legislative restrictions apply to Watercare Services Limited that are inconsistent with the corporatisation model.

The Local Government Act specifically provides that Watercare is not to pay a dividend or distribute any surplus to its owner or any other shareholder. Each year Watercare is to decide whether or not to return any surplus to its customers, and to determine the method of return. Watercare's prices are to be set to recover only its operating costs including interest and planned maintenance and renewals. Watercare must first seek funding for investment from the territorial authorities and only if the territorial authorities decline to subscribe is Watercare able to fund capital requirements from outside providers.

The legislative restrictions applying to Watercare Services Limited result in a confused ownership and accountability structure for the organisation. Because the institutional arrangements adopted matter for the performance of an organisation, it is likely that the unusual arrangements applying to Watercare weaken its performance.

These arrangements mean that the owners (the Trust), who bear the risks of investment and who have responsibility for management of the company, are unable to retain income from surpluses generated. The company's operations and investment programme are subject to territorial authority agreement. Customers enjoy the rights to residual earnings but are unable to directly influence performance. They can, however, restrict Watercare's ability to invest or increase prices.

The ownership arrangements deviate from the corporatisation model which requires LATEs to have a commercial focus, and provides strong incentives to maximise profits. The prospect of reaping a profit or surplus is the motivating force for efficiency in a market economy. When firms must compete for customers, or monopoly power is constrained (by regulation or the threat of regulation), the ability to make a return over and above cost depends on the ability of the organisation to use resources efficiently - to develop a cost-effective production process, to meet customers' preferences for quality, to implement streamlined management practices and so forth. Profit provides a focus for the maximisation of differences between income and costs which drives the efficiency of resource use, given competition, the threat of competition or other constraints on market power.

Where the surplus is captured by owners of a firm, they generally have strong incentives to ensure the organisation is managed efficiently. Where profits are not returned to owners, they are, not surprisingly, much less concerned about the performance of the organisation. In those circumstances potential surpluses are likely to be dissipated through inefficiency, higher payments to staff and to other suppliers of inputs. In the case of Watercare, the surpluses must be returned to customers - thus customers have an incentive to ensure the organisation is operated at minimum cost. However, in the absence of an ownership stake, customers do not have the ability to directly influence the behaviour of the organisation to ensure its efficiency. In addition, if profits are distributed to customers on the basis of customer demand, the effect may be to induce additional demand.

Watercare's prices are to be set to recover only operating costs, including interest and planned maintenance and renewals. It is thus unable to increase charges to reflect periods of shortage and is restricted in its ability to raise prices to reflect long-run marginal cost. If prices to end users are well below the marginal cost of supply or cannot be increased to reflect periodic shortages, then investment is likely to be required before it is economically justified. Given the capital intensive nature of the business, the non-adoption of efficient pricing can have a significant impact on the dynamic efficiency of the organisation.

The effect of provisions restricting Watercare's access to capital is that Watercare can only operate, and undertake any significant capital expenditure, with the active cooperation of most or all of the territorial authorities. The territorial authorities must agree with the programme of capital expenditure, agree to subscribe capital and/or contract for bulk services provision and/or agree with price increases. Watercare's access to outside funding is implicitly subject to the agreement of the territorial authorities since the security of any loan can only be provided by contracts or agreements for sale of services to the territorial authorities, and increases in prices or charges also require the agreement of the territorial authorities. If agreement from the territorial authorities is not obtained, Watercare's capital expenditure programme would be restricted to the financial constraints of its depreciation and maintenance provisions. Even with the territorial authorities' agreement, funding is restricted by the ability of the territorial authorities to raise capital.

These unusual requirements have resulted in a number of lending institutions being reluctant to provide Watercare with funding. New equity is not a viable alternative for financing capital expenditure because new equity partners cannot receive dividends under the current legislative regime.

The 25-year contract between the Auckland Regional Council (when it was the bulk water supplier) and the territorial authorities expired in 1988 and no contract has been agreed to replace it. Watercare has held a number of rounds of negotiation but no agreement has been reached. The negotiations are made more difficult by the lack of commercial pressures and incentives on either party to negotiate in good faith, and confusion resulting from the territorial authorities' 'ownership' and customer roles.

The lack of long-term contracts and the sunk cost nature of Watercare's investments results in substantial scope for opportunistic behaviour by Watercare's customers seeking to expropriate some of the value of Watercare's assets. This would be achieved through under-pricing of services provided by Watercare. Because there are opportunities for major wealth transfers between the Auckland Regional Services Trust which legally owns Watercare and its customers, as well as between the different customers, the difficulties and risks of financing any major new investments are significantly increased. The Trust cannot retain or distribute any surplus Watercare generates, so it cannot obtain a return for any risky investment it undertakes. This must affect its incentives to undertake such investment.

The special legislative provisions relating to Watercare Services Limited serve no useful purpose and should be repealed. Watercare should be established as a LATE under the general provisions of the Local Government Act.

8.5 Club Ownership of Bulk Supply in Auckland and Wellington

In both Auckland and Wellington, separate businesses supply bulk water and retail distribution services. In Section 7 we concluded there may be advantages in vertical integration of wholesale and retail supply, in the absence of complex shareholder arrangements.

This conclusion might be changed if the territorial authorities all wished to retain an ownership share in the wholesaler, resulting in a 'club' arrangement.

The major potential benefit of such an arrangement is that club ownership, in which an organisation's customers are also its owners, would remove the organisation's incentives to charge its customers monopoly prices. Club ownership would not prevent the territorial owners then charging final consumers monopoly prices. Club ownership would prevent the levying of monopoly prices at each level of the industry. (If each independently attempts to extract rents the total monopoly rents extracted are reduced but greater efficiency losses are incurred than with a single integrated monopoly).

However, club ownership in which territorial authorities have a relationship with the company as both customers and shareholders could be problematic. In particular, such an arrangement has some potential weaknesses resulting from the following:

• The territorial authorities' interests as shareholders would at times conflict with their interests as customers and with other shareholder/customers. A territorial authority is likely to push for developments that benefit itself as customer even if it were to the disadvantage of the organisation, and may resist developments advantageous to the company and other users. Developments undertaken by the supplier are likely to have a differential impact on territorial authority customers, while they all have to bear the potential costs and risks through their shareholding roles;

• Club ownership is also likely to result in politicisation of price setting with each authority attempting to obtain prices that benefit itself as customer. Gaming is possible because the benefit of a particular set of prices might fall on one customer, but the costs of inefficient pricing would fall on all owners;

• No party would have a majority position in the jointly owned water utility so that decisions could not be made without the agreement of two or three (or possibly all) of the shareholders. The territorial shareholders would at times have difficulties making collective decisions given their conflicting interests. A likely result is a failure to undertake required capital investment in a timely manner. Capital distribution decisions could also be difficult;

• The territorial authorities would be shareholders in the utility because they were major users, and not because they were the investors best able to manage the company and maximise its value. They are unlikely to have any particular advantages in owning a water/wastewater supply company. It is therefore quite possible that alternative owners could realise strategic value and, by taking a different view of the risk and possible return from investment and by changing the monitoring and accountability arrangements, increase the value of the company; and

• There are significant difficulties in establishing a 'club' arrangement and providing flexibility for it to adjust through time. For example, in principle ownership would be set in proportion to the relative share of the

water/wastewater company's output that was used by each territorial authority. The relative size of each territorial authority's consumption would be expected to change through time, but it would be difficult to adjust ownership shares to reflect this.

Overall, there appear to be advantages from integration of the wholesale and retail supply of water in Auckland and Wellington (as discussed in Section 7). However, integration in which multiple territorial authorities are shareholders in the bulk supplier is likely to be problematic.

The option of territorial authorities owning an integrated company that itself supplied final consumers is less problematic. Such an arrangement does not involve the direct conflict of interest which arises if the territorial authorities are both owners and customers. There may be concerns that the territorial-authority owners might attempt to advance the interests of their own ratepayers through the company at the expense of the overall interests of the region. However, this could be overcome by preventing councillors standing as company directors and instituting a formal process to ensure that directors were appointed for their commercial skills. Trust ownership, which is the main alternative if public ownership continues, suffers from problems including the limited accountability to ultimate owners that is inherent in public ownership, and the influence that politics has on the selection of board directors (apparent in the selection of directors for Watercare Services Ltd).

8.6 The Case for Privatisation

While practical experience with corporatisation in New Zealand has shown that the gains from this process can be substantial, it has also focused attention on inevitable deficiencies in the corporatisation 'model'. These deficiencies stem from incentive problems associated with continuing government ownership. In particular, they result from the following:

• Experience indicates that politicians may be unwilling to accept some of the basic principles of the corporatisation model. For example, councillors may be appointed to boards even when their commercial expertise is limited;

• Capital market constraints on the performance of businesses that remain in government ownership are relatively weak. For example, management is not exposed to the threat or reality of takeovers and information generated by the sharemarket reflecting management performance is absent;

• There is an ongoing risk that businesses remaining in government ownership will be subject to politically motivated intervention. Government ownership facilitates the use of these organisations to deliver benefits to organised interest groups at the expense of ratepayer owners. Accountability to the ultimate owners, ratepayers, is intermediated through politicians, a more indirect mechanism than in the private sector; and

• As ultimate owners of government-owned organisations, ratepayers have relatively weak incentives to monitor the performance of management and the government agencies that are acting on the shareholder's behalf because they are not able to act directly on that information (e.g. by buying or selling shares).

These deficiencies are discussed in more detail in Appendix G. An additional concern in the current case is that continued local government ownership may impede rationalisation of the industry (in terms of mergers etc) because of parochial desires by councils to retain local control.

The deficiencies in the corporatisation model in the longer run suggest that privatisation can, in general, provide benefits. The case for privatisation is less clear cut when an organisation has monopoly power as is the case for piped water and sewerage service providers. In these circumstances, no ownership and regulatory regime can provide incentives to minimise costs without at the same time providing incentives for monopoly pricing. The choice between public ownership, private ownership with no regulation, and private ownership with regulation involves trading off the different problems.

Private owners of water businesses would have stronger incentives than government owners to minimise costs and optimise investment since that would maximise profits. In the absence of regulation or the threat of regulation, private owners would also have stronger incentives to set monopoly prices.

Price regulation would reduce the incentives of private owners to set monopoly prices but would also weaken their incentives to minimise costs. A heavily-regulated water or wastewater company is unlikely to outperform a government-owned company.

Private ownership, combined with a light-handed regulatory regime, could retain the incentives for managers to minimise costs while providing constraints on the monopoly power of water suppliers. In our view, this option provides the best trade-off between the problems of cost minimisation and monopoly pricing. We are sceptical about the benefits of privatisation if private ownership is accompanied by heavy-handed regulation. The distortions to incentives to perform efficiently are likely to be serious with both government ownership or private ownership with heavy-handed regulation.

In recent years there has been a worldwide movement towards greater private sector involvement in the water industry. Factors underlying this trend include the following:

• Previous institutional arrangements have been perceived as inadequate. Public sector investments have sometimes been motivated by political ends, resulting in poor quality decisions. Inadequate accountability and monitoring arrangements have contributed to inferior performance in elements of the water sector; and

• Higher environmental and water quality standards have driven a requirement for additional capital. This, combined with constraints on public finances, has led to government organisations turning to the private sector for the services they require.

Greater private involvement can be achieved through the sale of water and wastewater entities to the private sector, greater involvement of private companies in aspects of the industry or through greater use of contracting arrangements with the private sector, with ownership of assets remaining with councils.

8.6.1 Private Ownership

Assuming establishment of a light-handed regulatory regime, council-owned sewerage and water service providers could be sold to private sector operators. A number of issues, including the nature of the regulatory regime, would need to be resolved prior to privatisation.

Private supply of water already exists in New Zealand in smaller towns and isolated communities. Oamaru has a private water supply with water provided by the farmer controlled Lower Waitaki Irrigation Company Limited. Privatisation of the 50 government-owned irrigation schemes, completed in 1992, resulted in the new owners achieving large reductions in operating costs, of up to 70 percent in some cases.

Privatisation and rationalisation of water and wastewater services would meet widespread opposition from many territorial authorities. It might need to be actively encouraged or mandated by central government. In the short term at least, franchising and contracting out appear to offer the greatest scope for increased private ownership in the water and wastewater industries.

8.6.2 Franchising and Contracting Out

In Section 5, we examined the option of franchising as a regulatory tool. Franchising can also increase private involvement in an industry to overcome public sector capital constraints and reduce costs without necessarily being aimed at reducing any market power. Private contractors may be involved in construction and maintenance of pipelines, operation of treatment plants and so on. Councils can retain ownership while allowing private sector operation of assets. Contracting and franchising can allow small councils to take advantage of a large private firm's experience in operating several plants, often internationally, and may allow access to more highly trained personnel and bulk purchases of materials and supplies. As long as the contracts are subject to a competitive tendering process, this approach should help to minimise the input costs of the water and wastewater supplier. However, these arrangements do not necessarily prevent the council or operator charging monopoly prices.

As discussed in Section 5 and Appendix F, contracting requires careful design of contracts, identification of methods for handling contingencies and strong monitoring of assets and performance by the council.

A private operator of publicly-owned facilities faces a number of risks. These include (for the operation of a wastewater plant):

• Politicisation of the contracting out of the operation;

• End of contract costs and the possibility that the contract would not be rolled over;

• Potential for industry-wide reform mid contract;

• Failure of the territorial authority to recognise contingency pricing;

• Changes in consent conditions as a result of a consent review;

• Allocation of responsibility for environmental hazards associated with old sludge;

• Costs of the consent process;

• Costs of prosecution for non-compliance with consents;

• Lack of control of plant influent; and

• Risk that new works would be constructed during the contract.

A number of studies have demonstrated benefits from contracting out of services. For example, Oklahoma City, which contracted the operation of three of its wastewater plants for a five year period, saved around US$4.6 million annually. The Indianapolis Department of Public Works contracted out the operations and maintenance of two wastewater treatment facilities in 1994, with cost savings projected at US$65 million over the five year life of the contract. The New Orleans Sewerage and Water Board contracted out the operations and maintenance of all its wastewater treatment plants, achieving savings estimated at US$5 million per year.

Another study of competitive tendering estimates savings of 30 percent from contracting out major construction, maintenance of water treatment plants, information technology, and the operation and maintenance of wastewater treatment plants; 20 percent savings for maintenance of mains, services and connections; 15 percent for meter reading; and 5 percent for payroll functions.

Some councils already contract for services from other public or private organisations. Contracting for construction and maintenance is common, with contracted operation of facilities less common. Rodney District Council has contracted the operation, maintenance and repair of its water and wastewater system to Works Civil Construction. Wellington City Council's water supply is operated by the Wellington Regional Council. Wellington City Council has contracted with Anglian Water International to design and construct a wastewater treatment plant for Wellington and to operate it for 21 years. The capital cost of the plant is $149 million.

8.7 Summary

Since the reform of local government in 1989, councils have made substantial changes in organising their business activities, making increasing use of business units to deliver their water and wastewater services. The establishment of business units has helped to improve the commercial focus and discipline of these businesses. Nevertheless, the inherent tensions and conflicts with this arrangement are not conducive to good management even when councils appoint talented individuals to positions of responsibility. A failure to adequately separate political, commercial and regulatory objectives combined with limited external monitoring reduces the accountability of managers. The likely result is poor commercial performance.

Substantial improvements in efficiency could be achieved by corporatising the larger water and wastewater businesses using the local authority trading enterprise provisions of the Local Government Act. Experience in New Zealand and overseas suggests that as long as the integrity of the corporatisation model is retained, application of the model to the water industry would yield substantial efficiency benefits.

Some councils are opposed to corporatisation because of the unfavourable tax treatment of LATEs compared with business units. Although the formation of LATEs may result in efficiency gains from the national viewpoint, these gains, from the point of view of local authorities, may be outweighed by the tax paid to central government. Unfortunately there are practical obstacles to achieving tax equality between private organisations, LATEs and council operations. A possible solution to this problem is for central government to require corporatisation of activities that are readily identified as commercial. This approach was adopted for port and airport companies, among others.

The legislative restrictions applying to Watercare Services Limited result in a confused ownership and accountability structure. Application of the standard corporatisation provisions of the Local Government Act is likely to improve the company's performance.

While practical experience with corporatisation in New Zealand has shown that the gains from corporatisation can be substantial, it has also focused attention on the following incentive problems associated with continuing government ownership:

• Experience indicates that politicians may be unwilling to accept some of the basic principles of the corporatisation model. For example, councillors may be appointed to boards even when their commercial experience is limited:

• Capital market constraints on the performance of government-owned businesses are weak;

• There is an ongoing risk that businesses remaining in government ownership will be subject to politically-motivated intervention; and

• The ultimate owners of the businesses (ratepayers) have relatively weak incentives to monitor the performance of management.

Deficiencies inherent in the corporatisation model suggest that further gains could be achieved by greater use of contracting out, franchising, or privatising of water and wastewater businesses, as long as any monopoly concerns could be handled by light-handed regulation.

Section 9.0 International Experience

9.1 Introduction

This section examines the different institutional arrangements adopted internationally for private involvement in the supply of piped water. The English model involving price-cap regulation is examined in Section 9.2, the American model based on rate-of-return regulation is discussed in Section 9.3 and the French model involving franchising in Section 9.4. Variants on the French model are discussed in Section 9.5. The costs and benefits of the different approaches are reviewed in the summary in Section 9.6.

9.2 The English Model

The English model of water supply offers more scope for private sector participation than any other model currently in use. No other country has fully privatised its water supply assets.

English privatisation dates from 1989 when the government sold ten regional water companies to private investors. England followed the same procedure and model used for numerous other privatisations under the Thatcher government. The private regional water companies now serve about three-quarters of the population of England and Wales. The remainder of the population was served by 29 statutory, privately owned water

companies, now consolidated to 23 companies through mergers. English water companies generally handle both water supply and wastewater treatment but the 23 statutory companies only provide water supply services.

At least for the ten large water companies, the British water industry has been regionally integrated. The American system, in contrast, is fragmented across towns and municipalities. The water supply systems of different municipal governments are not usually linked or coordinated.

English privatisation was motivated by the need to infuse new capital into the industry. The English water supply infrastructure is aged and decaying; some estimates suggested that $US50 billion of new investment was needed over the 15 to 20 years following privatisation. The British public sector simply did not have resources of this scope available, which led to pressure for privatisation.

Privatisation policy included the creation of three new regulatory bodies to oversee the system. These bodies regulate water quality, wastewater discharges, and the prices of the private operators.

Price regulation under the British system is complex. A price-cap formula links water prices to the rate of inflation, plus some factor "K." K is determined on a company-by-company basis, and is influenced by the costs of that water company's investments and their expected environmental obligations. Companies are allowed to pass along unexpected increases in costs that cannot be prevented by management. British regulators also disallow discriminatory pricing across different classes of customers.

The British government deliberately chose price caps over American-style rate-of-return regulation. In theory, price caps allow companies to turn cost reductions into greater profits, and thus provide an incentive to reduce costs. In the long run, however, the government may capture some of the benefits of cost reduction by lowering the price caps for more efficient companies. Nonetheless, the K factor, which is supposed to be reviewed every five years, gives the company at least several years to reap a return on productivity improvements.

The price-cap method has been partially compromised by political pressures. The British system is moving towards implicit rate-of-return regulation. High dividends and managerial salaries at the water companies, publicised through the media, have caused the government to review the price caps sooner than planned. The British regulatory authorities (Office of Water Services, or OFWAT) have made it clear that they now regard the initial K factors as much too generous, and they wish to lower allowable profits. In fact, the K figures were initially set artificially high to ease the costs of privatisation and to spark investor interest. The government now stands in the awkward position of wishing to renegotiate the basic contract.

Political pressures often do not allow water utilities to enjoy high private rates of return, even if they have earned their profits by productivity improvements. Governments cannot tie their hands and precommit to no future rate-of-return controls. The possibility of such controls in the future implies that all regulatory regimes involve a degree of implicit rate-of-return regulation. In some British privatisations, such as the airports, the subsequent move towards rate-of-return regulation has been explicit.

The English system is experimenting with metering to determine water charges. Prior to privatisation, most households were not metered; charges were instead assessed according to the taxable value of the property. The 1989 privatisation legislation stipulated experimentation with water metering trials, and required that the land value pricing system expire by the year 2000.

The privatisation reforms changed the constraints facing the smaller, statutory water companies. Under the prior law, the dividends, reserves, and rates of return of these companies were regulated by the Secretaries of State for the Environment and for Wales. Subsequently, these companies have been allowed to convert to public limited companies, and have been freed from direct controls on dividends and reserves. Rate-of-return controls have been replaced by price-cap regulation.

The English water supply system attempts to use traditional commercial constraints to bring productive efficiency. Private corporate governance provides internal incentives to keep costs down, and outside investors provide external incentives. One French water company, the Lyonnaise des Eaux-Dumez, has already bought up several smaller British water companies and taken equity positions in some of the larger ones. Private markets provide capital and bring needed monitoring and technical expertise. Many water company employees have

bought into the companies that employ them. Partial employee ownership may spur productivity by giving workers a stake in their company and by defusing adversarial attitudes towards managers and investors.

British water regulators publicise explicit comparisons of the performances of utilities. Companies are asked to publish data on comparative efficiency, such as operating costs per unit of water delivered. The director of OFWAT scrutinises these measures and encourages companies to adopt the demonstrated "best practice." This system is known as "yardstick competition." OFWAT also discourages mergers that might interfere with their ability to make such comparisons. One proposed merger was held up for this reason, although it was eventually approved.

The effectiveness of these required comparisons is questionable. Differing operating environments and inherited asset bases make any OFWAT judgments highly subjective. Regulators cannot usefully separate the competence of management from other external influences. Furthermore, OFWAT has no legal authority to compel companies to take heed of its efficiency recommendations. Comparisons across water companies have been forced only through internal commercial pressures. Shareholders and board members do take an interest in the comparative figures, and ask for explanations when their companies do not measure up to their peers.

In 1992, British regulators attempted to increase the competitive pressures on water companies by additional deregulation. Large customers are no longer legally tied to their regional company and can now purchase water from any of the certified companies. The customer can request bulk supplies of water, and the use of sewage treatment and disposal facilities. Although large customers have yet to initiate switches to other companies, the greater competitiveness of the market may spur water companies to improve the quality of their service.

9.3 The American Model

Most water delivery systems in the United States, especially in the larger cities, are publicly owned by municipalities. Yet America also has about 40,000 smaller systems, some serving populations of fewer than 3,300. Sixty-four percent of these smaller systems are privately owned utility-like organisations. These investor-owned systems serve approximately 15 percent of the American population. In both cases, rate-of-return regulation is the predominant means of controlling monopoly power; such regulation is the defining characteristic of the American system.

Many parts of the United States municipal water supply system are over 100 years old. In contrast to their French and English equivalents, many American urban supply authorities are losing money and are losing the ability to maintain their rapidly aging assets. Rates of water leakage and water main breaks are relatively high.

Utility pricing is determined by a complex political process. State governments provide the highest level of regulatory authority, and state commissions make the final decisions on rate increases. Companies must apply to the commissions for rate increases, which are then evaluated using formal judicial procedures. The hearings are subject to legally stipulated rules of evidence and procedure. Generally, the commission attempts to determine whether the proposed rate increase can be justified by an underlying increase in costs.

The committee also rules on what is to be considered a "fair" or "allowable" rate of return. Various interested parties bring in expert testimony, and the commission selects a rate of return between the rate needed to cover costs and the rate available on comparable risky investments.

State commissions usually have three to five members. They are either appointed by the state governor, elected by popular vote, or elected by the legislature. Commission members are more likely to push for low prices than to serve the interests of the water companies. Prices are often low relative to costs, although the high level of costs does not mean that prices are necessarily low in absolute terms.

The effects of rate-of-return regulation depend crucially on how the utilities' costs are measured. Most state commissions use an accounting standard of historic cost, although some use replacement cost or "fair value" approaches.

Rate hearings typically involve a high administrative burden. Such hearings are frequently held as often as annually, especially in inflationary times. A variety of consumer, political, and industry groups present evidence at such hearings. Regulators must scrutinise utility costs carefully in preparation for each hearing.

9.4 The French Model

Private sector involvement in the provision of water services has the lengthiest history in France. Private companies have been closely involved with French water supply since the mid-nineteenth century. Today, approximately 75 percent of the French population receives water from private operators, and about 40 percent receives sewerage services from private operators.

Although municipalities have the option of providing water services themselves, private participation has approximately doubled in coverage over the last 40 years. French water companies have also become involved in supplying water services in the third world (see further below).

The responsibility for French water supplies is taken by France's 36,000 local municipalities or communes. These municipalities often combine to form water supply syndicates. Regulations are provided by all levels of government, from local to national. Four major private suppliers account for the bulk of the market.

9.4.1 Forms of Franchising

French water supply contracts with private suppliers include management contracts, leasing contracts ("affermage"), and concession contracts. These various arrangements reflect varying degrees of franchise responsibility; the French municipalities decide which combination of models to use.

Management or service contracts arise when municipalities contract out specific functions to private companies. The municipality retains ownership of the assets, accepts general responsibility for the system, and continues to bill customers. The private company accepts responsibility for a series of well-specified tasks for a predetermined period of time. Management contracts involve more limited private sector participation than do either leasing or concession contracts.

Water supply leases typically give a private sector institution responsibility for asset operation and maintenance, billing, and collection of fees from customers. The contractor finances working capital and all assets with a lifespan shorter than some agreed-upon limit. The public organisation is responsible for longer-term investments, and for debt service on the water supply assets. Contracts delegate the relevant responsibilities and specify the quality of maintenance required.

The private lessee retains commercial autonomy in hiring decisions and day-to-day business decision-making. The lessor and lessee agree on water fees that allow both parties to cover their costs, service relevant debts, and provide a return on investment. This "affermage" model is the most commonly used in France.

The concession model places further responsibility upon the contractor. To varying degrees, the contractor takes on responsibility for financing, maintaining, or improving longer-term assets. Contract length is correspondingly longer to allow private sector investors to recoup their up-front investment. Whereas leases are usually for periods in the neighbourhood of ten years, concessions typically last for fifteen to thirty years (often at the higher end of the range). At the end of the contract the assets revert to municipal ownership, although municipalities will usually renew the franchise agreement and the ongoing relationship.

French water fees are established through initial negotiation, or sometimes on the basis of competitive bidding. Adjustments for inflation are allowed according to a pre-agreed formula Concession contracts specify initial prices and a procedure for subsequent indexation to the rate of inflation and, to some degree, the utility's costs. Contracts usually index prices to a weighted average of published prices for key inputs. These contracts also contain five-year "break points," when the company may request a price renegotiation. The Ministry of Economy and Finance monitors fee levels.

French companies do not face explicit rate-of-return regulation. Nonetheless, the price negotiations between the company and municipality are often based on participants' perceptions of a fair rate of return for the services rendered. As in England, political pressures discourage either bankruptcies or huge profits on the part of the water companies.

The French water utility market is highly concentrated. The largest firm, the Compagnie Genérale des Eaux, accounts for 40 percent of the market; the second largest firm, Lyonnaise des Eaux-Dumez, accounts for 23

percent. The next two largest firms cover five and two percent of the market, respectively. Most of the smaller companies have been bought out by one of the larger operators. The larger companies are also active in a wide range of businesses, including television broadcasting, waste disposal, construction, mortuary services, and electrical contracting.

Although the French system awards monopoly concessions, some competitive pressures are present at the contracting stage. Previous performance helps determine whether a company will win a municipality franchise. Municipalities often use benchmark indicators to measure which companies have been offering superior performance. The influence of such indicators, however, is strongest when contracts are initially awarded, and not when renewal decisions arise. The second largest French water company, Lyonnaise des Eaux Dumez, has indicated that it receives renewal for 92 percent of its contracts.

In most cases the French private operators use metering to determine charges. The profit incentive behind private supply motivates companies to institute efficient pricing systems. In contrast, most government-run systems price on the basis of estimates or on the basis of explicitly political considerations. Even in such large, well-established markets as New York City, government suppliers have only recently begun to implement the partial use of metering. In the absence of metering, consumers do not pay the full costs of their water usage, and thus they tend to overuse water resources. The water supplier cannot fully isolate system losses or measure demands, and thus finds it difficult to improve efficiency.

The French operators have achieved cost savings over the previous government-run systems. The French model appears to have worked reasonably well in the city of Paris. Private investors have helped supply Parisian water services since the mid-1980s. The distribution system was split into two geographically distinct areas, which correspond to the Left Bank and the Right Bank of the city. In each sector a private company was given the responsibility for maintaining the system (these contracts were not tendered competitively, however), and asked to accept the financial risks of profit and loss.

Parisian water provision has improved dramatically since private sector participation began. The level of unaccounted-for water dropped from 22 percent in 1987 to 12 percent in 1991. Information about the quality and condition of water supply assets has also improved dramatically.

9.5 Variants of the French Model in Other Countries

Variations on the French model are found around the globe, especially in the third world. In most cases private sector participation has yielded superior results to the previous government-dominated systems. The French system, whatever its problems may be, has usually outperformed government control and ownership of water facilities.

9.5.1 Argentina

The city of Buenos Aires, Argentina has recently implemented a version of the French model of water supply. In December 1992, the Argentine government awarded a franchise contract to an international consortium of local and international companies called Aguas Argentinas. The consortium is led by the major French water supply firm, Lyonnais des Eaux-Dumez (25.3 percent). Other international investors include Aguas de Barcelona (12.6 percent), Genérale des Eaux (eight percent) and Anglian Water (4.5 percent). Local investors hold 39.6 percent and employees hold 10 percent. The Buenos Aires concession lasts for 30 years, and covers the entire water and sewage system.

As under the French model, the private sector is responsible for operating, maintaining, and investing in water sector assets. The consortium accepts all of the financial risk and is responsible for billing customers. At the expiration of the contract, however, the private institution retains no property rights in the assets it has managed.

The verdict remains out on the Argentine water privatisation experience, which has been implemented only recently. Considerable improvements upon prior arrangements are nonetheless expected. Pre-existing water institutions were poor in Buenos Aires. Little information was available about water revenues, water use, water demand, or the condition of water supply assets. In the absence of a profit motive, the water supplier (the central government) had no incentive to gather market information or attain productive efficiency. More often than not,

water supply operations had been run on a political basis. The new consortium operator found it necessary to lay off 1,800 employees on the grounds of low productivity.

9.5.2 Guinea

The West African nation of Guinea provides an example of how even partial water sector reforms benefit the citizenry. Guinea, although one of the poorest nations in the world, has improved its water supply services considerably in a few short years.

The pre-existing problems in Guinean water supply were huge. The quality and reliability of water supply were low, prices were set below marginal cost, the water suppliers had little information about either demand or supply capabilities, and the overall economic and political environment was extremely risky. Although the Guinean stock of water has historically been adequate, Guinean supply institutions have been among the least developed in West Africa. In 1989, for instance, less than 40 percent of Guinea urban dwellers had access to piped water.

The government of Guinea began to restructure its water supply sector in 1987, when it encouraged private sector companies to apply for water supply leases. The major reforms were in place by 1988.

The resulting system combines leases with mixed public and private enterprises. The government created a new state water authority (SONEG) that owns urban water supply facilities. The operation and maintenance of these facilities is leased out to a private sector company. The company (SEEG) functions as an autonomous commercial enterprise, even though it is owned partly by the Guinean government. In general, the private organisation SEEG assumes commercial and technical risks, while the public organisation SONEG owns the facilities and assumes the responsibility for long-term investment decisions.

The private company keeps an agreed-upon fraction of the fees collected, and turns the rest over to the public organisation. The government has announced its intention to support water prices that allow both private and public sector participants to recover their costs and achieve a reasonable return on equity. Until such fees are implemented, however, the agencies involved continue to receive subsidies from the government and from international agencies, such as the World Bank.

Despite considerable public sector involvement, profit incentives have helped improve Guinean water supply. Gains in productive efficiency can be captured in the form of higher profits. Collection of water fees, a perennial problem in many state-run systems, has improved vastly in Guinea. Since the new reforms, collection of water fees has risen from 15 percent to 70 percent.

9.5.3 Ivory Coast

Urban water has been supplied by the private sector in the Ivory Coast for the last twenty-five years. The Ivory Coast system mixes concessions and lease contracts. The relevant company, SODECI, was established first in 1960 as the subsidiary of a large French water utility. Subsequently, shares of stock were floated on an exchange. SODECI is now a private company owned 52 percent by local stockholders and 48 percent by French commercial interests.

Later, in 1987, the system moved closer to a true market when many of the subsidies to SODECI were removed. All new investments in water supply have been self-financed since this date. Some of the collected fees go into governmental funds for water sector debt service and for sanitation.

Ivory Coast water policy has met with success. Seventy-two percent of the urban citizenry had access to safe water by 1989, as compared to 30 percent in 1974. Approximately 80 percent of the rural population is served by hand-pump wells, as compared to 10 percent in 1974. (An unknown proportion of these wells are not fully operational, however.) In urban areas, unaccounted for water is only 12 percent, a remarkably low figure for a developing country. Ninety-eight percent of all levied fees are collected, also a very high rate. The company's productivity (130 connections per employee) is twice as high as that of any other water utility in West Africa.

9.5.4 Macao

In Macao, water supply has been provided since 1985 under a 25-year concession contract between the government of Macao and a consortium of French and Hong Kong interests (Lyonnaise des Eaux-Dumez, and New World, respectively). The water system is small, with about 130,500 customers, but is growing at about 10 percent per annum. All households are connected and metered, an unusual result for a country at Macao's level of development.

In the early 1980s, the Macao Water Company had several major problems, including a financial deficit, outdated and outmoded facilities, and high levels of unaccounted-for water (reaching as high as 40 percent in 1982). In 1982 the Company was put under a management contract with New World; costs were reduced and water quality improved. The concession came into effect in 1985, which further improved water supply. A large investment programme was begun to increase supply capacity and water quality, and to improve metering and billing. By the early 1990s, unaccounted for water was reduced to 11-12 percent and employees' productivity had doubled. Between 1985 and 1991 supply capacity more than doubled. In real terms water rates remain below their 1985 level.

9.5.5 Mexico

The Mexican city of Puerto Vallarta has also adopted a version of the French model. The municipality has signed a construction and operations agreement for water and wastewater facilities with a British company. In the last year Mexico City has begun to use private operators for distribution and commercial activities, although not for production. The Mexican city of Monterrey is expected to use the French model to produce and operate three wastewater plants.

9.5.6 Germany

The German privatisation program has been concentrated in the former East Germany. Following German unification, the German government announced a commitment to improving the quality of public services in the former Eastern Länder (provinces).

Sewers and wastewater treatment plants need substantial upgrading if East Germany is to join the ranks of developed Western economies. The problem of polluted water supplies is especially severe. Under the communist regime, untreated wastewater was discharged from households and industries directly into lakes and rivers.

As in many countries, German privatisation has been motivated by the desire to minimise fiscal burdens. The German government wishes to improve the water facilities in the East, but faces record deficits, even after large tax increases. Privatisation presents a means of funding infrastructure projects while avoiding the necessity of coming up with scarce public funds.

The Germans are experimenting with two different privatisation models. Under the first model, private sector institutions combine with the relevant municipalities to form a jointly-owned company. The resulting company operates wastewater treatment facilities.

The second model, called the Betreiber, is based on the idea of franchise contracting, similar to the French model. The municipality allows private companies to accept the responsibility for sewerage systems, wastewater treatment facilities, sludge disposal, and night soil collection. The contracts usually last thirty years. The private company accepts both maintenance responsibilities and the concomitant financial risks of running the business. At the end of the thirty-year period, however, the relevant assets revert back to government control (although the contract comes up for renewal).

Other regions of Eastern Europe have also moved in the direction of water privatisation, although most of the reforms have yet to be fully implemented. In Poland, for instance, water supply and sewerage services were transferred to municipal governments in 1991. The municipalities are now being encouraged to form regional joint stock companies. In due time, these companies are expected to be self-financing and fully autonomous.

9.6 Summary

The supply of water in today's world is dominated by government provision. Full private ownership of large scale water utilities is rare, and is found only in England and in the United States. Partial private sector involvement is less rare, but still infrequent. Nonetheless, private sector participation in water supply is increasing rapidly around the world. Government-owned systems have proven inefficient, and frequently lack the capital and expertise to implement water supply improvements.

Where private ownership or involvement is found, the accompanying regulatory regime is a major determinant of outcomes. Three basic models characterise overseas experience with private participation in water supply: privatised utilities and price-cap regulation (the English model); franchise contracts with municipalities (the French model); and rate-of-return regulation of monopoly utilities, which may or may not be privately owned (the American model). The problems with these regulatory regimes were noted in Section 5. The light-handed regulatory regime, which has been adopted in New Zealand for a number of monopoly industries, is rarely observed overseas.

Section 10.0 Summary

10.1 Introduction

This report examines the potential for reforming the water industry. It focuses on mechanisms for allocating water between different uses as well as the institutional arrangements governing businesses that supply water and wastewater services. It discusses possible problems with the status quo and examines options for reform.

The review is motivated by the importance of water as a resource and the sizeable public investment in water and wastewater infrastructure in New Zealand. The value of natural water for waste disposal, water supply, recreation and commercial fisheries (and excluding ecological and cultural values) has been estimated at around $1.5 billion per annum. The accumulated investment by local government in water supply and wastewater assets is of the order of $6 billion. This is larger than the investment in Telecom Corporation of New Zealand's network and roughly comparable to the national investment in the electricity transmission and distribution system.

10.2 Case for Reform

Although reform of the water sector has taken place over the past ten years, a number of concerns about the industry remain:

• Water permits are sometimes assigned to low-valued uses at the expense of higher-valued uses in water-short areas;

• Water quality in the lower reaches of many streams is poor;

• Many territorial authorities have poor information on the condition of their infrastructure assets, although this is being addressed;

• The pipelines of many water and sewerage businesses are in poor condition;

• System failures result in the discharge of untreated effluent into coastal waters;

• Water losses from pipeline systems in some areas are high by international standards;

• Water restrictions are common in many towns and cities during summer months;

• The quality of drinking-water poses health risks in some areas;

• The decision-making process for major capital expenditure can be slow and costly, as demonstrated by the time it took the Wellington City Council to decide on its sewage treatment plant; and

• Controversy surrounds the introduction of usage-based pricing for water despite the environmental and efficiency benefits of such a pricing approach.

These problems suggest that institutional arrangements governing water allocation may be deficient. They suggest also that the ownership and control arrangements for the businesses delivering water and wastewater services may provide inadequate incentives for performance. Although the problems do not establish that the benefits from reform would exceed the costs, they do motivate further research and the examination of possible options for change.

10.3 Key Conclusions

Our analysis suggests that efficiency gains could be achieved by the following:

• Making greater use of tradeable permits for allocating water in water-short areas;

• Amending the RMA to allow permits to be obtained for in-stream uses and removing restrictions on the terms of permits;

• Introducing marginal-cost-based pricing for piped water and wastewater services for domestic consumers;

• Improving the incentives for performance of the local government-owned water and wastewater businesses through corporatisation;

• Making greater use of franchising and contracting-out if there is a strong political preference to retain public ownership;

• Removing the special restrictions in the Local Government Act which prevent Watercare Services Limited operating in a fully-commercial and accountable manner;

• Privatising the water and wastewater businesses to overcome the deficiencies inherent in the corporatisation model; and

• Regulating any market power problems through a light-handed regulatory regime relying on the Commerce Act and information disclosure requirements.

10.4 Water Allocation

Water is used in a number of competing activities including in-stream uses such as electricity generation, recreation, and the sustenance of flora and fauna; land use including irrigation and stock watering; and household, industry and commercial consumption including the provision of sewerage services.

Regional councils and unitary authorities are responsible for controlling the taking, use, damming and diversion of water and for the control of discharges into water. Whatever allocation regime is adopted, it is inevitable that there remains a substantial role for a centralised body to research the extent of the resource; decide on the quantity of water available for allocation; decide the initial allocation of permits; monitor water flows; define permit rights; and enforce compliance with permit conditions. In the foreseeable future, regional councils and unitary authorities are likely to fulfil these roles.

Regional councils and unitary authorities generally allocate water on a first-in first-served basis. Once the resource is fully allocated those with permits for low-valued uses have few incentives to transfer them to higher-

valued uses. In water-short areas, the result is that water is sometimes put to low-valued uses while higher-valued uses are denied access.

Where there are few competing demands for water relative to supply, administrative allocation of permits is likely to be relatively efficient. Where water is scarce relative to demand, a tradeable permits regime may provide advantages. Trading in permits provides incentives for permit holders to reallocate water to higher-valued uses. Trading can establish the opportunity cost of water in different uses and locations at different times. Trading can assist in decisions on whether to leave water in-stream or allocate it to abstractive uses.

Permit holders should be allowed to hold permits for the purpose of leaving water in-stream. If permits could be purchased to leave water in-stream, environmental, Maori and other groups would be able to increase in-stream amenities by such purchases.

Minimum flows could be established through administrative means. Alternatively, the full flow of a stream could be allocated, with councils or a central government agency retaining permits for in-stream flows or allocating them to private conservation groups. Permits could then be traded to maximise environmental values across rivers. Private individuals and groups would be able to increase environmental, cultural and recreational amenities by further purchases of permits for in-stream use.

Tradeable water permits could be allocated to Maori groups as part of Treaty settlements. Maori could then decide for themselves whether to leave water in-stream, abstract for their own use, or trade or lease permits and use the income for other purposes.

Adoption of a tradeable water permits regime (as with other regimes) requires resolution of a number of public good and third party effects. Experience with tradeable water rights in other countries indicates that these problems can be overcome sufficiently to enable net benefits to be achieved when water is scarce.

As long as permits are transferable, any method of initial allocation without strings attached is likely to be efficient within the constraints of transactions costs. The initial allocation may be controversial given the substantial wealth implications, particularly in water-short areas. Auctioning of existing permits may be undesirable because of the potential to expropriate the value of private investments. Auctioning of permits is particularly suited to the allocation of additional or unallocated supplies of water. The initial sale of water permits is currently constrained by the Resource Management Act.

The restriction of the term of permits to 35 years should be removed. Where the return to an investment is conditional on a user retaining a permit, it would be desirable to provide permits with a commensurately long term. Removing the restriction in the Resource Management Act on the term of permits would better ensure that the permit holder faced the benefits and costs of resource-use decisions and would avoid the uncertainty and distortions that arise as the term of a permit is reached. The longer the term of the permit, the more desirable it is that it be tradeable.

Tradeable permit regimes are possible under current legislation. Several regional or unitary authorities are actively investigating or implementing tradeable water permits. These include: the Auckland Regional Council (Omaha); the Manawatu-Wanganui Regional Council (the Oroua area near Fielding); the Marlborough District Council (the Wairau); and the Tasman District Council (the Waimea area).

Progress in other areas is slow. In some cases, water is not scarce or the local geography is less conducive to a tradeable permits regime. In others, individuals affected are resistant to reform or councils have not examined the potential for a tradeable permit regime.

The potential gains from a tradeable permits regime could be strengthened by amending the Resource Management Act. Desirable changes include removing the 35 year restriction on the term of water permits and provisions for revising permits during their term; clarifying that permits can be obtained to enhance in-stream flows (including removal of the requirement that permits must be exercised to be retained); and explicitly allowing councils to tender permits.

10.5 Pricing of Water Services

Most utilities in New Zealand do not meter water for domestic or small commercial customers. Service charges are usually fixed, with no charge per unit of water used. Large commercial and industrial customers are usually metered and charged on the basis of usage. Sewerage charges are generally fixed.

Where prices for the marginal use of water or sewerage services are set at zero (as is the case when only fixed charges apply), or the full opportunity costs of consumption are not taken into account, there is little incentive for users to take proper account of the costs of supplying water and sewerage services. The result is that too much water is consumed, capital expenditure is brought forward, and greater environmental damage incurred.

When prices reflect the marginal cost of a particular good or service, they encourage efficient resource use by ensuring that at the margin customers pay an amount equal to the cost they impose on the economy.

Marginal-cost prices for water and sewerage services should (within the constraints of measurement) include the costs of depleting natural resources, the value of water in alternative uses (i.e. the opportunity cost of water), the cost of operating and maintaining the system, the opportunity cost of capital and the capital costs brought forward by demand. The capital costs should be calculated as the present value of all of the avoidable or incremental costs, whether they are incurred today or in the future, that are attributable to today's demand.

Marginal-cost pricing requires metering of usage or adoption of a proxy for usage. It is possible that the benefits of user charges may be outweighed by the costs of installing and monitoring meters in some supply areas for some customers. In assessing the viability of metering, account should be taken not only of the benefits of reduced demand, but also of the improvement in the utility's ability to monitor the condition of its pipes and to identify substantial losses of water from the system.

The cost of metering usage of water services has reduced to the point where it is economic at least in some areas, with a few major centres already metering domestic use. Measuring the discharge of effluent from residential and commercial properties is likely to be too costly at present. Since there is a reasonably strong correlation between water consumption and the volume of effluent discharged into sewers, it may be efficient to base the sewerage charge on water usage.

An increasing-block tariff is sometimes proposed on income distribution grounds. Initial blocks would be charged at zero or low prices with higher prices charged for additional blocks. If the maximum rate were set at marginal cost, and a large proportion of customers faced this charge, then an increasing-block tariff may be more efficient than sole reliance on a fixed levy.

An increasing-block tariff involves efficiency costs to the extent that significant numbers of customers consume only within those blocks for which price is below marginal cost. For efficiency to be maximised, the price for each consumer's marginal consumption should be set at marginal cost. It is irrelevant (in efficiency terms) whether the consumer's consumption is large or small. In addition, a utility's charges may be insufficient to enable it to cover total costs and additional efficiency costs could be associated with making up any shortfall.

10.6 Regulation to Constrain Market Power

The transmission components of the water industry pose some market power problems. Overall, the constraints imposed on water and wastewater service providers by substitutes appear moderate.

Choices between regulatory regimes for monopoly industries are choices between imperfect alternatives. No regulatory regime can provide a monopolist incentives for cost minimisation and efficient investment without also providing incentives for monopoly pricing.

With either private or public ownership under a sustainable commercial structure, a light-handed regulatory regime, involving reliance on information disclosure and the provisions of the Commerce Act, appears likely to impose the least costs while providing a constraint on the market power that monopoly suppliers of water and wastewater services might have.

The advantages of the light-handed approach include the benefits of retaining incentives for managers to optimise the efficiency of their organisations, the lower level of resources involved in the regulatory process and the consistency across different industries that it achieves. The regime does not, however, eliminate the

possibility of monopoly pricing although it eliminates the prospect of major abuse. Uncertainty as to the precise nature of the regime is likely to reduce as guidelines emerge from decisions by the Commerce Commission and the courts. Concerns about monopoly pricing warrant continued monitoring of the regime. Only if monopoly problems become obviously costly or an *ad hoc* regulatory structure emerges would we advocate departure from the light-handed regulatory approach. Experience to date suggests that a light-handed regulatory regime will, in the long term, impose fewer costs than the heavy-handed alternatives.

Franchising appears to offer some benefits compared with price-cap and rate-of-return regulation, at least in the short term, and may be an option for increasing private sector involvement while retaining public ownership of infrastructure assets. Franchising, rate-of-return and price-cap regulation all require substantial government input, distort incentives for the regulated organisation to operate efficiently and require substantial resources for setting and monitoring prices. Rate-of-return regulation is the least desirable of the major regulatory options.

10.7 Regulation of Quality

Whether or not explicit regulation is required to control quality depends in part on the nature of any regulation to control market power. Our preferred regulatory option involves reliance on the Commerce Act, and a disclosure regime rather than price controls. In that case explicit regulation of quality (other than drinking-water quality) is unlikely to be required whatever ownership structure is adopted.

Given the difficulty of customers monitoring the quality of drinking-water and the potentially serious consequences of inadequate quality, a strong case can be made for the government or an industry body at least establishing voluntary quality standards, checking compliance with them and publishing comparative results.

Under the current regime, some supply systems are inadequately monitored and a number fail to provide safe drinking-water. There is little evidence to suggest that these failings could not be addressed under the current voluntary compliance regime.

10.8 Structure of the Utility Industry

It is nearly impossible for a central planner to determine accurately the optimal shape of an industry. Instead, it is preferable to give owners and managers of organisations involved in the industry the incentives and ability to seek out efficient organisational structures. However, unless the operations in the water and wastewater sector are privatised, owners and managers are unlikely to have strong incentives to achieve the optimal structure for the industry. Thus, if the utilities are to remain in public ownership, there may be a role for central government imposing structural reform on the industry.

It appears probable that technical economies of scale are exhausted in the larger of New Zealand's utilities, but that savings in costs might be achieved through amalgamating smaller utilities supplying towns and rural areas. Some savings in management, financial and overhead costs might also be achieved by integration.

Integration of headwater supply and distribution, and/or of the wholesale and retail distribution businesses, appears likely to reduce the transactions costs of contracting given the specific sunk cost assets involved in the relationship between the different businesses. It would also remove the possible distortion to prices which occurs when vertical monopolists independently set monopoly prices. A single organisation would have clear responsibility for the quality of supply, reducing the 'politicking' over problems that is a feature of the current structure.

There do not appear to be substantial economies of scope from integrating water supply with wastewater disposal although some management economies are possible. Interrelationships between sewerage and drainage operations could be handled contractually and do not require integration.

Integration of wholesale and retail operations in Wellington and Auckland may offer some benefits over alternative arrangements. Integration may allow modest economies of scale and savings in management and overheads; it may reduce transactions costs arising from contracting between bulk and retail supply given the relationship-specific assets involved; it may increase the probability that organisations in the industry operate commercially and reduce the politicking that currently distorts pricing and investment decisions. However,

integration would reduce the limited scope for competition from headwater suppliers and would involve transitional costs.

10.9 Ownership of the Utility Industry

Since the reform of local government in 1989, councils have made substantial changes to the organisation of their business activities, making increasing use of business units to deliver their water and wastewater services. The establishment of business units has helped to improve the commercial focus and discipline of these businesses. Nevertheless, the inherent tensions and conflicts with this arrangement are not conducive to good management even when councils appoint talented individuals to positions of responsibility. A failure to adequately separate political, commercial and regulatory objectives combined with limited external monitoring reduces the accountability of managers. The likely result is poor commercial performance.

Substantial improvements in efficiency could be achieved by corporatising the larger water and wastewater businesses using the local authority trading enterprise provisions of the Local Government Act. Experience in New Zealand and overseas suggests that as long as the integrity of the corporatisation model is retained, application of the model to the water industry would yield substantial efficiency benefits.

Some councils are opposed to corporatisation because of the unfavourable tax treatment of LATEs compared with business units. Although the formation of LATEs may result in efficiency gains from the national viewpoint, these gains, from the point of view of local authorities, may be outweighed by the tax paid to central government. Unfortunately there are practical obstacles to achieving tax equality between private organisations, LATEs and council operations. A possible solution to this problem is for central government to require corporatisation of activities that are readily identified as commercial. This approach was adopted for port and airport companies, among others.

The legislative restrictions applying to Watercare Services Limited result in a confused ownership and accountability structure. Application of the standard corporatisation provisions of the Local Government Act is likely to improve the company's performance.

While practical experience with corporatisation in New Zealand has shown that the gains can be substantial, it has also focused attention on the following incentive problems associated with continuing government ownership:

• Experience indicates that politicians may be unwilling to accept some of the basic principles of the corporatisation model. For example, councillors may be appointed to boards even when their commercial experience is limited;

• Capital market constraints on the performance of government-owned businesses are weak;

• There is an ongoing risk that businesses remaining in government ownership will be subject to politically-motivated intervention; and

• The ultimate owners of the businesses (ratepayers) have relatively weak incentives to monitor the performance of management.

Deficiencies inherent in the corporatisation model suggest that further gains could be achieved by greater use of contracting out, franchising, or privatising of water and wastewater businesses, as long as any monopoly concerns could be handled by light-handed regulation.

10.10 International Experience with Private Participation in the Industry

The supply of water in today's world is dominated by government provision. Full private ownership of large scale water utilities is rare, and is found only in England and the United States. Partial private sector involvement is less rare, but still infrequent. Nonetheless, private sector participation in water supply is increasing rapidly around the world. Government-owned systems have proven inefficient, and frequently lack the capital and expertise to implement water supply improvements.

Where private ownership or involvement is found, the accompanying regulatory regime is a major determinant of outcomes. Three basic models characterise overseas experience with private participation in water supply: privatised utilities and price-cap regulation (the English model); franchise contracts with municipalities (the French model); and rate-of-return regulation of monopoly utilities, which may or may not be privately owned (the American model). The problems with these regulatory regimes were noted in Section 5. The light-handed regulatory regime, which has been adopted in New Zealand for a number of monopoly industries, is rarely observed overseas.

Appendix A Criteria for Assessing Options

A.1 Introduction

In examining options for reforming the water industry, it is necessary to have some basis for choosing between different arrangements. Below in Sections A.2 and A.3 we examine economic efficiency and fairness as criteria for assessing reform options. A crucial determinant of efficiency is the quality of institutional arrangements which mould behaviour by determining and constraining individuals' rights, incentives, opportunities and costs of transacting. The importance of efficient institutional arrangements is examined in Section A.2.2.

A.2 Efficiency

A.2.1 Definition of Economic Efficiency

Economic efficiency is about obtaining the greatest possible benefit from scarce resources. Economists use the concept of efficiency to evaluate the success with which an economic system combines scarce resources to satisfy competing wants. A concern with efficiency is a concern with enabling individuals to attain, at the least possible cost, any number of ends that they value. An efficiency criterion can therefore accommodate the value to individuals of leisure, culture, environmental amenities and the like. It incorporates consumer preferences for the availability of services, quality of output, and service levels. In principle, an economic system will be efficient if the following hold:

• It is not possible to produce more of any one commodity which contributes positively to an individual's welfare without having to sacrifice production of another commodity. Economists call this *productive efficiency.* At the level of the firm, productive efficiency exists when a firm has adopted the least cost methods of production including the most efficient internal organisation for producing a given set of goods and services;

• No alternative combination of outputs in the economy would enhance the welfare of any one individual, except at the expense of someone else. Economists call this *allocative efficiency*. At the enterprise level, allocative efficiency requires that the quantity of each good or service produced is such that the incremental or marginal cost of producing an extra unit of output just matches consumers' willingness to pay for it; and

• The optimality of consumption, savings and investment over time is also critical. Economists say that *dynamic efficiency* has been achieved when it is not possible to increase anyone's welfare without reducing that of someone else by altering savings and investment decisions.

A.2.2 Importance of Institutional Arrangements

A crucial determinant of the quality of economic outcomes is the quality of institutional arrangements which mould behaviour by determining and constraining individuals' rights, incentives, opportunities and costs of transacting. Well-designed arrangements facilitate and motivate individuals to identify evolving consumer needs and to find ever-cheaper ways of meeting them. Given the myriad of transactions which take place between individuals as they accumulate knowledge, organise production and interact with consumers, institutional arrangements which unnecessarily raise transaction costs will impair efficiency.

Finding a framework that serves efficiency involves devising a set of rules, procedures and conventions which minimise the costs of interactions between individuals seeking to improve their welfare (i.e. transaction costs).

An efficient institutional structure must deal with the fact that information is scarce and costly to obtain and that individuals have a limited ability to collect and process information. As a result there are costs in negotiating, monitoring and enforcing agreements, and in resolving interdependencies.

An institutional framework is efficient if there is no identifiable alternative framework which would better satisfy all community wants, i.e. there is no other framework that would benefit some members of the community enough for them to remain better off even after compensating everyone disadvantaged by the change.

Public policies oriented towards efficiency must focus very closely on the institutional environment which is created by government action. Developments in economic thinking in recent decades have greatly clarified for policy-makers the principles which should govern the search for the most efficient institutional arrangements. In particular, arrangements are likely to be more efficient the more closely they conform to the following guiding principles:

• Individuals bear the full costs and benefits of their decisions;

• Precise limits to actions are specified. A high degree of precision reduces the costs of determining how resources can be used;

• The owners of an asset enjoy a high degree of exclusivity in their ability to decide how to use their property, to retain income derived from that property, and to transfer the rights to that property to others;

• Coercive regulations are avoided except where they are warranted by specific difficulties in the relationship between the users and suppliers of a commodity; and

• Where coercive regulations are imposed, safeguards, such as disclosure and periodic review requirements, are put in place to preserve the efficiency focus for any regulatory decisions.

Even with the help of such principles, the task of determining the optimal institutional arrangements in complex situations can be extremely demanding. The scope for market and political failures must be carefully assessed and actions taken to deal with them. Difficulties which may need to be considered include: those associated with uncontracted-for third-party effects (for example it may be hard to stop people benefiting from activities for which they have not paid and/or to ensure that others are adequately compensated for the costs imposed on them by others); possible abuse of market power; the scope for opportunism and gaming; the possibility of regulatory and bureaucratic capture; and disputes arising over historical property rights.

A.2.3 Market Processes

In most circumstances, information about consumer preferences and production opportunities is so widely dispersed and costly to accumulate that efficient economic outcomes can only be achieved through heavy reliance on market arrangements. A market provides a powerful means of aggregating information and coordinating economic activity. It produces, uses and processes information without the conscious effort of any information collection agency and without individual participants needing to have a great deal of knowledge beyond their own firm's production possibilities, the value of their own labour, or their consumption preferences.

Prices, reflecting underlying conditions of supply and demand, are the by-product of the many exchanges that take place in the economy. Market-determined prices are commonly vastly superior to any other mechanism for disseminating information about relative scarcities and wants. The price mechanism coordinates individual actions and resolves many problems of interdependence.

A market process makes individuals accountable for their stated value judgements and degrees of preference. It eliminates the opportunity for someone to profit by overstating their preference for a particular outcome.

Markets put in place a selection mechanism that tends to guide resources to those users and uses that maximise the value of products derived from resources, as measured by consumers' willingness to pay. The market process provides incentives for individuals to discover what customers want and what competitors are doing to meet these wants, and if possible to find more creative ways to meet consumer needs.

In the absence of a market, a public decision maker must trade-off conflicts between different uses and users without information on the relative value of uses or the preferences of users obtained from prices. The lack of information forces the public decision maker to resort to political criteria which at best provide a distorted measure of value. These problems are exacerbated by the incentive problems of the public sector, where the rewards of the decision- maker are often not dependent on maximising the value of resources at the manager's disposal.

All decisions are made under conditions of uncertainty and incomplete information. People will therefore make their decisions on the expectation of achieving a particular outcome. Sometimes they will be mistaken and decisions *ex post* may not appear to be efficient.

A.2.4 Advantages of Full Private Ownership

Property rights are described as 'private' when the owner has, within defined limits, the relatively exclusive right to derive income from an asset, the ability to transfer it to the person who values it most highly, and the ability to use the resource and to exclude others from access or degradation of it.

Full private ownership of an asset including freedom to use and trade it, subject primarily to the constraints of contractual and liability law, affords a high degree of control over the asset, and generally increases the chances that it will be used in a way that maximises its contribution to overall well being.

A substantial measure of exclusivity in property rights within clearly defined limits generally provides incentives for efficient resource use. Exclusivity tends to ensure that the owner experiences the full costs and benefits of decisions, giving strong incentives to use property efficiently and to use resources at a rate that maximises their value through time. Exclusivity provides incentives to invest in improving resources since the benefits of such investment are captured by the owner. It provides incentives for the owner to invest in information relevant to the best use of that resource and ensures that the person with the best knowledge of the resource makes decisions relating to its use.

Transferability of well-defined property rights means that resources tend to be directed to their highest-valued uses and users. Anyone who places a higher valuation on a given resource than its current owner, due to either differences in taste or productivity, can bid in the market for the ownership or use of that resource. Non-transferability restricts the information that would otherwise be available on the benefits the resources might yield in alternative uses, weakening the incentives for efficient management of resources in their current uses.

The ability to retain income from ownership is also important in ensuring that owners have strong incentives to manage the resource properly and to invest in research into management of the resource and the minimisation of costs.

Establishing and enforcing exclusive property rights is costly. Potentially the costs may be so high that it is not worth doing. In that case non-exclusive property rights may be the best achievable outcome.

A.3 Fairness

In a society in which resources are scarce and one person's use of a scarce resource affects use by another person, the equity or fairness of public and private arrangements is likely to concern people and hence governments. Equity is a subjective concept which means different things to different people.

An important equity issue in the water industry in practice is likely to be the impact of alternative pricing arrangements for water on the distribution of wealth between members of the community, particularly given the sunk cost nature of much investment in the water industry. Any change in institutional arrangements can affect the future stream of income generated from assets and the entitlement of individuals to share in those returns.

A study of the impact of changes to water tariffs on households undertaken for the Wellington Regional Council concluded that "of those houses that would be worse off [from a change to usage-based charging], an assessment of the relationship to household expenditure suggests that for most households the cost increase would be affordable". The study suggested that "1.5% of total households in the Wellington metropolitan water supply area could face real hardship if they were charged increased water costs".

Thus while the structure of prices in the water industry may affect wealth distribution, few low income households would be made worse off by a change to more efficient pricing. If there are real concerns about the ability of some families to pay for water, this should be addressed directly through income support, rather than through sacrificing the cost saving and environmental benefits achievable by reform of pricing arrangements.

Fairness and efficiency can be compatible objectives. Often the most efficient solution to a problem will promote healthy cooperation and competition and reduce the likelihood of subsequent costly disputes over fairness.

Applying multiple objectives to water industry reform would be likely to lead to particularly poor outcomes. Unless trade-offs amongst conflicting objectives are clearly specified and agreed to, multiple objectives provide no workable criteria for making well-focused decisions or monitoring their success.

A.4 Summary

The criterion guiding the reform of the water industry which we have adopted is the efficiency with which society uses its scarce resources to satisfy competing demands.

Efficiency is not advocated as the sole criterion for guiding government policy. However, bearing in mind that distributional objectives play a substantial role in designing the tax and welfare systems, we believe that distributional objectives should not be pursued through industry-specific regulation.

Acceptance of efficiency as the sole objective for government policy in industry regulation provides no general implications as to the extent of government involvement in the relevant sphere of activity. A moderate degree of government intervention may be efficient in some circumstances and inefficient in others.

Appendix B New Zealand Water Utilities

B.1 Introduction

This Appendix briefly reviews the overall supply and use of water in New Zealand and provides an overview of water utility activities in the major centres.

B.2 Overall Supply and Use of Water in New Zealand

Table B.1 summarises the overall supply and use of water in New Zealand.

Table B.1

New Zealand Water Supply and Use

Estimated Total Supply and Use Cubic Kms p.a.

- Fresh water yearly reserves 300,000

- Annual use, excluding hydro 2,000

- Annual hydro throughput 100,000

Distribution of Use Excluding Hydro Cubic Kms p.a. Percent

Irrigation[1] 1,100 57

Livestock 350 18

Industry[2] 260 14

Household[3] 210 11

Total 1,920 100

Notes:

1. Area irrigated is approximately 234,000 hectares.

2. Two-thirds of industry water is from private sources.

3. Household use is equivalent to 550 litres/day, accounted for as follows.

Breakdown of Household Use Litres/Day Percent

Toilet 140 26

Bath/Shower 130 23

Gardens/Watering 110 20

Laundry 100 18

Kitchen and Miscellaneous 70 13

550 100

Source: *Official Yearbook 1994* and *New Zealand Geographic*, April - June 1993, pp 66-67 and 70-71.

Noteworthy features include: the large volume of water flowing through the hydro-electric system; the volume abstracted for irrigation and livestock; the relatively small amount of publicly-provided water used by industry; and the relatively small amount of household water which is required for purposes for which only drinking-quality water is suitable.

B.3 Major Utilities: Some Statistics

Table B.2 summarises the asset values and numbers employed by the major water and wastewater utilities which are described in this Appendix. The report does not compare the performances of different territorial authorities. Comparisons would be difficult because of differences in accounting measures, standards, topography, the charging of corporate costs, capital charges, and possible cross-subsidisation across services.

In the following table, assets are valued on a depreciated replacement cost basis unless otherwise noted.

Table B.2

1993 Statistics on Major Water Utilities in New Zealand

Utility	Water Asset Value $m (repl)	Sewerage Asset Value $m (repl)	Stormwater Asset Value $m (repl)	Numbers Employed
Watercare	872	794	n.a.	468
Rodney	26.6	70.6	25.4	9
Waitakere	89.9	85.2	110.7	17
Manukau	70.4	86.4	166.8	66
North Shore	46.1	165.1	50.4	26
Auckland	116	= 577 -		59
Hamilton	76.9	133.1	111.0	55
WRC	187 (hist)	n.a.	n.a.	40
Porirua	17.1	= 36.7 -		20
Hutt	45.3	74.2	48.2	12
Upper Hutt	38.3	= 43.2 -		5[1]
Wellington	122	= 337 -		65
Christchurch	115.8	198.8	170.9	131

Note:

1. Four of the Upper Hutt employees are dedicated part-time to these activities.

B.4 Auckland

In Auckland, bulk water supply and wastewater treatment is provided by Watercare Services Limited ('Watercare').

The retail distribution of water in the Auckland region is undertaken by 6 local authorities: Rodney District Council, Waitakere City Council, Auckland City Council, Manakau City Council, North Shore City Council and Papakura District Council.

B.4.1 Watercare Services Limited

Watercare is a local authority trading enterprise set up under special provisions of the Local Government Act and owned by the Auckland Regional Services Trust. In 1993, Watercare employed 468 full time staff, down from 537 in 1992.

Watercare sources its water from five dams in the Waitakere Ranges, five dams in the Hunua Ranges, and an aquifer at Onehunga. The system has an average flow of 320 million litres per day and a total reservoir storage capacity in 54 reservoirs of 827 million litres. The company's water supply assets include: ten dams; six filter stations; 400 km of water mains; 23 water pumping stations; and 49 service reservoirs.

Watercare supplies bulk water from Orewa (north) to Papakura (south). In 1992-93 Watercare supplied 114,525 million litres of water to territorial authorities at metered supply points across the region. A breakdown of local authorities' water purchases from Watercare is shown in Figure B.1 on the next page.

Watercare regains responsibility for the treatment of wastewater following its usage by consumers, except in North Shore City and Rodney District where the respective councils provide treatment. With these exceptions, Watercare transports wastewater to the Mangere treatment plant from the sewerage systems of territorial local authorities. On average, 300 million litres of wastewater are treated every day. Watercare's wastewater assets include 250 kilometres of sewer mains and 52 pumping stations.

The water supply assets have a replacement value of $872 million. Wastewater assets were valued at $109.3 million as at 30 June 1993, based on historic cost; the replacement value was assessed to be $794 million.

Watercare recovers its water supply costs from territorial authorities on the basis of usage. In the year to 30 June 1993 its charges stood at around $44.6 million. This included $0.3 million from income unrelated to its water activities. The average charge per cubic metre was, on this basis, around 39 cents. Watercare's charges for wastewater treatment were based on bulk usage by each territorial authority.

Figure B.1

Watercare's Sales to Local Authorities

Source: Watercare Services Limited Annual Report 1992/3

Note: Rodney District Council began purchasing water from Watercare Services Limited

in the 1993/94 financial year.

B.4.2 Rodney District Council

In 1993, sixty-one percent of Rodney District Council's 58,800 population lived in townships; the rest were in rural areas. Parts of Rodney's catchment area had no reticulated water supply, including most of the Whangaparaoa Peninsula - the largest non-reticulated population in New Zealand. Properties in these areas relied on rainwater collected on roofs, supplemented with tankered water. Except in parts of Helensville Borough, connected properties are metered.

All operation, maintenance and repairs to the system are contracted out to Works Civil Construction. Rodney Council employed 3 senior services engineers, 2 engineers and 2 engineering assistants.

In 1993, the Council operated seven water supply systems and ten separate sewerage systems and maintained stormwater systems in 28 major and 20 minor catchments. Its water was sourced from local rivers, underground aquifers, natural springs and Watercare. The water assets included 236 kilometres of pipeline, treatment plants, bores and 1100 fire hydrants with most of the water reticulation network dating from the 1960s and 1970s. The sewerage assets comprised 396 kilometres of pipes, 67 pumping stations and ten treatment stations. Stormwater assets included 267 kilometres of piped stormwater drains, 183 kilometres of open drains and 450 manholes.

Rodney's fixed assets, based on a depreciated replacement cost valuation basis (as at 1 July 1990) were $26.6 million for water services, $70.6 million for sewerage services and $25.4 million for drainage.

Water operational costs were covered by a metered consumption rate - one in the rural and townships area and one in the Hibiscus Coast. Capital costs for water were covered by a uniform per property charge for properties connected, or with the potential to be connected to the water supply. In addition, in fiscal 1994 around $300,000 was earned from selling water to commercial water carriers and collecting a connection fee from people connecting to the system.

Sewerage operational costs were funded by separate pan charges. Each individual pan was charged except that domestic residential properties were deemed to have only one pan per separately rateable property. In 1994 the pan charges were $180 per pan for Hibiscus coast properties and $288 for rural and townships. Sewerage capital expenditure and loan costs were funded by way of a separate standard property uniform charge in each of the rural and townships area and the Hibiscus Coast area. Properties connected, or which had the potential to be connected, to the system paid this charge.

Drainage activities were funded by an allocation from the general rate.

Water supply services were supplied at a net cost of $1.4 million in 1993, sewerage services at a surplus of $917,000 and stormwater services at a net surplus of $146,000, to give an overall net cost of supply of $0.4 million

B.4.3 Waitakere City Council

Waitakere City Council buys its bulk water from Watercare, accounting for 12.1 percent of Watercare's sales in 1992/93, or 13,857 million litres. Staff employed to manage the water supply business included two design engineers, four water rates processing staff and three managerial/customer services staff. The sewerage operation was managed by five managerial/customer services staff and three engineers.

In 1993 the water supply assets included 1,042 kilometres of pipe, fire hydrants and valves, approximately 50,000 water meters, 12 pumping stations, 7 storage reservoirs and 4 storage tanks. Sewerage assets included 907 kilometres of pipeline, 43 pumping stations and 18,264 manholes. Waitakere City operates a system of pump stations and gravity sewers, which collect the sewerage then discharge it into trunk sewers for final disposal at the Manakau wastewater treatment plant. Stormwater assets included 606 kilometres of stormwater pipelines and culverts, 9,761 cesspits and approximately 11,000 manholes.

As at 30 June 1993, Waitakere's water reticulation assets were valued at $89.9 million, based on 75 percent of the average replacement cost as at 30 June 1991; sewerage reticulation assets were valued at $85.2 million, based on 67 percent of average replacement cost as at 30 June 1991; and stormwater reticulation assets were valued at $110.7 million, based on 75 percent of average replacement cost as at 30 June 1991.

Retail supply charges for water were based entirely on metered consumption with a minimum charge per property of $34 per annum. Loans raised for water reticulation prior to amalgamation were recovered as special rates on properties in the respective areas.

The net cost of water supply services for the year ended 30 June 1993 was $5.4 million. Before taking account of the cost of capital, water supply produced a surplus for the Council of $320,000. The net cost of stormwater and sewerage services in 1992/93 was $25.0 million.

B.4.4 Manakau City Council

The Manakau City Council buys its water from Watercare Services Limited, which feeds water into the Manakau network at 24 supply points. Manakau City took 24.6 percent of Watercare's production in 1992/93, or 28,173 million litres. In 1993, water supply, sewerage and stormwater services were managed through the Works Group of the City Council. Sixteen engineers and support staff were employed in the 'specifier' unit and over 50 in 'Manukau Works', a stand-alone business unit that undertook most of the physical maintenance and construction work.

The water network consisted of approximately 1,600 kilometres of piping. All 71,000 connections in Manakau City were metered, with 38 percent of Manakau's water being consumed by approximately 4,000 commercial and industrial connections. Sewerage assets included 67 sewerage pumping stations and 1100 kilometres of sewer pipes. Sewerage from the urban sector is treated at Mangere, the main treatment plant for the region operated by Watercare. The Council's stormwater assets included approximately 1200 kilometres of stormwater drainage pipes and a storm detention and flood control dam.

The water reticulation network was valued at $70.4 million (net book value as at 30 June 1993), based on depreciated replacement cost. Sewerage reticulation assets were valued at $86.4 million and stormwater assets at $166.8 million on a comparable basis.

The net cost of water services for the year ended 30 June 1993 was $642,000 from an overall turnover of $16 million. The net cost of services for the year ended 30 June 1993 for sewerage and drainage was $23.1 million.

B.4.5 North Shore City Council

Watercare Services Limited supplied the Council with 15,804 million litres of water at 24 bulk supply points throughout the city in 1992/93. North Shore distributed water to approximately 59,000 water meters.

Five managerial and engineering staff, one support staff, plus the equivalent of half an engineer's time in the area office, managed water supply services. Stormwater and flood protection were managed by six managerial and engineering staff, one support staff and the equivalent of one and a half engineers in the area office. In total, 19.5 staff were employed to manage and operate North Shore City's wastewater services.

The water assets comprised about 950 kilometres of water mains, eight pumping stations and four reservoirs. Stormwater and flood protection assets comprised 22 detention ponds, 12 kilometres of lined channels, 80 kilometres of unlined channels, 363 kilometres of pipelines, and approximately 7,400 manholes. The sewerage assets consisted of 64 kilometres of trunk sewers, 778 kilometres of local sewers, 79 pump stations and 19,733 access manholes. In addition, North Shore City operated its own wastewater treatment plant, which processed an average 45 million litres per day. The plant included 2 sludge digesters and 2 oxidation ponds, which cover 42 hectares and have a capacity of 1.3 million cubic metres.

As at 30 June 1993, water reticulation assets were valued at $46.1 million, the stormwater assets were valued at $50.4 million, and the sewerage reticulation network was valued at $165.1 million, all based on depreciated replacement cost as at 30 June 1993. This did not include the treatment plant, which is included in fixed assets.

The cost of services for stormwater and flood protection was $3.3 million for the year ended 30 June 1993, funded almost entirely by rates revenue. The net cost of water services for 1992/93 was $836,000. Wastewater services were provided at a surplus of $300,000 in the 1993 year.

B.4.6 Auckland City Council

Auckland City Council purchased 51,765 million litres of water from Watercare Services Limited in 1992/93, which represented 45.2 percent of Watercare's total bulk water sales.

The Council employed 24 engineering and administrative staff to manage retail water distribution and the relationship with Watercare. Water main replacement and maintenance was carried out by contract. Management of drainage operations involved 35 engineering and administration Council staff. Sewer replacement and maintenance was generally carried out under contract.

Auckland City's water assets included 3,000 kilometres of water pipe, 110,000 water connections, four water supply pump stations, three small storage tanks and seven pressure reduction valves. Stormwater and sewerage assets were accounted for jointly by the Council. Its sewerage assets comprised 1260 kilometres of drains and 396 kilometres of combined sewerage and stormwater drains. Other drainage assets included 881 kilometres of stormwater drains.

The water assets were valued at $116 million as at 30 June 1993, on a depreciated replacement cost basis. Sewerage and drainage assets were worth $577 million, based on depreciated replacement cost as at 30 June 1993.

All households and commercial users were charged for water based on their metered consumption plus a fixed connection charge The net cost of services for Auckland City's water supply in 1992/93 was $1.7 million. In 1992/93 the net cost of services for drainage was $15.4 million.

B.5 Hamilton

Hamilton City Council obtains water from the Waikato River which is pumped and treated before entering the reticulation network. Fifty-five people were employed to manage the water, sewerage and drainage systems and water treatment plant.

In 1993, water assets included seven service reservoirs, with total storage capacity of 68 million litres (1.7 times the average daily demand); six booster stations, attached to specific reservoirs; 761 kilometres of pipes, of which over 750 kilometres is under 60 years old; and a treatment station. The sewerage reticulation network

serviced 99 percent of developed city areas. Sewerage is transported through the reticulation network to the water pollution control plant, commissioned in 1975. The plant treats the effluent which is then discharged into the Waikato River. The plant can handle sewerage from a city with a population of 110,000 and a peak wet weather flow of 227 million litres per day. The sewerage network included 580 kilometres of sewers, 12,300 manholes, 36,350 connections, 95 pumping stations, and four major sewerage bridges. Drainage assets included 409 kilometres of stormwater drains, 7,800 manholes, 5,500 connections, ten major outfalls, three retention dams and 90 kilometres of open drains.

The infrastructural water supply assets had a consolidated book value of $76.9 million as at 30 June 1993, based on depreciated replacement cost as at 30 June 1991, with additions at cost. The City Council's infrastructural sewerage and drainage assets had a consolidated book value of $133.1 million and $111.0 million respectively as at 30 June 1993, based on depreciated replacement cost as at 30 June 1991, with subsequent additions at cost.

The net cost of services for water supply for the year ended 30 June 1993 was $2.4 million for water treatment and reservoirs, and $0.6 million for water distribution. Capital works and loan repayments were funded by water rates. In addition, each residential property paid a uniform annual charge. Non-residential properties were metered, and were charged according to use.

The net cost of services for water pollution control was $2.4 million and for sewerage reticulation $4.1 million for the year ended 30 June 1993. Sewerage operations were funded through rates. The net cost of services for stormwater reticulation for the year ended 30 June 1993 was $4.0 million. $2.8 million of this was funded through a loan, the remainder through rates.

B.6 Wellington

B.6.1 Wellington Regional Council

In Wellington, the Wellington Regional Council ('WRC') supplies bulk water to Wellington City, Porirua City, Hutt City and Upper Hutt City. This is managed by the Bulk Water Department in the Council's Operations Division. The WRC collects the water from rivers and reservoirs in the hills surrounding the city itself (although underground water is an important source in the Hutt), treats it to drinking water standards, and delivers it into local distribution systems. In the year to 30 June 1993 (53 weeks), WRC supplied approximately 53,600 million litres to the four councils. Wellington City purchased 51.6 percent, Porirua City 11.2 percent, Hutt City 27.8 percent and Upper Hutt City 9.3 percent of this supply. WRC also manages Wellington City's retail supply on a facilities management basis, in a separate business unit. Sewerage and urban drainage services are provided by the city councils. In 1993, WRC employed 40 staff in its Bulk Water Department.

In 1993, the fixed assets of WRC's water supply business include 182 kilometres of pipeline, six reservoirs, two water treatment plants and 17 pump stations. Their value, at historic cost, stood at $187 million as at 1993.

Local councils paid bulk water levies of $23 million to the WRC based on water usage.

B.6.2 Porirua City Council

Porirua City Council bought approximately 6,000 million litres of water in 1992/93 from the WRC. The Council employed nine staff to manage its water supply operations, with 11 staff overseeing its drainage operations.

Porirua City Council owned 17 reservoirs with a total storage capacity of 26 million litres, and a reticulation network, consisting of 257 kilometres of pipes and 5 pumping stations. The sewerage reticulation system included a 293.1 kilometre network of piping and 34 pump stations. The Council operates a land-based wastewater treatment plant at Titahi Bay. Approximately 75 percent of the operational costs were met by the Porirua City Council; the rest was paid by the Wellington City Council. The plant has capacity for a population of 80,000 and in 1992/93 treated sewerage for 62,000 people. Drainage assets include 80 kilometres of stormwater pipelines of various sizes throughout the city, and a number of open channels and water courses in public areas.

As at 30 June 1993, the book value of the city's water supply assets was $17.1 million, based on depreciated replacement cost valuation. Sewerage disposal and stormwater assets were valued at $36.7 million on a comparable basis.

The net cost of providing water services in 1992/93 was $4.1 million, while sewerage and stormwater services cost $2.6 million for the same period. Residential properties were levied at the rate of $226 per annum for water use, with commercial water users charged $1.10 per cubic metre of water. Sewerage services were funded by a charge of $270 per annum per pan.

B.6.3 Hutt City Council

In the year to 30 June 1993, Hutt City Council purchased approximately 14,900 million litres of water from the WRC. The Council employed the equivalent of four staff to manage water supply services, four for wastewater services and three staff equivalents for stormwater services. One further person managed the Hutt Valley sewerage treatment project. Construction, system operation and maintenance, and technical services were contracted services.

Hutt City Council's water assets included 25 reservoirs (with 63.5 million litres of capacity), 11 pumping stations, 446 kilometres of distribution mains, 170 kilometres of domestic mains, and 15 pressure reducing installations. Stormwater assets consisted of 7 pumping stations and 475 kilometres of piped drains. Sewerage assets consisted of 540 kilometres of wastewater drains, 17 wastewater pumping stations, 69 kilometres of bulk wastewater drains, 26 bulk wastewater pumping stations, a treatment plant at Wainuiomata and a milliscreen treatment plant. Hutt City Council is intending to introduce secondary treatment for Hutt Valley sewerage. This higher standard of disposal is expected to cost the Council around $100 million.

Hutt City Council's water supply assets were valued at $45.3 million (net book value at 30 June 1993, based on a 1990 valuation of infrastructural assets). Stormwater assets were valued at $48.2 million and sewerage assets were valued at $74.2 million on a comparable basis.

The 1992/93 net cost of services of water supply was $8.9 million. The net cost of sewerage and stormwater services for 1992/93 was $7.3 million. Rates for water were levied as a uniform annual charge on all serviced properties, while industrial users were also charged for the quantity used. Local wastewater services were funded as a uniform annual charge, with bulk waste water funded through a rate on property value, together with some user charges. Stormwater services were funded through a rate on property value.

B.6.4 Upper Hutt City Council

In 1992/93, Upper Hutt City Council purchased 5,155 million litres of water from WRC. Upper Hutt employed five staff to maintain the stormwater assets, although four of these staff only worked part-time on these activities. Only urgent maintenance on stormwater assets was carried out by Upper Hutt's own staff, with all capital works and routine (regular) maintenance contracted out. Capital works on sewerage assets were contracted out.

Sewerage assets comprised 1 treatment plant, 9 pump stations and 216 kilometres of sewer mains. Stormwater assets included 6 pump stations and 140 kilometres of stormwater mains. Upper Hutt has committed to upgrade the existing sewerage system in conjunction with Hutt City Council, at a cost to Upper Hutt of $44 million.

Stormwater and sewerage assets were valued at $43.2 million, on a depreciated replacement cost basis. Water piping, reservoirs and pump stations were valued at $38.3 million at 30 June 1993 on a depreciated replacement cost basis.

In 1992/93 water services cost $3.4 million, funded principally by rates, with the balance funded by user charges and internal recoveries. The net cost of stormwater and sewerage services was $2.1 million, funded almost completely by rates.

B.6.5 Wellington City Council

Wellington City Council bought approximately 25,000 million litres of water in 1992/93 from the WRC. Wellington City Council has a contract with the WRC to manage, maintain and operate its water supply facilities. Thirty-three staff were employed in the Wellington City Water Department of the WRC's Operation Division. The Wellington City Council had 32 staff responsible for drainage services. Most of the sewer operation and maintenance work was performed internally, with a greater proportion of upgrading work contracted out. These services were funded from rates based on capital value.

As at 30 June 1993, the Council's water assets included 850 kilometres of reticulation pipelines, 710 kilometres of domestic pipe, 67 reservoirs and 28 pump stations. The Council had a drainage network consisting of one treatment plant, 49 pumping stations, 500 kilometres of piped stormwater and 800 kilometres of sewers.

The water reticulation assets had a value of $122 million, on a depreciated replacement cost basis, and sewerage and drainage assets had a value of $337 million. Drainage system assets had a depreciated replacement cost at 30 June 1993 of $337 million.

Households and most commercial ratepayers were charged a water levy based on the capital value of their property. About 630 commercial ratepayers paid metered charges based on usage. Drainage services were provided at a net cost of $7.2 million in the 1992/93 year. Water services were furnished at a net cost of $13.4 million. The Council has committed to the development of a $149 million sewerage treatment plant.

B.7 Christchurch

Christchurch City Council supplied 53,000 million litres of water to the Christchurch area from untreated underground sources in 1993. Water supply was managed through the Council's Water Supply Unit of the Technical Services Group. 63 full-time equivalent staff were employed in the water business unit and 68 (full-time equivalent) staff operated the sewerage system.

The water reticulation assets included 78 pumping stations, 33 reservoirs, 1300 kilometres of water main, 99,600 connections and 60,000 water meters. The sewage assets included 1300 kilometres of sewer mains, 100,000 lateral connections, 73 pumping stations, and 3 sewerage treatment works, which pump 140 million litres of sewage per day. Stormwater assets included 18 pumping stations, 287 kilometres of open stormwater drains, 572 kilometres of piped stormwater drains, and 5 reticulation basins.

Christchurch City's water reticulation assets were valued at $115.8 million as at 30 June 1993. The Council has installed over 60,000 water meters, which are not yet billable. These were valued at $3.1 million. Sewerage assets were valued at $198.8 million as at 30 June 1993. The drainage system's assets were valued at $170.9 million as at 30 June 1993.

In 1993 water services cost $19.6 million. Stormwater and sewerage services had a combined cost of service of $60.1 million for the year ended 30 June 1993.

Separate rates were charged by the Christchurch City Council for water, sewerage and land drainage based on capital value. Properties connected to the water supply network paid full water rates, otherwise half the rate was charged. Income from user charges for water totalled $1.8 million.

Appendix C Marginal-Cost Pricing

In simple terms, when prices reflect the marginal cost of a particular good or service, they encourage efficient resource use by ensuring customers pay an amount equal to the cost they impose on the economy.

If prices fall below marginal costs, consumers do not bear the costs to the economy of the resources that are consumed in producing the goods or services in question. If prices are set above marginal cost, consumers are

forced to forgo consumption when they would have been willing to at least pay the costs to the economy of providing the goods or services.

There is often confusion over whether 'short-run' or 'long-run' marginal costs are relevant to pricing. The key principle is causal responsibility - the price of a unit of today's output should equal the present value of all of the avoidable or incremental costs, whether they are incurred today or in the future, that are attributable to today's demand. If that demand will necessitate the construction of additional capacity, those additional capacity costs should in principle be included in the price charged to consumers whose demand is causally responsible for that additional capacity. If demand varies according to some time pattern (e.g. seasonally or according to time of day), consumers at the peak consumption time (and not off-peak consumers) should be charged the additional future capacity costs per unit of output that their demand will necessitate unless it is uneconomic to do so.

The marginal cost depends on the degree of excess capacity in the system and the extent to which today's consumption decisions bring forward capital expenditure. If capital expenditure is required only in the distant future then the discounted cost of bringing it forward will be much less than if it is imminent. If the costs are sunk and there is no need to augment the system in the foreseeable future, then the marginal cost associated with the capital assets will be zero.

Marginal-cost pricing can result in significant price fluctuations through time - marginal costs are low during periods of excess capacity and rise as capacity becomes constrained. Thus marginal costs can vary daily, seasonally and over time. In the absence of transaction costs, prices would fluctuate with short-run marginal cost, and average around long-run marginal cost.

In practice, it is difficult, if not impossible to calculate with any precision the marginal cost of producing a unit of almost any good or service. Hence it is generally not efficient for firms to attempt to price exactly at marginal cost because the information costs of doing so would be excessive. Moreover, if marginal costs vary markedly over time or among different units of output, comparable fluctuations in prices may disrupt consumers' consumption and investment plans. Consumers may prefer to pay for greater price stability.

In general, efficient pricing involves setting the price per unit of a service in advance, based on the expected marginal cost of meeting expected demand (which may or may not equal actual demand). In a normal commercial environment where investments in sunk cost assets are important, long-term contracts specifying pricing arrangements are likely to be agreed prior to investment. These contracts may involve long-term, take or pay contracts. Fixed charges may be used to recover sunk and fixed costs. Alternatively, the provider and purchaser may vertically integrate. A rich variety of arrangements can be observed reflecting the complexities introduced into efficient pricing decisions by such factors as the relative costs of different metering and billing systems, the risks of uncertain demand, the prospect of opportunism once assets are sunk, discounts for bulk purchases, problems of common-cost allocation and the adjustment of prices over the term of a long-term contract.

Defining efficient pricing arrangements for water and sewerage *ex post* is complicated because the pricing methodologies and contractual arrangements must be devised in an environment in which investments in assets have already been sunk. The pricing and contractual arrangements that might now be achievable may differ from those that would have been efficient prior to the commitment of the assets.

Over the life cycle of the assets, marginal-cost pricing may or may not be sufficient to fully recover total costs (depending on whether or not there are common costs or economies of scale).

If there are true economies of scale in the provision of water and sewerage services, or common costs which cannot be allocated on a causal basis to particular services or users, pricing at marginal cost would not allow total costs to be covered. In those circumstances, prices must average above marginal cost.

Where marginal-cost pricing does not allow a firm to recover its total costs, whether sunk or not, the economics literature suggests two broad, somewhat stylised, approaches for recovering fixed costs which are relatively efficient: Ramsey pricing and multi-part tariffs. Once assets are committed, the preferred *ex ante* Ramsey pricing or multi-part tariff structures would be expected to prevail, adjusted as required for changing circumstances. Where the assets have a sunk cost element, such a pricing structure would allow a return to be earned on the assets, unless changes in competitive circumstances forced prices downwards.

The Ramsey pricing and multi-part tariff approaches are outlined below:

• Under Ramsey pricing, the prices charged to each customer are set so that those customers that are least responsive to prices are charged the most and those that are most responsive are charged the least. This form of pricing means that, assuming zero cross-elasticities of demand between goods, all demands are reduced by the same proportion relative to the quantities that would be demanded if prices were set at marginal cost. Where it is not possible to discriminate amongst various classes of customers (for example, because the customer who bought cheaply could profitably on-sell), it is not possible to apply Ramsey pricing;

• Under a multi-part tariff, the price per unit of service may fall as the amount consumed rises. The economic advantage relative to Ramsey pricing arises because a multi-part tariff allows the price for the marginal unit consumed to be set closer to the marginal cost inducing greater consumption of the good or service provided than under Ramsey pricing. The two-part tariff is an important category of multi-part tariff. The most efficient form of tariff in an increasing returns to scale situation combines an access or entry fee designed to recover fixed costs with the price per unit of consumption set at the marginal cost of meeting a unit of expected demand for the service. A two (or multi) part tariff can smooth pricing fluctuations, ensure total costs are recovered efficiently and ensure that common costs are recovered. As long as any access charge is fixed (i.e. it does not vary according to consumption) and it is not so high that it forces some consumers to decide not to take piped water, the charge will not interfere with the efficiency benefits of marginal-cost pricing.

While there may be some economies of scale associated with pipeline construction and treatment plant, overall economies can be easily overstated given the increasing costs associated with new investment in water storage facilities and in expanding the distribution systems and the environmental costs of water usage.

Appendix D The Nature of the 'Market Power' Problem

D.1 Introduction

A major issue relevant to whether or not to regulate the water industry is the extent and implications of any 'market power' that the organisations supplying water might possess. A water supplier may not be tightly constrained in its behaviour by alternative suppliers or competing products. In such circumstances it may have 'market power'; it may maximise its profits by restricting output and raising prices relative to price outcomes and the profitability of firms in a 'competitive' market.

The potential harm created by a monopolist is the misallocation of resources, i.e. allocative inefficiency, and the transfer of wealth from consumers to producers (the so-called monopoly rents).

The monopoly rents generated may be wasted through reduced pressure on management to produce output at the lowest possible cost, particularly if the organisation is subject to explicit or implicit rate of return controls, and is not subject to capital market pressures (i.e. is in public ownership so that managers are not constrained by the threat of takeover and so on).

The existence of a dominant producer of a good is not necessarily indicative of a monopoly 'problem'. Indeed, it may be an indication of outstanding excellence in meeting consumers' requirements. A large market share may be the result of low prices, better production methods or better organisational arrangements used by the existing producer. The dominant firm may find that if it attempts to raise prices to extract monopoly rents, competing suppliers will enter the market. Potential entry is an important constraint on monopoly pricing behaviour.

In any case, because of information costs and the considerable product differentiation that characterises market economies, most firms have some discretion to price in excess of marginal cost without losing all of their sales, i.e. they have some market power. For example, the corner dairy could raise its prices without losing all of its

customers. Since there is a continuum from low to high degrees of market power, there is no basis in economics for a sharp dividing line between monopolies, or dominant firms, and others.

Clearly, the process of determining whether or not a firm's prices significantly exceed marginal cost is not straightforward in practice. Marginal costs are not directly observable and their estimation is necessarily a subjective process. Even if a divergence between price and marginal cost is identified, it is then necessary to establish how serious the associated costs are. Assessments of potential losses from an unregulated industry should focus on the market constraints which limit the ability of suppliers to price above marginal cost and reduce output below the level consistent with marginal cost pricing and the way in which these constraints are affected by changes in the structure of the industry.

For intervention to be justified, the benefits of preventing or deterring efficiency-reducing behaviour must exceed the costs imposed by the interventions. These costs include the direct costs of administering and complying with competitive rules.

A number of conditions must be met before the allocative efficiency losses associated with market power are significant enough to raise concerns. The market power problem is unlikely to be large if any of the following conditions hold: there are reasonably similar alternative suppliers or substitute products that could satisfy consumer needs at a similar price; potential new suppliers could enter the market reasonably readily; or there are no significant 'sunk' cost or legislated barriers to entry into the market.

D.1.1 Role of Substitute Products

The size of the allocative efficiency losses in any monopoly situation will depend on the availability of substitute products and alternative suppliers. Competition from substitutes will tend to drive a firm's prices towards its marginal costs and hence will reduce the extent of any potential welfare losses. For example, the transport and distribution of water may have natural monopoly characteristics at least at some levels of the industry. However, rain water collected off the roof and stored in tanks at an individual's residence may be a reasonable substitute for piped water in many end uses. If so, the relevant market for analysis of market power may need to include this possible source of supply. On the other hand, there may be no reasonable substitutes for water for some uses or at some times, e.g. during low rain periods or for bulk supplies. If a supplier can discriminate on the basis of end use or can charge a high price for connection to the water system, the constraint imposed by alternative supplies, for example, may be limited although real.

D.1.2 Role of Alternative Suppliers

The presence of actual or potential competitors will constrain a firm's ability to price in excess of marginal cost. For example, competition might be possible at the boundary of adjacent suppliers.

If a good or service is currently imported (above a minimum threshold level) a domestic firm is unlikely to have sufficient market power to raise concerns. In the context of the water market, individuals and companies have the option when establishing of choosing to locate in different areas or even countries and, in some cases, of moving operations to take advantage of differential prices. To that extent competition from different locations potentially provides some constraint.

The process of constraint by competitors or new entrants is likely to be limited when entering the market involves incurring high 'sunk' costs - an investment such as a pipeline that has little value in an alternative use if the entrant subsequently leaves the market. Where sunk costs are low, the presence of only a few players in a market - or even only one player - does not present a problem, as any exploitation of market position will encourage new entrants into the market. Where, by contrast, sunk costs are high, the potential for abusing market power - and reducing allocative efficiency - is increased. The higher these costs are, the longer is the expected time over which it will be necessary to amortise the costs of entering and leaving an industry, and the greater, therefore, will be the risk to new entrants.

However, even markets in which sunk costs are high will be contestable in the long run, so that the potential for an incumbent company to exploit its position of dominance is, ultimately, constrained. This means that in designing interventions, the long-term effects in terms of allocative efficiency must be considered as well as the short-term effects.

Appendix E Regulatory Options to Address Monopoly Concerns

E.1 Introduction

In this appendix we provide a brief description and discussion of the regulatory alternatives that might be applied if market power is perceived to be a problem in the water sector.

We consider the following regulatory options:

• No industry-specific regulation (reliance on the Commerce Act and common law requirements for charges to be 'fair and reasonable');

• Ring fencing monopoly components;

• Mandatory disclosure and benchmark comparisons;

• Franchise arrangements;

• Long-term contract arrangements;

• Common carrier provisions;

• Auctioning of capacity shares;

• Rate-of-return, price-cap, and benchmark regulation; and

• Government ownership.

E.2 No Specific Regulation, Commerce Act and 'Light-Handed' Regulation

E.2.1 The Threat of Regulation

Even in the absence of an explicit regulatory regime, businesses that possess a substantial amount of market power are usually subject to an implicit or explicit threat of regulation. Such businesses suspect, or know, that if they exploit their consumers in an obvious fashion the government is likely to step in and penalise them, perhaps by instituting a relatively harsh regulatory regime.

As a regulatory option, the threat of regulation has both advantages and disadvantages. On the one hand, it avoids the direct and indirect costs associated with regulatory agencies and their processes, and can thus represent a significant saving in costs. Companies have an incentive to minimise the threat of regulation by maintaining their reputation for dealing fairly with their customers. The threat of regulation is therefore likely to constrain a company's ability to exercise market power.

On the other hand, use of the threat of regulation, rather than explicit regulation, may increase the ability of politicians to disguise the costs of regulatory policies that benefit some groups within the community at the expense of others. A related concern is that unless the regulation that is threatened is clearly defined, its impact over time is likely to be driven by changes in the balance of political power among interest groups, rather than an economic assessment of the implications of market power for consumer welfare. Regulatory uncertainty can impose large costs, particularly for industries with long-lived assets such as dams or pipelines. A known regulatory regime, even one with known costs, may prove less costly over time than a regime without regulation, but an increased potential for unpredictable government action.

The outcome of the threat of regulation will depend to some extent on the incentives and opportunities it establishes for interest groups (including customers) to influence outcomes relative to explicit regulation. The

incentives for interest groups to be involved in influencing outcomes will depend on the nature of the threatened regulation, although the interest groups that are important in influencing explicit regulation are likely to be important in influencing outcomes through the threat of regulation.

E.2.2 The Commerce Act

One option for regulating the water industry is to rely on the Commerce Act to deal with any abuses of market power, with the Commerce Commission taking the ultimate responsibility for deciding both the need for intervention and the appropriate form of that intervention. This would, for example, remove some of the risks associated with an industry-specific regulatory agency. It could also serve to reinforce continuity and consistency in the handling of market power problems across the economy as a whole.

The use of a position of market power to restrict entry, or prevent or discourage competition, is covered by Section 36 of the Commerce Act. These provisions have been subject to varying judicial interpretations. Under the Act, a water transmission company may be required to offer to transport water for a competing water supplier. Physical access is likely to be guaranteed by the Commerce Act where the customer requires access to compete with the monopolist or another party in a market. Arguably, the Commerce Act solves the possible problem of an organisation using its market power at the transmission level of the market to affect competition at other levels without requiring ring fencing or separate ownership of these levels. It is unlikely that Section 36 could be used to ensure access for a customer that is not competing with the monopolist or another party in a market, since the provisions of the Act are directed at the impact of competition in a market.

The price that a network owner may charge a competitor for access to a network has been the subject of extensive judicial review resulting in a set of principles termed the 'Baumol-Willig rule'. In essence, the Baumol-Willig rule provides that a monopolist can only charge the opportunity cost of providing a service. The opportunity cost includes the incremental costs of access as well as well as profit forgone by providing capacity to a competitor. The Baumol-Willig rule does not necessarily preclude monopoly pricing by the transmission service provider.

The major potential disadvantage with relying solely on the Act is that the Act does not prevent the utility from charging monopoly prices to its end users (unless such pricing affects competition in a market).

Experience with the decisions of competition authorities in New Zealand and elsewhere supports concerns about the capacity of these authorities to deal with the complex economic and technical issues presented by network industries. However, these are unlikely to be overcome by specialist regulatory agencies or a more heavy-handed regulatory regime.

Reliance on the Commerce Act as a regulatory regime also involves some uncertainty since, within the broad parameters of the Act, the rules that become accepted depend in part on the influence of interest groups, politicians and regulators operating through both political and legal processes. Whether this process will result in a better or worse outcome for regulating network industries than more explicit, clearly-defined regulation cannot be determined in an *a priori* way.

The major advantage of the light-handed regulation is that reliance on the Commerce Act interferes only minimally with the ability of network companies to operate efficiently and to optimise investment over time (except to the extent that the threat of regulation is also operating). It places an onus on private parties to themselves negotiate satisfactory commercial arrangements within the broad framework provided by the Act and the Courts. Having a single regulatory agency ensures a consistent approach to regulation is adopted across all industries and avoids the costs of more extensive involvement by regulatory agencies.

E.2.3 The Common Law Doctrine of Prime Necessity

An additional constraint is imposed on the water industry by the common law doctrine of 'prime necessity'. If a supplier is providing a commodity that is a 'prime necessity', the supplier is in a position of 'great and special advantage'; and if it would be highly inconvenient to exclude the proposed purchaser from the supply of the commodity, the supplier has an obligation to supply a consumer as long as the consumer is willing to pay a 'fair and reasonable' price.

The doctrine derives from a series of cases beginning with Minister of Justice for the Dominion of Canada v the City Of Levis (1919) AC 505 and has included a number of New Zealand cases involving the supply of water, sewerage services and electricity. The doctrine has been found in New Zealand to apply to the supply of electricity and water, but not to sewerage services where residents had septic tanks and reticulation was not already in place. Although the doctrine has generally been applied where the supplier had a position protected by statute, it is also likely to apply where a monopoly without statutory protection is involved. Generally, the New Zealand courts have been willing to find a duty to supply where reticulation is already in place, but have been reluctant to require investment in reticulation to achieve supply. However, arguably, such a requirement could be derived from the Levis decision.

The cases heard in New Zealand have generally found that the charges levied by suppliers have been fair and reasonable. The doctrine has not developed in any detail the attributes of a 'fair and reasonable' price. In the Levis case, the court noted that the price was "not excessive having regard to all the conditions, and the charges imposed on the owners or occupiers of taxable property". In other cases the issue of price has been decided later by arbitration or the case has focused on whether or not charges should be levied at all rather than whether the proposed charge was reasonable.

E.2.4 Mandatory Disclosure and Benchmark Comparisons

The information disclosure regimes applying to some monopoly industries in New Zealand are intended to provide consumers, potential competitors and the Commerce Commission with better information about the cost structure and contracting practices of businesses possessing a substantial degree of market power. Information that must be disclosed by the electricity industry, for example, includes financial accounts, price, terms and conditions of supply, pricing policies and methodologies, costs, performance measures and output. The Ministry of Commerce is responsible for promulgating regulations covering the information to be disclosed and monitoring the information provided.

In the case of water utilities, disclosure of contractual terms and prices for water transmission may enable direct consumers and distribution companies to bargain more effectively with the pipeline company, and realise prices closer to competitive levels for water transmission. It might also enable new potential water suppliers to ensure that they are given access to the pipeline at reasonable prices.

Where a number of companies in an industry exist, the comparison of costs and charges across companies in different geographical regions (and possibly different countries) can help alert customers, the Commerce Commission and the government to excessive prices being levied by an organisation. The disclosure of information may facilitate action taken under the Commerce Act or common law. It may give the government a clearer idea of the need for more or less direct regulation of pipeline operations. However, it can be difficult to make valid comparisons across utilities because of differences in operating conditions, geographic characteristics, and so on. There is also a risk that companies will be forced to disclose information that is commercially sensitive and that business strategies will be compromised by the regime.

E.2.5 Experience with Light-Handed Regulation in New Zealand

New Zealand has generally adopted a 'light-handed' approach to regulation of monopolies, relying on the Commerce Act, common law and the threat of regulation; or supplementing these with an information disclosure requirement.

The major potential concerns with the light-handed regulatory regime to date include the high costs of recourse to the courts to settle access and pricing disputes, a concern by some customers that they are facing monopoly prices, and the possibility that the regime might be changed at some future date.

In the initial years of the regimes, both Wellington Airport Limited and Telecom New Zealand Limited were subject to extensive legal challenges (the airport over landing charges and Telecom over interconnection arrangements). In the Telecom case, though, one of the key issues that has contributed to the litigation is Telecom's obligation (imposed in its articles of association) to cross-subsidise residential consumers, and its attempt to obtain a contribution to this obligation from those parties seeking interconnection to its network. In other words, the regulatory constraint on Telecom appears to have contributed significantly to the costly litigation under the 'light-handed' regulatory regime.

In part the resultant costs are likely to be transitional in that they will set the ground rules within which contractual relationships must operate. For example, in the case of Wellington airport an important issue was whether prices should be set at short-run marginal cost or whether Wellington should be allowed to recover a return on its sunk cost assets. The court rejected strict short-run marginal-cost pricing. The valuation of Wellington Airport was therefore an important issue - having settled that issue, it is unlikely to be the subject of further substantial litigation. It is unclear at this stage whether further litigation on different issues is likely.

Litigation in both the Telecom and Wellington airport cases has resulted in part because short-run marginal costs following investment have been below long-run marginal costs; prices set at short-run marginal cost have been insufficient to allow the organisations to earn a 'reasonable' return on their sunk cost assets (valued at ODV), and long-term contracts have not been signed prior to the construction of assets. Similar difficulties are likely to arise in the case of water assets. However, given that most economies of scale appear to have been exhausted for water supplies, and water suppliers face increasing costs, difficulties imposed by economies of scale are likely to be of less concern in the long run.

Of course, it is worth noting that costly litigation is not avoided by heavy-handed regulation. Hearings in front of regulatory bodies can require substantial resources and generally can be appealed through the courts (as occurred, for example, when natural gas was subject to price control).

A number of major customers have complained that network companies are charging monopoly prices. As yet there is insufficient information to judge the merits of their claims although it seems unlikely that, given the threat of regulation, any organisation would engage in gross abuse of market power. It is particularly difficult to judge the merits of claims of monopoly pricing because of the incentives for customers to act opportunistically given the sunk cost nature of investments in networks. Once the assets are in place, they have little value in an alternative use. In the absence of enforceable long-term contracts, an owner may be forced to accept prices that do not cover total costs.

The Commerce Commission has also received a number of complaints about actual or 'constructive' denial of access to electricity networks. It is in the process of investigating these complaints. Again it is too early to draw conclusions on the efficacy of the Commerce Act in resolving access issues.

The light-handed approach has been successful to date in reducing the direct costs of regulation and avoiding the incentive difficulties created by heavy-handed regulatory regimes. Substantial ongoing improvements in efficiency have been evident in a number of the network industries (for example Telecom New Zealand Limited, the electricity distribution companies, ports and airports) reflecting the benefits of a regulatory regime that does not encourage a cost-plus approach to pricing.

Overall, the light-handed regulatory regime appears to offer advantages over alternative regulatory approaches. These advantages include the benefits of retaining the incentives for managers to optimise the efficiency of their organisations, the limited resources involved in the regulatory process and the consistency across different industries that it achieves. Uncertainty as to the precise nature of the regime is likely to reduce as guidelines emerge from decisions by the Commerce Commission and the courts. Concerns about monopoly pricing warrant continued monitoring of the regime. Only if monopoly problems become obviously costly or an *ad hoc* structure emerges would we advocate departure from the light-handed regulatory approach.

E.3 Ring Fencing

'Ring fencing' involves separating competitive from monopoly elements of an industry and regulating the monopoly element. In the water industry, ring fencing would involve separating the potentially competitive function of water supply from the more monopolistic distribution functions.

The major advantage of ring fencing is that it can simplify regulation of that part of an industry where market power raises concerns. The benefits of separating supply from distribution may be limited: if there are substantial transaction costs associated with separating headwater supply and reticulation services; if transaction costs of coordinating a set of storage facilities are increased by multiple ownership; or there are problems with multiple firms abstracting from the same water source (one entity's abstraction of water will affect another's).

E.4 Franchise Arrangements

E.4.1 Description

Competition *for* a market where there is a significant degree of market power is in some cases possible, without regulatory intervention, where competition *within* the market is infeasible. Rival companies can in effect bid for the right to supply the whole market. In this bidding competition, the company offering customers the most favourable terms will obtain their patronage. If the number of bidders is large or if, for other reasons, collusion among them is impractical, the contracted price can be brought very close to per-unit production cost. If one bidder can do the job at a lower cost than two or more bidders, the bidder with the lowest price for the entire job will be awarded the contract. The lowest price need not, in this context, be a monopoly price.

Franchise bidding is a formal competitive tendering or auctioning of the legal right to be the sole supplier of a service of a given quality for a given period. Two bidding schemes are possible. The franchise could be granted to the bidder who agreed to supply a certain quality of product to the market at the lowest price path. Here any monopoly profits would be bid away by the initial auctioning process, because the successful bidder would be forced by competition to a price path in which price, rather than marginal revenue, equalled marginal cost. Given the tendered price path, output would be set by demand at the competitive level.

Alternatively, the franchise could be awarded to the person who bids the most for the right to supply the market. In this case, the supplier could be expected to charge monopoly prices, but the government could capture the monopoly rents through the payment for the franchise. The latter kind of system would not resolve the underlying monopoly problem.

There are two broad categories of franchise contracts - owning and operating. Under an ownership franchise, the franchise acquires ownership of the business's fixed assets and these must be divested in the event of contract termination. In the case of an operating franchise, the assets remain in public ownership.

A number of problems exist with franchise bidding, which must be weighed against the costs of allowing unregulated operation of a monopoly.

First, where the agreement is to supply a certain quality of service, problems may arise in defining and subsequently enforcing the quality standard relative to the tendered price path. In general, the franchisee will supply a number of products, with many dimensions to quality. The regulatory agency may have difficulty in assessing the different combinations of price/quality offered at the bidding stage and then monitoring and enforcing agreed quality standards. When the franchise has been obtained, the successful bidder may also be in a position to lobby the regulator for changes in technical standards and the quality of service.

Secondly, problems may arise because of the costs of writing complete contracts under conditions of uncertainty, covering technology, demand, supply conditions, inflation, and so on. Franchise contracts require the prospective franchisee to specify the prices at which services will be supplied in the initial period, and if price changes are to be made in response to uncertain future events, the conditional terms under which service will be supplied in the future. As well, it is necessary to specify the nature and severity of the penalties for infringing the original terms of the contract. Such contracts are generally regarded as complex to write, negotiate and enforce. (This problem is not, of course, limited to franchise bidding.) Franchisees are likely to argue for changes to the price path as a result of subsequent unexpected developments (e.g. changes in quality standards, franchise liability risk, real wage shocks and so on).

Thirdly, if the franchise contract is renewable, existing franchisees may have a substantial advantage over competitors during the refranchising period. These include familiarity with and possible influence over the regulatory agency. The franchisee is likely to have a better feel for the factors that will most influence the officials involved. Sunk costs may also confer some cost advantages on the existing franchisee. These advantages could be dissipated by requiring the existing franchisee to sell capital assets to the new franchisee, though this could create valuation problems. On the other hand, if there is a substantial risk that the incumbent will not win the franchise in subsequent periods, he or she may fail to maintain the facility properly, particularly towards the end of the franchise period.

Fourthly, applicants may make unrealistically low bids for a specified quality of service given the expected scope for renegotiating the terms of a franchise once that franchise has been awarded.

Finally, a franchise scheme involves detailed input from the buyer in contract design and performance monitoring. It does not therefore necessarily overcome incentive problems associated with government involvement. In particular, the government owner would still need to decide what services it required, the timing of investment, contractual terms and so on, and must monitor the performance of the private company. If the product is homogeneous, and there is no demand for a range of qualities and price levels, price is the only issue. Otherwise, government rather than individuals in a market will have to define the services required. This will entail welfare losses from the distortion of the underlying consumer preferences. Incentives to select the most cost-effective option to put up for tender may still be lacking, and political considerations are likely to influence decisions. Councils may lack the skills needed to monitor the private contractor.

In summary, franchising can bring competitive pressures to bear on the supply of a monopoly service, particularly in the early stages of the franchise period. However, franchising can require a significant administrative apparatus similar to that associated with other, hands-on regulation. In particular, it does not eliminate the risk of capture of the regulatory agency by the industry incumbent, or the evolution of a complex regulatory scheme.

Franchise bidding appears to offer the greatest potential where the product or service can be defined with relative precision, supply and demand conditions are relatively stable, further investment requirements are not high, and the asset condition can be readily detected.

Franchising can also be used to overcome public sector capital constraints, and reduce costs without necessarily being aimed at reducing any market power. It can allow small councils to take advantage of a large private firm's experience in operating several plants, often internationally, and may allow access to more highly trained personnel and bulk purchases of materials and supplies. Private contractors may be involved in construction and maintenance of pipelines, operation of treatment plants and so on. As long as the contracts are subject to a competitive tendering process, this approach should help to minimise the input costs of the water supplier. However, these arrangements do not necessarily prevent the council or operator charging monopoly prices.

E.4.2 Application to the Water Industry

Franchising in the water industry would involve local government retaining responsibility for providing water and wastewater services, but contracting with a private firm for part or all of its provision. Facilities may be built, owned and operated by a private firm under contract to a council, or owned by the council. Options for franchising range from build-own-operate-transfer arrangements in which the private sector owns the assets for, say, thirty years before they revert back to local government ownership, to a situation in which a council continues to own the assets but contracts to private companies to provide operations and maintenance. The private operator might obtain its income from user fees, with the council obtaining a return to capital from a fixed fee, or the private operator could obtain its remuneration from the council, with the council billing users. Longer contracts allow the private company to take on more functions, including greater involvement in capital investment.

The main economic and technological characteristics of the water/sewerage industry do not suggest that a franchise approach to minimising market power problems is particularly suitable (although it appears no more problematic either). Difficulties in defining the dimensions of quality of the product, uncertainties as to the future, problems imposed because the industry's asset base is underground and its condition not easily monitored and so on appear to be as serious as for other industries such as gas and electricity which make little use of franchising arrangements.

However, private franchise arrangements are widely used in the water industry in France, and are also used in the United States (refer to Section 9 for a detailed description of such arrangements). They are becoming increasingly popular in countries such as Spain, Argentina, Mexico and Eastern Europe and have been adopted in New Zealand, for example for Wellington's sewerage scheme.

The prevalence of franchising of water appears to be driven largely by political considerations - it may be more efficient than government ownership and operation, but full privatisation, which might be even more efficient, is much more difficult to 'sell' politically than, for example, sale of electricity or telecommunications assets. Historically, public health concerns may have motivated continued government ownership, as may have

uncertainties as to the ownership of water rights. Other common concerns include arguments that access to water is a basic need and should be affordable.

The widespread use of franchising in France, and its survival for more than a hundred years, suggests that at least in the French environment it is possible to construct contracts that are reasonably efficient, and preferable to continued public provision. French private water companies are recognised as leading the field in terms of innovation and management and have been successful in gaining access to markets overseas.

Franchising arrangements in the United States have generally been for much shorter periods than in France (typically 5 years) with efficiency outcomes less clear cut. Although early experience with franchising appeared to deliver few benefits, more substantial gains have been apparent in recent years.

In both countries, the outcomes are affected by the competitiveness of the tendering process. If contracts are not awarded on a competitive basis, then customers will not necessarily face competitive prices.

E.5 Contracting Arrangements

Establishing long-term contracts that specify a price path (without the ownership complications associated with franchising) may provide customers some assurance that they will not be subject to monopoly exploitation during a transition period of reform. This requires that the price path adopted involve competitive pricing - such contracts could be established by the government prior to privatisation of a state owned monopoly, with conditions written into the articles of association of the company and protected by kiwi share provisions. Many of the difficulties discussed above (for example the pressure to change the agreed price path in response to unanticipated changes to supply or demand conditions) would complicate the application of this option.

E.6 Common Carrier Provisions

Common carrier or open access requirements are one way of attempting to reduce barriers to competition that may exist because of the large 'sunk' costs associated with network or transmission assets. The basic feature of this approach is that the owner of an asset such as a gas or water pipeline or distribution network is required to lease it on a common carrier basis to other potential transporters, charging a 'reasonable' price for this access. A distinction between common carrier and open access regimes is that, with a common carrier approach, there is generally a responsibility for expanding capacity to meet customer demands, also at a 'reasonable' price. Such a requirement may not exist in the case of an open access rule. Common carrier and open access regimes are sometimes used in the gas and electricity industries. We are not aware of any examples of common carriage of water.

The principal advantages of a common carrier approach are that it:

• Facilitates entry to the market by new service providers - for example, new suppliers of water - who might otherwise need to build their own pipelines or transmission network in order to serve customers; and

• Allows simpler regulatory and administrative arrangements than if the entire market were subject to regulatory oversight.

A common carrier approach does not directly deal with the market power possessed by a transmission company and does not ensure that the pipeline charges efficient prices for access. The imposition of a common carrier rule may have adverse effects if access is priced inappropriately. For example, if regulators insist upon a price for access to a pipeline related primarily to actual transportation costs, and not to the risks that the pipeline owner has taken in developing the pipeline, incentives for investment in the construction or expansion of pipeline facilities are likely to be reduced. Expansions or extensions of the water transportation network are, accordingly, likely to come later than might be justified, or not at all.

E.7 Auctioning of Capacity Shares

One way of circumventing concerns that a single pipeline or grid owner will exploit his or her position at the expense of consumers is to divide ownership of capacity within the pipeline or grid among a number of owners.

These parties would not hold a share in the pipeline or grid company (in other words, the pipeline or grid would not be subject to club ownership); rather, each would own rights in a defined amount of pipeline or transmission capacity. Where the asset involved is a network, rather than a single pipeline or transmission line, these capacity rights would be defined from node to node of the network, or in terms of injection and withdrawal rights. The pipeline would be managed as a cost centre by a separate operating company and each co-owner would pay an agreed share of the pipeline's variable costs up to its percentage of ownership whenever it utilises capacity.

In the case of a water pipeline, for example, the capacity owners might be specialist transmission businesses, but could also be water suppliers, distributors, or major users. These capacity owners would compete to sell transmission services to water suppliers and customers. The risk that they would collude to exploit consumers could be handled by conditions attaching to their ownership rights, without the need for any separate regulation of transmission prices.

The basic strength of this option is that it addresses concerns about the ability of a pipeline or grid owner to exploit his or her market position, by introducing competition into water transmission without duplication of facilities. At the same time, it creates an environment in which capacity expansion decisions are driven by demand, in the sense that they will be made in response to transmission price increases as pipeline or transmission line use nears capacity. In this sense, once set up, this arrangement might be expected to function relatively smoothly with minimal need for continuing regulatory oversight.

However, it should be noted that this is an option for which there is, to date, only limited practical experience. Investor-owned electric and gas utilities in the United States often own pipelines, transmission lines and base-load generation units under arrangements somewhat like that proposed. However, in these instances the capacity shares are generally not freely transferable, the unit involved is not operated as a cost centre, and joint approval is usually required for any capacity expansion. Despite such differences, however, these United States arrangements often result in competition. For example, two power companies sharing capacity rights to a base-load generator may compete in selling power in the spot energy exchanges or under long-term contract. Similarly, sharing transmission rights to a pipeline has sometimes afforded a third party, needing to acquire capacity rights, two sellers with whom to negotiate.

E.8 Rate of Return/Price Cap Regulation

E.8.1 Rate of Return Regulation

Under rate-of-return regulation, the regulatory agency sets the maximum rate of return that the business may earn on its assets. Any profit over this amount must generally be turned over to the regulatory agency.

Rate-of-return regulation is intended to reduce the incentive of businesses with substantial market power to raise prices to generate monopoly profits, since the regulatory agency will appropriate any 'excess' profits. The theoretical advantage of rate-of-return regulation is that it reduces the extent to which prices deviate from broadly competitive levels, without *explicitly* interfering with the price-setting behaviour of the businesses concerned.

In practice, there are a number of problems with rate-of-return regulation. Regulators generally have difficulty obtaining information needed to set and monitor 'fair' rates of return - for example, the capital base on which to calculate the return, and the 'true' level of profits. Because the information requirements for this kind of regulation are great, the resource requirements of the regulatory agency are usually large. Parties involved in the regulatory agency's decisions will incur high costs - notably the regulated business itself. Regulatory processes of this kind also tend to become highly political. In their attempts to represent the interests of (often vocal) consumers, regulators may end up making decisions that threaten the viability of the affected business.

Under rate-of-return regulation, there comes a point at which the regulated business has little or no incentive to attempt to control its costs or increase the efficiency of its operations. It may therefore, for example, follow a policy of maximising benefits to its employees, rather than running a lean operation and risk turning over profits to the regulatory agency. Behaviour of this kind will be very hard for the regulatory agency to detect or counteract.

The rate of return set by the regulatory agency will be an important influence on investment by the regulated business. In particular, if the allowed rate of return is greater than the business's cost of capital (what it must pay in debt and equity markets for access to funds), a regulated business intent on maximising its profits will tend to substitute capital investment for other inputs to its production processes (notably, labour). If, on the other hand, the allowed rate of return is below the cost of capital, the regulated business will have an incentive to pursue a less capital-intensive method of production than it otherwise would. In both cases, rate-of-return regulation will result in production costs higher than if the business decided what inputs to use purely on the basis of their relative prices.

Extensive experience with rate-of-return regulation in the United States has shown that it tends to result in inefficient pricing, high administrative costs, and poor production decisions.

E.8.2 Price-Cap Regulation

A close relative of rate-of-return regulation is 'price-cap' regulation, which utilises some form of pricing rule. One price rule, particularly favoured in the United Kingdom, is the 'RPI-X' rule. Here the prices of a regulated monopoly are allowed to increase each year by the movement in the retail price index ('RPI') less some amount 'X' which represents expected (or required) productivity gains.

The attraction of an RPI-X rule is that it is simple to understand, prevents 'cost-plus' pricing by the regulated business, and is likely to be less subject to manipulation by the regulated business than alternatives such as pure rate-of-return regulation.

Price-cap regulation does, however, have a number of draw-backs. If the price is set too high, the business will earn high profits. If it is set too low, the level and quality of services may suffer as the business finds it impossible to earn a reasonable rate of return. Further, there is no unambiguous way of determining an appropriate allowance for productivity gains ('X'). There is also no reason to believe that the RPI or CPI are good indicators of changes in the costs faced by a regulated business.

Compared with rate-of-return regulation, price-cap regulation works best if it is applied for only a short period of time, in the hope that, over this period, some degree of competition will emerge in the market concerned. If competition does not emerge, or for some reason price-cap regulation is maintained, outcomes will begin to converge on those of rate-of-return regulation. The longer the period over which price-cap regulation remains in place, the less certain regulators can be that the prevailing price reflects incremental production costs. The only way to get around this is to establish some fresh rule for revising 'X'. Determining an appropriate 'X', and means of revising it, is a problem much the same as that of regulators attempting to determine and monitor a permissible rate of return. The X may be established through using benchmarks derived from utilities in the industry (discussed in the section below).

Substantial competition for reticulated water and sewerage services is unlikely to develop in the short term. Thus controls are likely to be ongoing. The water industry is complex, and control of standards of service may need to be complex. A CPI-X rule appears likely to involve high information requirements if the different situations of different utilities are taken into account.

Price-cap regulation also requires an industry to be in a reasonably steady state so that a counterfactual can be projected. In the United Kingdom, price-cap regulation of water utilities has been problematic because the failure of utilities to fully maintain and replace capital in the past, and the change in water quality regulations imposed by the European Union standards has made it difficult for the regulator to establish an appropriate X. Although there have been concerns that the regulator has in fact set X too high, the regulated price has generated sufficient income to allow utilities to undertake capital investment to achieve water quality standards and to undertake a backlog of maintenance.

Price-cap regulation of local calls for domestic customers was a condition of privatisation of New Zealand's Telecom. The conditions were written into the company's articles of association and can only be changed with the agreement of the government (which holds a 'kiwi' share to protect the regulatory provisions in the articles).

E.8.3 Benchmark Regulation

The objective of benchmark regulation is to create a transparent flow of information to customers, managers, regulators and others about the company's performance and efficiency compared with others in the industry, thus inducing 'comparative competition'. The information may be used by the regulator to incorporate efficiency targets into price limits. It helps customers to judge the standard of service they receive and can help managers improve management practice.

When a number of firms exist, as is the case for the water industry, an industry yardstick, reflecting the performance and prospect of the industry as a whole, can be developed. The industry yardstick can be used to set X in CPI-X regulation. Each firm then knows that the future level of X is determined only in part by its own performance. If its performance exceeds the average for the industry, it would be able to enhance its profits. However, the fact that movements in a regulated firm's prices are unrelated to its own costs does risk the prospect of substantial losses in allocative efficiency.

The comparison of costs across water utilities may be complicated because the quality of services differs across utilities, costs are affected by operating conditions, geographic conditions differ, the quantity of water delivered to final consumers may not be known (losses from the system are not measured), and many companies are involved in large investment programmes which affect them to different degrees.

The quality of the services can vary along the following dimensions: drinking quality of water, pressure of mains water, interruptions to water services, water usage restrictions (e.g. hosing restrictions), and response to written complaints.

Costs might be affected differentially by the source of the water (ground versus river abstraction), resource characteristics, population and economic growth, density of connections, the quality gap between raw and treated water, topography, regional factor markets, asset condition, customer mix and standard of service. Efficiency requires minimisation of total costs, including the cost of capital. This, however, introduces difficult problems associated with valuing of assets and determining an appropriate cost of capital. These difficulties have led regulators to focus on operating expenditure and operating costs rather than total costs.

The comparators need to be carefully selected since their use inevitably leads the regulated companies to skew their attention to achievement of the activities measure. In any benchmark regulatory regime there will be a trade-off between the requirements of non-intrusive regulation (for example minimising data requirements) and the accuracy and comprehensiveness of any comparisons.

E.9 Government Ownership

Public ownership is suggested as an alternative to regulation based on the belief that public monopolies act in the public interest and therefore do not raise their prices to extract monopoly rents, and that government control of monopoly power can be achieved more efficiently through public ownership than by regulation of private companies.

However, as is discussed in Section 8, there are a number of incentive problems associated with government ownership which are likely to lead to allocative and productive efficiency losses. Government owned organisations are more susceptible to political interference than privately owned ones, leading to inefficient outcomes. Effective monitoring of management performance has proved problematic, resulting in productive efficiency losses. Inflated prices and inferior services were the norm in government trading departments and local government business such as ports prior to corporatisation.

Government ownership does not prevent the exercise of monopoly power. Where accountability is lacking, prices are likely to be set on a cost-plus basis with monopoly profits being dissipated in higher costs of operation, overstaffing and an 'easy life' for managers and staff. On the other hand, if the organisation has strong commercial objectives, the behaviour of its managers will be similar to that of private monopoly organisations. Alternatively, given the desire of managers to increase the size of their businesses, prices may be set below cost, and losses incurred in an effort to increase market size or share.

There is likely, however, to be little difference in the efficiency of a privately owned utility that is subject to heavy-handed regulation and a publicly owned utility since both will suffer from incentive problems. The case against public ownership is therefore strongest where private ownership can be combined with a light-handed

regulatory regime.

Appendix F Corporatisation

F.1 Why Ownership Matters

Within the water industry world-wide, it is possible to observe a wide variety of ownership arrangements, both with regard to the identity of owners and the relationship between the ownership of an organisation and control over its management. Practical experience and economic theory attest to the importance of these factors in determining how well organisations work, in terms of the efficiency of their operations in the short run and the quality of their longer-term decision-making.

The success of any business depends on its ability to use scarce productive resources in a manner that is both cost-effective and responsive to consumers' needs and preferences. This requires not only efficient production and marketing processes but also efficiency in the way in which the business is structured and decisions are made. The identity of owners, and the relationship between ownership and control of operational and strategic decision-making, are key components in this equation.

Over time, organisations whose ownership and control structures are well-tailored both to the conditions of the industry or sector in which they are found, and to the realities of human nature in the people they employ and deal with, will be more successful than those that are not. Ultimately, commercial survival may be as much a matter of getting ownership and control structures right as of engineering excellence, innovative product development, or precision of marketing. For this reason, it should be of little surprise that vast areas of economic activity have come to be dominated by only a handful of relatively successful ownership arrangements. These include ownership by dispersed, private investors.

The identity of owners, and the structuring of the relationship between ownership and control, matters, at the most basic level, because of the scarcity and costliness of the information needed to run an organisation, manage its relationships with other parties, and chart its course over time. Not only does the scarcity and cost of information mean that all decisions, most importantly strategic ones, are clouded by uncertainty, but also that all relationships, both within and between organisations, must be engineered to deal with the fact that people's interests will differ, and that no one will ever have complete knowledge about, or control over, what is going on. In this context, successful organisations will be those which economise on information, and structure their relationships so as to mobilise other people's interests to match their own. The pay-off comes both in their general performance, and in their ability to respond to the specific problems that arise to confront them.

F.2 Corporatisation Framework

Key elements of the corporatisation framework are as follows:

• The managers of the enterprises are set clear and non-conflicting objectives. Generally, a single key objective of operating the enterprise concerned as a commercial business is established;

• The objectives of the enterprises must be set out in detail in annual statements of corporate intent, which are subject to the approval of the shareholder and against which managers are held accountable;

• Where the owner requires a social service from the enterprise (in conflict with its commercial objectives) the service required must be explicitly contracted for;

• Managers are given a high degree of autonomy over day-to-day operational decisions, as in private sector corporations;

• Managers are answerable to owners via a board of directors appointed on the basis of commercial expertise. The board is responsible for strategic decision-making;

• The enterprises are generally required to provide half-yearly and annual accounts;

• Monitoring arrangements are established; and

• Regulatory advantages and disadvantages are removed.

Where an enterprise cannot be exposed directly to the market pressures faced by private sector enterprises (and in particular capital market pressures) because of government ownership, rules are imposed that are designed to mimic comparable private sector arrangements.

F.3 Deficiencies with the Corporatisation Model

F.3.1 Introduction

Deficiencies in the corporatisation model stem from incentive problems associated with continuing government ownership. In particular, they result from the following:

• Politicians may be unwilling to accept some of the basic principles of the corporatisation model;

• Capital market constraints on the performance of the businesses that remain in government ownership are relatively weak;

• There is an ongoing risk that businesses remaining in government ownership will be subject to politically-motivated intervention; and

• The ultimate owners of government organisations have relatively weak incentives to monitor the performance of management.

These elements are examined in more detail below.

F.3.2 Rejection of Basic Aspects of Model

Experience suggests that politicians (both local and national) may be unwilling to accept as sacrosanct some of the basic principles of the corporatisation model. In particular, there have been instances of unwillingness to allow full discretion over prices, thereby compromising commercial accountability.

In addition, there has not been complete acceptance of the principle of appointing boards and managers for their commercial skills rather than because they are councillors or represent sectional or political interests. Given the difficulties of designing appropriate monitoring arrangements for these organisations, the quality, focus and commitment of key personnel is, if anything, more important to sustainable commercial success than in the private sector.

F.3.3 Capital Market Pressures

Publicly-owned organisations are not exposed to the full set of incentives that capital markets can create for commercially desirable decision-making. These include:

• A direct flow through to the cost of equity from perceptions of company performance. A perception that managers are under-performing will lead to a lower share price and increasing difficulty in raising equity funds;

• The related operation of a market for managers, linked to company performance in the share market. Poor performance, as measured by the medium- to long-term return to shareholders in dividends and share price appreciation, will lead to pressure for replacement of key managers;

• The exposure to the threat or reality of takeovers (and the related threat of replacement of managers); and

• Exposure to the disciplines of a board of directors elected by shareholders to protect their interests.

F.3.4 Political Intervention in Decision-Making

Where an organisation is publicly owned (whether at a national or a local level), the accountability of managers to the ultimate owners is less direct than in a privately-owned company. Owners are unable to take any direct action that might influence the management of the company. They are also unable to sell their ownership rights. Instead, they must rely on politicians and their elected officials to monitor management and take steps to safeguard their interests.

At the same time, the political system - central and local - generates incentives that cause politicians' interests to diverge from the best interest of the owners of publicly-owned businesses. In particular, politicians' incentives to monitor the commercial performance of these businesses (as opposed to their performance in delivering politically-useful non-commercial objectives) will be relatively weak. At the same time, they will be motivated to use publicly-owned businesses to deliver benefits to constituents and interest groups, in part as a means of ensuring their own re-election. Public ownership facilitates the use of these businesses to deliver favours to particular groups. The costs of such use are typically obscure and widely dispersed, so that the political (as opposed to economic) costs will be relatively small.

Although the state-owned enterprise model adopted in New Zealand has placed much emphasis on the establishment of an arm's-length relationship between politicians and managers, experience both here and overseas suggests the fragility of this protection against politically-motivated intervention.

F.3.5 Incentives for Monitoring

When a firm is in private ownership, people who are better at obtaining information about companies or monitoring them are able to buy shares and obtain benefits as share prices change. People who obtain control of a company and implement efficiency improvements are able to reap some of the gains achieved. The result is a strong incentive for monitoring of privately-owned organisations.

With public ownership of firms, ownership rights are not transferable and income from them is collectively owned. An individual can benefit from the application of superior information only to the extent that it leads to better performance and through that to lower taxes or improved services. The result is that the incentives of ratepayers or taxpayers as owners to monitor management performance and to ensure that resources are used efficiently are reduced. An individual is rarely able to capture gains from using superior information or skills to improve the way a company is operated. Current owners are unable to transfer shares to people who might use them more efficiently and value them more highly. The problems faced by owners in obtaining the information needed to monitor the firm's performance are substantial.

Implementing effective monitoring arrangements has proved one of the more problematic elements of the corporatisation framework.

Appendix G Conversion Factors and Basic Statistics

Conversion Factors

1 cubic metre = 1,000 litres

1,000 cubic metres = 1 million litres

1 million cubic metres = 1 billion litres = 1 cubic kilometre

Global Stock of Water

Total water = 250 cubic kilometres per person

of which

Fresh water = 40 million cubic kilometres, 3% of world water

of which

Glaciers & icebergs = 30 million cubic kilometres

Rivers, lakes & soils = 0.2 million cubic kilometres

Underground water = 4 million cubic kilometres

Adult Consumption

Adults typically take in and release 2.5 litres per day.

Adult Intake Adult Release

Beverages 60% Urine 60%

Moist Food 30% Exhaled Vapour 28%

Metabolic 10% Sweat 8%

100% Faeces 4%

100%

In Auckland, the average person uses 180 litres of piped water/day. In New Zealand, the average household uses about 550 litres/day.

Sources: Offical Yearbook 1994 and New Zealand Geographic, April - June 1993.

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