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Impediments to Best Practice in the Onkaparinga Catchment:
A Review of Policies

Darla Hatton MacDonald
Policy and Economic Research Unit

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Onkaparinga Catchment Water Management Board

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Important Disclaimer

Cover Photograph:

Location: A Creek in Bigg's Flat, Onkaparinga Catchment
Chris and Elizabeth Ey's Farm
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EXECUTIVE SUMMARY

Overview

This report considers the institutional framework which shapes the operating environment for the Onkaparinga Catchment Water Management Board. The report highlights some of the impediments to Best Practice from the perspective of:

- economic efficiency,
- fairness and
- the impact on the quantity and quality of water.

This report will also consider the institutional framework and government policies within the Onkaparinga Catchment (board area). The purpose is to:

- identify potential impediments to best practice in the management of the resource;
- identify potential gaps in the institutional framework as it exists;
- ensure that our understanding of the framework is sufficient before moving forward to consider various incentive mechanisms for water management.

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The report provides an overview of some of the directions of change that might occur given the social and economic forces at work in the Catchment. The Onkaparinga is an interesting case study as it has experienced some degradation as a result of land clearing and salinisation but it is not in a dire situation. Further, the Catchment is in the enviable position of having achieved a considerable level of economic development with potential remaining. At issue is how to balance the interests of the environment with aspirations for further social and economic development.

Main Impediments

The current institutional arrangements result in roughly four layers of government with an interest in natural resource management. The layers are tied together in varying financial, statutory and regulatory arrangements. Roughly, the hierarchy might be seen as:

Commonwealth

State

Catchment Water Management Board

Local Government.

Institutionally, the Catchment Water Management Board is slotted in between the State Government and Local Government because the Minister for Water Resources must approve all Catchment Water Management Plans but the Boards have the power to request changes to the Development Plans of Councils. The Onkaparinga Catchment Water Management Board is approximately three years old and has been through a capacity building stage with the process of putting together the Catchment Water Management Plan.

A proposed Integrated Natural Resource Management (INRM) Bill proposes to coordinate the management of resources in the State. At least initially, the INRM groups will be established on an interim basis using existing NHT boundaries. If the proposed powers to employ staff, contract work, apply for grants, etc, are implemented, then many of the Board's existing functions will be duplicated. This can be expected to impede the capacity of the Board to work closely with the community in delivering change. In particular, because the proposed new arrangements facilitate separation of delivery of positive financial incentives such as grants, etc, from regulatory and allocation arrangement, the proposed framework could seriously impede Board operations.

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If the result is division of the Board's area into an INRM region for all the Adelaide Hills but not the Adelaide Plains, then this arrangement could impede the capacity of the Board to integrate urban and rural land and water use planning.

The question we have to ask is whether or not implementation of the Bill would or could impede the ability of the Board to deliver on its mandate. The answer to this question–of course–depends on which parts of the proposed Bill is implemented.

- If the Boundaries chosen coincide with Water Catchment (board areas) and Water Catchment Boards remain the prime vehicle for planning and implementing the water management plans and coordinating decisions about water-affecting activities, then the Bill could actually assist the Boards.
- If Boundaries do not follow those used by the Boards, and another layer of plans are developed for each region, then the proposed arrangement is likely to impede the capacity of the Board to implement the Water Management Plans that have just been completed and approved by Parliament.

The obvious alternative arrangement that is consistent with government objectives would be to remove the word 'Water' from the Boards' title and instruct them to accept full responsibility for coordinating and, to the extent possible, facilitating sustainable NRM in the Water Catchment

(board areas). Through the evolution of Boards over the next few years, people with a broad natural resource background could be appointed and provide more depth of experience in soils, natural vegetation, etc.

Direction of Change

There has been a strong trend towards urbanisation in the lower Onkaparinga Catchment (board area). With the Southern Expressway reducing commuting times, densities may increase. Urbanisation could lead to more salinity problems if the water table rises with water usage such as lawn watering.

Forestry has the potential to change aquifer recharge and this is an issue under review by the State Government and intergovernmental bodies such as the Standing Committee on Agriculture and Resource Management (SCARM).

Only the McLaren Vale is a prescribed area within the Onkaparinga Catchment (board area). Arguments could be made for prescribing much larger areas, if not the whole Onkaparinga Catchment (board area), in order to ensure that water resources are not over-exploited. As well, prescribing will provide greater certainty for people considering investments in the Catchment.

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Farm dams are controlled through a permit system in the Mount Lofty Ranges Watershed. Farm dams represent a resource that could be brought into a water trading system, if the Board opts to use market mechanisms. This is a topic to be considered in the next report.

The last section of the report introduces some initial ideas about how to move away from minimum standards. The basic idea is to secure interests in water and then provide incentives to innovate and exceed standards. There must always be penalties with teeth that are enforced to ensure no back-sliding.

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1 INTRODUCTION

1.1 Purpose of the Report

This is the first report in a series of three that the Policy and Economic Research Unit, CSIRO Land and Water will be preparing for the Onkaparinga Catchment Water Management Board. This report will focus on the institutional framework and government policies within the Onkaparinga Catchment (board area). The purpose is to:

- identify potential impediments to best practice in the management of the resource;
- identify potential gaps in the institutional framework as it exists;
- ensure that our understanding of the framework is sufficient before moving forward to consider various incentive mechanisms for water management.

One of the foundations of good economic research is an understanding of the institutions. This report covers the institutions which define the policy environment as well as some of the trends and opportunities which may emerge. There are a number of proposed changes to the legislative framework and these changes may have implications for the way in which a Catchment Water Management Board operates.

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The next report in this series will focus on incentive mechanisms for moving natural resource management practices away from minimum standards to practices which clearly exceed the minimum. Options such as the role of information, off-sets, water and salinity trading and a specific assessment of effective use of water pricing and charging arrangements will be considered.

The third report in this series will be the capstone report which will outline the development of an integrated ecosystem modelling and assessment system. Ideally, the model will enable social, economic and biophysical interactions to be monitored, progress against objectives to be evaluated, and alternatives tested.

These reports are designed to aid in the next major review of Catchment Water Management Plan in the Onkaparinga Catchment (board area). The Catchment Water Management Plan, approved by Cabinet in December 2000, is a foundation document. A major review has to occur within five years (December 2005). Budgets are on a three-year rolling cycle. Each year, an annual review occurs and with this the previous year's budget is replaced with a new third year. Other amendments may be introduced as well.

The series of reports being prepared by CSIRO will provide an integrated approach to addressing the requirements of section 92, 3, (g), (iv) and (vi) which require the Board to identify:

> (iv) "methods for improving the quality of water of the water resources in the board's Catchment area and the health of ecosystems that depend on that water; and ...
>
> (vi) methods for encouraging sustainable use of water;"[1].

1.2 Description of the Catchment

The purpose of describing the Onkaparinga Catchment (board area) is to identify the potential areas where impediments to best practice are at issue or have the potential to be in the future. A first step is to ensure that sub-areas of the Onkaparinga Catchment (board area) are described in a consistent manner.

The Onkaparinga Catchment (board area) contains a diversity of economic uses of land and water that will continue to be of concern as the area develops. Institutions and institutional arrangements will evolve in response to these development pressures. If we take a snapshot of the current situation, this will serve as a reference point. The consultation sub-areas (from the development of the Water Management Plan) will serve as a tool for categorisation of the Catchment. The Onkaparinga Catchment (board area) is not homogenous in terms of its economic land uses, see Figure 1.1.

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- Upper Catchment (above Mount Bold Reservoir) – this area includes the townships of Lobethal, Woodside, Oakbank, Hahndorf, Echunga and Stirling. This area is semi-rural including land uses such as viticulture, horticulture, grazing and dairying and hobby farming as well as residential land use.
- Lower Onkaparinga (below Mount Bold Reservoir) – this area includes the lower reaches of the Onkaparinga River as well as a section of coastline. It includes the communities of Clarendon, Blewitt Springs, Kangarilla, Hackman and Noarlunga.
- Noarlunga Embayment – this area includes part of the City of Marion and the City of Onkaparinga. These areas are urbanised. The area includes the Happy Valley Reservoir, Christie Creek and Field River.
- McLaren Vale and Willunga Basin – this area includes the McLaren Vale Prescribed Wells Area and a large section of the coastal area which comes under the Board's jurisdiction.

[1]Appendix I contains section 92 of the *Water Resources Act 1997* which lists all the elements that Catchment Water Management Plans must contain.

Figure 1.1 Consultation Sub–Areas within Catchment

1.2.1 Salinity in the Catchment

As part of the National Land and Water Resources Audit–Dryland Salinity Theme Project I, the condition and trends with respect to salinity have been assembled for Catchments across South Australia, including the Onkaparinga Catchment (board area). While there are limitations with respect to the amount and continuity of data collected, the report documented a couple of key indicators for the Catchment. The situation is not dire but warrants attention. Salinisation has occurred with a number of stations reporting salt input/output ratios greater than one. "[T]he data show that this stream [the Onkaparinga] has a flow-weighted EC well below the Australian drinking water standard, but the high flow volume means that salt loads to the reservoir are high" (Jolly *et al*., 2000, p.48).

The simple observation to make is that salinity levels in some parts of the Onkaparinga Catchment (board area) are significantly higher than those in the Murray River. While there may be a slight linear increase in salinity, it is not statistically significant.

The trend in the data may be reflecting the fact that land in the Catchment, especially in the Mount Lofty Ranges, has been cleared for many decades and we may be seeing the final landscape response to last phases of clearing.[2] Given the importance of the Mount Lofty Range Watershed to the drinking water supply of Adelaide metropolitan area, it is clear that any trends will be important to monitor.

1.2.2 Core Environmental and Water Allocation Issues

Agriculture and urban development are two of the major forces which have modified the Catchment. As well, Mount Bold within the Onkaparinga Catchment (board area), serves as a water collection point for Adelaide. This has resulted in degradation, isolation and fragmentation of ecosystems which contribute to a decrease in biodiversity in the Onkaparinga Catchment (board area). The Catchment in all likelihood cannot be restored to pre-European settlement conditions. However, the health of the waterways and dependent ecosystems can be enhanced if the needs of the environment are taken into account in the allocation of water resources and in the control of water-affecting activities. The Onkaparinga Catchment Water Management Plan sets out a series of core environmental strategies that include:

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- rehabilitating and managing watercourses through programs to fence riparian zones, clear woody weeds and exotic trees;
- revegetating degraded areas with local indigenous plant species;
- maintaining and enhancing the quality of surface and ground waters which includes maintaining wetlands.

A recent initiative is the Board's proposal not to levy areas of native vegetation protected by a heritage agreement and, hence, of high biodiversity value.

[2] Clearing occurred in two phases from approximately 1860-80 and 1930-50. (Jolly *et al*, 2000)

2 INSTITUTIONAL FRAMEWORK

2.1 Defining Institutions

After setting out broad principles about how a society wishes to manage its resources, effective public policy needs to be context specific. In particular, public policy prescriptions tend to be more effective when they are consistent with the underlying institutional framework. This sounds nice but what do we mean by the term institution? The term institution can be used to describe everything from the Office of the Prime Minister, to a Catchment Board, to rules which govern financial transactions.

Many people interpret institutions to mean only administrative arrangements. This report will use terms such as institutional environment or institutional framework to describe the set of fundamental political, social and legal ground rules which govern economic and political activity (Bromley, 1989). Institutions are important because when we evaluate a given policy and deem it to be "efficient", the statement is only valid for the institutional framework being referenced. If the governing rules are changed, then what is viewed as an economically efficient use of resources might also change. That is, the framework is one that moves with changes in values held by the community. It is an adaptive not a fixed concept.

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Institutions, as defined by governing rules are, in turn, able to shape the policy environment through tools or instruments at their disposal and thereby change the way in which resources are managed and used. The range of instruments might include:

- Motivational instruments such as prizes, awards, etc.
- Information
- Grants
- Financial assistance
- Levies and Charges
- Regulations.

Not all these instruments are available to all the governing bodies with an interest in natural resource management. The Commonwealth Constitution says very little about water resources and thus jurisdiction resides largely with the State and Territorial Governments.[3] The Commonwealth Government can participate in water resource management through financial incentives. However, the incentives must

[3] The Commonwealth is responsible for international agreements that may relate to water resources.

not be shown to discriminate between States under the cooperative federalism framework. The Commonwealth Government as a first layer of government often takes a coordinating role. The mechanisms it uses tend to become more refined when delivered in partnership with States and agencies.

The State Government as a second layer has the power to put together packages of legislation and regulation to manage water, land and resources. In South Australia through the *Water Resources Act* 1997, Catchment Water Management Boards are a third layer of government which put together plans to manage the resource. The final layer is Local Government which assembles the Development Plans for Council areas. The Catchment Water Management Boards have the ability to request changes to Development Plans and thus in the hierarchy of governance, Catchment Water Management Boards are a third layer and local Councils a fourth layer.

These layers are interconnected largely through fiscal arrangements but also regulatory authority. However, one of the interesting features of this report will be to consider some of the proposed changes in the institutional framework and follow the potential evolutionary path that various layers of government might end up taking. Cooperative arrangements between Catchment Boards, Local Government, etc, can be used to collapse the third and fourth levels into one.

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2.2 Defining the Institutional Framework

There are probably three current pieces of South Australian legislation, which are critical to the management of the Catchment, namely the *Water Resources Act 1977*, *Development Act 1993* and the *Environment Protection Act 1993*. The primary piece of legislation is, of course, the *Water Resources Act 1997*. Responsibility resides with the Minister for Water Resources and administration and enforcement of the *Water Resources Act 1997* is carried out by the Department for Water Resources. Land development and land use is covered by the *Development Act 1993* through the Minister of Transport and Planning. Land use can have an immediate impact on ground and surface water or have slow moving effects over time. For this reason, Regional Planning Strategies and Development Plans of Councils often contain a number of requirements to protect the water resources of the area. However, Councils are concerned with a wide variety of social, historical and cultural issues including economic development which may sometimes over-ride the concern for one resource. The final piece of legislation, the *Environment Protection Act 1993*, allows for the Environmental Protection Agency to issue protection policies on various environmental quality issues. Other legislation that are of some relevance include the *Native Vegetation Act 1991* and the *Soil Conservation and Land Care Act 1989*.

The Onkaparinga Catchment Water Management Board, as established under the *Water Resources Act 1997*, is concerned with managing a crucial resource, water, and water-affecting activities. Rivers, tributaries and groundwater aquifers are unfortunately oblivious to the boundaries created by people and refuse to be contained within only one. If the resource won't stay within a jurisdiction, efforts to coordinate various levels of government are required.

The Onkaparinga Catchment Water Management Board contains five local Councils: the City of Marion, City of Onkaparinga, Adelaide Hills Council and the District Councils of Mount Barker and Yankalilla. Figure 2.1 outlines the current boundaries of the Councils.

Figure 2.1 Local Council Boundaries

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The Adelaide Hills Council is the product of amalgamating previously existing Councils, namely DC Stirling, Onkaparinga, Gumeracha and East Torrens. The City of Onkaparinga Council is the product of an amalgamation of the Cities of Happy Valley, Noarlunga and part of the DC of Willunga. The present structure reduces the number of jurisdictions which have interests in the Catchment. Councils by their nature are concerned with a broad number of social, economic, planning issues within their jurisdictions. This means everything from delivering library services, catching dogs to development planning.

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3 WATER MANAGEMENT IN THE ONKAPARINGA—HOW DO THE VARIOUS ACTS OVERLAP AND COINCIDE?

Legislation defines how economic resources within society will be organised. There can be differences between what is written on paper and what is actually enforced. A host of interesting questions emerge. As we analyse the state of affairs from the Catchment level, we can consider what the relevant parts of the Act mean relative to a set of criteria. How an Act or Policy performs on individual criteria can be viewed as a clean way of untangling the different threads. The criteria might include things like:

- enhancing economic efficiency,
- increasing fairness,
- improving water quality and maintaining the quantity of water for consumptive purposes.

Terms like fairness need to be defined. For an economist, there are two main definitions of fairness used - Pareto fairness and Rawlsian fairness. With Pareto fairness, we might think about whether a potential change would increase income such that "winners" would be in the position to compensate "losers". One then needs to consider whether or not this compensation should then be paid. Rawlsian fairness requires that the changes make the least in society no worse off.

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3.1 Water Resources Act 1997

The *Water Resources Act 1997* has removed many of the impediments to best practice through the separation of title to land and to water. This has allowed extensive trading in water throughout the State. Very little trade has occurred in the Onkaparinga Catchment (board area).

There are some remaining practical administrative items that remain impediments to best practice. These items do not relate to the legislation itself but are part of the practical implementation of the separation of title to land and water. In another study, Young *et al* (2000) noted that the title registration system for water needs to move towards a Torrens title system to ensure that interests are registered clearly against title and transfers cannot be rorted.

The *Water Resources Act 1997* has put more power into the hands of the community to manage the water resources within a Catchment.[4] Through

[4] The level of participation depends on how involved the community wishes to become. The reasons for becoming involved vary across the Catchment (board area).

sections 53, 54 and 59, the Minister is able to search for people with a wide variety of experience, skills and expertise to come together as a Catchment Water Management Board. The Board is charged with putting together a Catchment Water Management Plan and Water Allocation Plans. These Plans are put together through community consultation and expertise of consultants, Board staff and the Board members. The Plans then proceed to the Minister for Water Resources and through a process of review and revision, become statutory documents. The fact that the Plans become statutory documents gives the process teeth and meaning. The Plans are not simply an expression of community aspirations.

The *Water Resources Act 1997* has provisions under Section 12 which allows for "one-stop shopping" and was described as one of the good news sections of the legislation designed to streamline processes. If a person has an authorisation under the *Development Act*, *Native Vegetation Act* or other natural resource management legislation to do an activity, then the person is not required to obtain a permit under the *Water Resources Act*. This has some interesting implications if we consider an example:

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Example 1 Land-clearing in Rural Areas

Let's consider a person with a parcel of land in the upper Catchment. Let's assume that the land is currently zoned for rural land use and currently has native vegetation on it. If the person wants to clear the land for agricultural use and has clearance under the *Native Vegetation Act*, the person would not need to seek permission from the Department for Water Resources for a Section 9 water-affecting activity.[5] Land clearing would be at odds with the current strategy within the Catchment to revegetate degraded areas or to use natural regeneration methods where remnant vegetation exists. Further, there is no obligation for the Native Vegetation Council to consult with Catchment Water Management Boards on vegetation clearance.

If the Board wants to influence a water-affecting activity being approved elsewhere, it must and is given the powers to change the decision making process, but not an individual decision. This is efficient and avoids duplication.

[5] This however, does not mean that a person could argue that they should necessarily receive a water allocation if the area was prescribed.

3.2 The Development Act 1993

The Development Plans of the Councils all set out various provisions to protect the watershed.[6] For instance, the Development Plan for the City of Marion restricts land uses that are not primarily agricultural in Rural Zone B, around Field River and its tributaries, that would detract from its character and function.[7] However, outside Rural Zone B, Field River enters an existing residential area, the Plan allows for residential housing of various allotment sizes to come within 30 metres of the River.

The provisions of the Development Plans are minimum standards which are designed to help preserve the waterways through the Catchment.[8] If the Onkaparinga Catchment Water Management Board was to perceive there to be a serious deficiency in the Development Plans, or provisions which are at odds with the Water Catchment Management Plan, the Board could request the Minister for Water Resources to put a request to the Minister for Transportation and Urban Planning that an amendment be made to the Development Plan of the Council in question. This would be a rather heavy-handed gesture and would indicate that communication between the Board and the Council was largely failing to reach satisfactory results. There are a couple of strategies that could be considered.

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Co-operative Strategy—Across the State, Catchment Water Management Boards and local Councils have been working along side one another. Depending on circumstances, there may be considerable room for Boards and Councils to develop policies on how amendments to Development Plans will be made. These policies could then be circulated to the Department for Water Resources and Planning SA. Only where Boards and Councils fail to come to agreement, would the respective Departments be called in to help negotiate solutions. The advantage of a cooperative approach is that it builds on local solutions and expertise. The disadvantage is that solutions may not be consistent across the State. The arrangement is not considered to be an impediment. It provides a positive incentive for differing administrative bodies to cooperate and, hence, is likely to be efficient. Moreover, it forces the policy signals provided to investors to remain consistent across the Councils in a particular Catchment.

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[6] There is considerable potential for overlap and differences in goals and objectives between the Development Plans of the Councils and the Water Management Plan of the Onkaparinga. A review of the Development Plans is being conducted by Stephen Smith, Strategic Planner with the Onkaparinga Catchment Water Management Board. For this reason, the aim of this report will be to highlight broad principles.

[7] Marion (City) Development Plan. Consolidated February 8, 2001. p. 152

[8] Floodplain management strategies are currently under review.

Legislative Approach—Amendments to legislation may be required to obtain a consistent approach across the State. This approach will yield a solution though it may or may not take as much time as Boards and Councils negotiating solutions. Further, the State Government may be seen as imposing a process.

Example 2 Compliant land use in a Prescribed Wells Area

The linkages between the Development Plans in effect across the Catchment and the Water Management Plan and Water Allocation Plan of the Onkaparinga Catchment (board area) may not be as well defined as perhaps an individual contemplating a development might wish. However, it is the responsibility of the entrepreneur considering a development, such as a boutique winery, to ensure that all approvals and licensing requirements are met. Some consideration could be given to amending policies, procedures and Development Plans to alert the entrepreneur to the fact that compliance in terms of land use is not a necessary and sufficient condition. The McLaren Vale Water Allocation Plan sets out some stringent rules for transferring water within the Prescribed Wells Area. The intent of the rules is to ensure that transfers do not result in further stress on the aquifer or increase soil salinity. Establishing the right to extract water in this area is likely to be the most important element in a business plan and would presumably be the starting point for an entrepreneur.

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In considering the *Development Act 1993*, there are some significant impediments as well as trade-offs among these criteria.

- Economic efficiency is impaired by the high cost of gathering information for individuals considering investments or land use changes. Some of this cost is unavoidable in protecting the varied interests of society.
- The Development Plans tend to focus on minimum standards. For example, Development Plans could include strong energy and water efficiency requirements starting with how new houses are to be situated on a site. Moving above minimum building standards as required by the Australian Building Code tends to decrease affordability. Fairness, in either a Pareto or Rawlsian sense, is impaired. Access to resources is not improved as the process of development approvals is weighted towards those with information.

- Development Plans do not generally protect or enhance water quality because of the incremental nature of planning approvals. Salinity may be increasing with urbanisation where irrigation is used extensively on landscaping.
- The protection measures of the *Water Resources Act* and the *Development Act* should ideally protect the quality and quantity of water available. However, the speed of economic change may place the resource under pressure.[9]

3.3 The Regional Planning Process

The Mount Lofty Ranges Regional Strategy Plan is a forward looking document released in 1993. The document still has relevance almost a decade later because many of the issues remain the same. The document seeks to set out principles and a process for protecting the resources and agricultural nature of the Mount Lofty Ranges. The strategy is designed to strike a balance between economic development of the region, the urban development and the environment generally. Contained within the document is a set of policies and procedures which are focussed on protecting surface and groundwater resources in the region. The challenge is not to change the administrative arrangements but rather to find ways to implement and enforce these policies.

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The Regional Strategy is concerned with the quantity of water resources for the area and recognises the importance of protecting the quality of Adelaide's supply of drinking water. In a number of instances, the Regional Strategy suggests that development be curtailed where the land use will affect the Mount Lofty Ranges watershed or sensitive coastal areas.

The Regional Strategy advocates the development of methodologies for assessing the cumulative impact of past decisions. Planning approval by its nature can take on an incremental view in that a project is assessed for its consistency with the relevant planning documents. The process is repeated one project at a time. If decisions are not periodically reviewed and evaluated as a whole then the process can lead to long-term degradation of resources.

The Regional Strategy predates the Onkaparinga Catchment Water Management Board and the statutory planning process of the Water Management Plan. The spirit of the Regional Strategy can be seen in the Development Plans of the Councils, such as the Adelaide Hills Council Development Plan. The Development Plan of the Councils needs to be consistent with the Regional Strategy and the State Planning Strategy.

[9] This will be discussed in more detail in Section 4–The direction of change.

However, the Regional Strategy is plagued by competing objectives without a clear set of overriding priorities. This is a problem common to many planning documents—how to sort out shifting and competing priorities and make trade offs among them. As well, documents of this kind also suffer from the degree of separation from the political decision making process. The Regional Strategy was approved for public release but is not a statutory document. Thus, decision makers can opt for increasing economic development through, say, tourism and wineries where the incremental effect of one more project is likely to be small. One way of overcoming this impediment—as indicated in the National Action Plan for Salinity and Water Quality—is to set targets and then use a suite of policy incentives to keep water-affecting activities and land use activities within the domain defined by the standards set.

It is difficult to evaluate the Mount Lofty Ranges Regional Strategy Plan against the criteria. Unfortunately, there is a significant difference between what the Plan set outs to achieve, which is a very good set of ideals, and what it actually delivers, which is very little.

In considering the Regional Strategy, some trade-offs between the criteria emerge:

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- Economic efficiency is not enhanced by the Strategy because it ends up being a soft guiding document.
- Access to resources is not improved as the process of development approvals is weighted towards those with information. Fairness in either a Pareto or Rawlsian sense is not improved.
- If the Regional Strategy had teeth then it might be better able to protect or enhance water quality in the region if the cumulative effect of planning decisions was periodically reviewed. Similarly, the quantity of water available would likely stay relatively constant if the Regional Strategy had teeth.

In summary, the prime impediment is the region lacks the clear articulation of a set of water quality and water-affecting practice standards and targets.

3.4 The Integrated Natural Resource Management Bill 2001

A draft Integrated Natural Resource Management (INRM) Bill is currently being circulated for public consultation. The bill, if and when it is passed, is intended to provide over-arching legislation to integrate natural resource management in the State. The draft is an exposure draft and is undergoing a process of wide consultation. As a result, it is likely that it could be changed significantly.

There are already a number of community-based bodies managing aspects of resource management in the State, including Soil Conservation Boards, Catchment Water Management Boards, National Parks and Wildlife Act consultative committees. The bill is intended to bring about greater coordination of these entities. It is said to be consistent with the State Government's policy of "eliminating duplication and maintaining, administration and planning in natural resources management".[10]

Under the proposed legislation, a Ministerial Board will be established and the Ministerial Board may designate an area of the State as an Integrated Natural Resource Management (INRM) Region. The boundaries of the Region may or may not correspond to current Water Catchment (board area) boundaries. The Ministerial Board will establish an INRM group for each region. As an interim measure, the boundaries used for the Natural Heritage Trust administration will be used. These boundaries do not align with existing Water Catchment board areas.

One of the important tasks of the proposed INRM groups is tackle the problems identified in the National Action Plan for Salinity and Water Quality. The explanatory paper suggests that existing bodies do not have "necessary status and resources to undertake the functions required by the National Action Plan for Salinity and Water Quality."[11] Section 92, 3 of the *Water Resources Act 1997* sets out the elements of the Catchment Water Management Plan that deal with ecosystem health. Not many ecosystems could be described as not being dependent on water. Thus, salinity management and water quality are part of the core business of the Catchment Water Management Boards. We would argue that the Boards represent an avenue for delivering a coordinated approach.[12]

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The proposed legislation presents a number of difficult issues. It is not apparent how the INRM legislation will fit with existing legislation such as the *Development Act 1993* and the *Environment Protection Act 1993*. The legislation as it currently stands may not include all aspects of resource utilisation such as mining and development of heavy industry.[13] In terms of ability to act under the current bill INRM may only have power to contract and distribute grants.

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[10] Draft Integrated Natural Resource Management Bill: Request for Comments & Explanatory Paper, p.2

[11] Ibid p.4

[12] If it is determined that the boundaries of the current Boards were too small, then it may be worthwhile having them "bunch up" for the purposes of the National Action Plan. There is likely to be sufficient level of good will among the Boards for this to work.

[13] Mining and its effects on water courses is covered by the proposed Environment Protection Policy discussed later in this section.

The basic premise of the proposed legislation, to enhance coordination of all aspects of natural resource management, is certainly on the mark. Under one model, the groups will act solely as a loose coordinating forum and assist the boards to negotiate change. Alternatively, the INRM groups could end-up serving as yet another layer of government or bureaucracy. Is this latter configuration the right approach? Table 3.1 outlines the aims of the Bill and considers how the Bill compares with the government objectives stated above.

Table 3.1 Comparison of the INRM Bill to Government Objectives

Aim	Proposal
Eliminate Duplication	Adds another administrative structure with local representation and contracting powers
Rationalise Legislation	Expands legislation without removing restricting powers from other legislation
Rationalise Administration	Adds a fifth level of government to the current four tiers concerned with natural resource management.
Rationalise Planning	Planning SA and the Minister for Transport and Urban Planning not included.

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The Catchment Water Management Boards, the State Water Plan, Council Development Plans, Soil Conservation Boards are all on their own planning cycles. If another layer of government is introduced with yet another planning cycle, there may be increased difficulty of getting all these planning processes to line up. There is considerable potential for constraining the process to where it is very difficult to make decisions.

Across the State the development of Catchment Water Management Plans have formed part of a process of building capacity within communities in order to be in the position to manage resources. In some Catchments, there may be considerably more appetite for participation in resource management and it is just a matter of investigating this potential. The obvious next step for strong, dynamic Catchment Water Management Boards is to widen the planning process to take full account of all the natural resource management issues.

Currently responsibility for soils resides with Primary Industries, Resources South Australia, water with the Department for Water Resources, and the remaining issues with the environment with Department of Environment and Heritage. Is there a need for yet another body to manage natural resources? Should there be one department responsible for all natural

resources or is it a matter of better coordination between arms of government that is actually required? Is there an alternative model such that a larger role for resource management can be assigned to Catchment Water Management Boards or Soil Conservation Boards, if there is the capacity to take on a larger role? The answers to these questions are not readily apparent but for resource management to be cohesive some tough choices have to be made and the resources put behind one of these resource management models.

If this legislation goes forward, there will be a real need for administrative partnerships between the government agencies, in particular, synchronised planning cycles. The Catchment Water Management Boards and the Department of Water Resources are currently on five year planning cycles. If the INRM legislation is to bring all planning cycles into line, it could be effective. If the INRM cycle adds one more planning cycle to the existing cycles, then the INRM may introduce new rigidities into the policy environment.

In considering the INRM bill, there are some significant impediments that need to be considered. However, much of this analysis is going to hinge on how the INRM bill evolves.

PERU

- Economic efficiency will be impaired if the INRM groups become another layer of government;
- If the INRM bill results in more rigidities then the ability of any one body to act will be fully restricted and, water resource quality may decline further;
- Access to resources is not likely to be improved as the INRM process has no social mandate to promote equity;
- There is a risk that the INRM groups will siphon resources away from Catchment Water Management Boards and compromise their ability to manage change.

3.5 Environment Protection (Water Quality) Policy

This last section brings an important area into the discussion namely the role of the Environmental Protection Authority (EPA). The EPA is not another layer of government but a point of coordination. The EPA has issued a draft policy statement on Water Quality which is of relevance to the Onkaparinga Catchment Water Management Board.

An Environment Protection Policy is one of the main legislative tools provided for by the *Environment Protection Act 1993*. As part of the management and control of point source pollution, Environment Protection Policy Protection Policy states as a general obligation that:

"11. (1) A person who undertakes to avoid need to discharge waste into waters –

(a) must take all reasonable and practicable measures that themselves cause environmental harm) to avoid the need to discharge the waste into any water; and

(b) in taking those measures, must have regard to the waste management hierarchy.

(2) Examples of the measures that could be taken are –

(a) cleaner production; or

(b) recycling or reusing the waste; or

(c) subject to this policy, discharging the waste onto land."

The draft policy appears to set very high standards for how pollution will be discharged into waterways but may be inadequate with respect to groundwater. The full impact of this policy will come down to the interpretation of "practical measures" and whether the economics of retooling production, or introducing new technologies will enter what is deemed practical.

PERU

Groundwater presumably falls under section 11 and some of the protections in sections 18 and 19 and sections 22 to 39 may be inadequate with respect to certain activities. Irrigation of reclaimed water onto land (section 11 (2) (c)) and subsequent leaching of residual contaminants may create serious problems without adequate monitoring. However, in some instances, the standards may be overly difficult to achieve. The draft Policy requires that all groundwaters in South Australia be protected to drinking water standards and this standard will act as a default across the State. The policy does not differentiate by the existing background quality of the groundwater.[14] Where, for example, an aquifer is naturally saline a more efficient policy would be one that allowed discharge in a manner that does not diminish aquifer quality. While the draft Environment Protection Policy allows for communities to amend the default policy, it would be a long and arduous process to change these defaults.

As will be discussed in the fifth section of this report and in the next report for the Board, there may be push and pull mechanisms which can drive the same sort of outcomes that allow agents in the regional economy more freedom of choice in how measures will be implemented.

In considering the Environmental Protection Policy, there are some significant impediments that need to be considered. However, much of this

[14] Submission by Peter Dillon on the SA Draft Environment Protection Policy (Water Quality).

analysis is going to hinge on how "practical measures" ends up being defined.

- There are often more efficient means of reaching the same outcomes by working with the market to move in the desired direction.
- Requirements to protect all groundwater to drinking water standards regardless of background water quality may result in aquifer recharge and storage becoming much more expensive.
- Access to resources is not likely to be improved as the policy has no social mandate to promote equity.
- The quality of available water of groundwater in the Catchment may be at risk from some activities such as irrigating with reclaimed water.

PERU

4 THE DIRECTION OF CHANGE

In the previous section, we have discussed legislation, proposed bills and draft policies which are shaping the institutional environment faced by the Board. This is only one part of the picture. There are distinct development pressures in the Catchment which will shape land use and the demand for water. There is the potential for greater urbanisation, decrease in grazing/dairying and movement towards more horticulture, tourism and wineries, etc.

4.1 Urban Development

In the lower Catchment, particularly the Willunga Basin and the McLaren Vale, there is increased urban development as construction of the Southern Expressway reduces commuting times to the Adelaide metropolitan area. As well, there are the amenity values associated with the beaches and the wineries of the area. Urban development has the effect of concentrating population densities and increasing water consumption over previous agricultural uses of water. As well, urban development changes how aquifer recharge occurs. As bitumen is laid, homes are constructed, and commercial areas are developed, a smaller percentage of rain actually permeates the soil and enters the groundwater. A higher percentage must run off as stormwater. Stormwater tends to be captured and swept away and in some areas directed away to the ocean. However, if the density of the new suburb is low and the landscaping requires irrigation through the summer period, then the amount of water reaching the water table can be quite high in comparison to a previous land use such as pasture.

PERU

The potential for Aquifer Storage and Recharge (ASR) is being explored in the Onkaparinga Catchment (board area). A demonstration project is in place and the possibility of a larger scale research initiative is under consideration.

The Minister for Water Resources and his Department, the water industry and CSIRO have been discussing the possibility of reducing Adelaide's dependence on the Murray River by making urban water use more efficient. To "free up" River Murray water for larger environmental flows, strategies such as water conservation, water recycling and alternative water sources (perhaps more water from the Mount Lofty Ranges watershed) become the main options. A question to ask at this point, where would water be put to its best use locally or regionally? How would the benefits be shared if more water was extracted from the Mount Lofty Area for Adelaide?

4.2 Forestry

Wide scale forestry plantations are being proposed for the Adelaide Hills. Under the Farm Forestry Incentive Scheme, incentive payments of up to $375 per hectare are available to landowners. Preference is given to sites which are greater than 10 ha and receive over 600 mm of annual rainfall with potential to extend to neighbouring properties.[15] The program is part of a strategy to make Australia self-sufficient in wood products and potentially a net exporter.[16] It is an example of the effect of a current policy signal which for an efficient outcome needs to be guided by local and Catchment planning processes.

Currently, the *Water Resources Act 1997* may not be adequate to deal with reducing recharge to groundwater brought about by a significant long-term land use change due to plantation forestry. It may be possible that neighbouring properties could take civil action where it is believed that recharge and draw-down were at issue. However, the data collection and onus of proof are likely to be beyond the means of most neighbours. The forestry issue is important if the water balance for the Mount Lofty area and the Adelaide metropolitan area is viewed from a regional sense. Changes in land use from pasture to forestry or vice versa are significant water-affecting activities.

PERU

Issues around forestry and recharge were identified by the Select Committee on Water Allocations in the South East. The Minister for Water Resources has been considering policy options and has foreshadowed amendments to the *Water Resources Act 1997* in his statement to the Parliament on this matter on 30 November 2000. The Standing Committee on Agriculture and Resource Management (SCARM) is considering the policy implications of land use change as an agenda paper. SCARM has requested the High Level Steering Group on Water to prepare a discussion document for the next meeting in Darwin, August 2001.[17] Young and Hatton MacDonald (2000) in reviewing options for the South East suggested that significant changes in land use that affect recharge such as forestry be required to have a water licence with a holding allocation.[18]

[15] Other conditions apply to the scheme, see Mount Lofty Ranges & Fleurieu Peninsula Farm Forestry Program Information Sheet.

[16] Using a subsidy to establish an exporting industry runs the risk of significant problems under current international trade rules, such as the General Agreement on Trade and Tariffs (GATT).

[17] Standing Committee on Agriculture and Resource Management, Agenda Paper, Item 1.1.4, Wellington, March 7, 2001.

[18] See http://www.clw.csiro.au/research/agriculture/economic/publications.html

For the Onkaparinga Catchment (board area), there are two unknowns. First, how many hectares will be planted with what species? Depending on the species planted (Tasmanian blue gum, Sydney blue gum, spotted gum, sugar gum, radiata pine, etc.) and intended use (woodchips, firewood, sawlogs), recharge may be affected for 10, 20 or 25 to 35 years. Second, how will the State Government choose to deal with recharge affecting activities? The State Government faces considerable opposition from a vocal group in the South East who believe that landowners have a right to the rain that falls on their land, irrespective of the effect their activities might have on recharge. The issue is important as in any fully allocated region whenever land use changes water yield, allocation must also be changed. If this is not done, ultimately the rate of use is likely to be unsustainable.

4.3 Areas within Catchment not Prescribed

Within the Onkaparinga Catchment (board area), only the McLaren Vale Prescribed Wells Area is in fact prescribed under provisions of the *Water Resources Act 1997*. The area relies on groundwater and reticulated water provided by SA Water for viticulture and other primary production activity. The groundwater resources could easily be over-exploited without these firm allocation arrangements.

PERU

There is the potential for other areas within the Catchment to come under pressure with the growing number of horticulturist and viticulturists moving into profitable enterprises that require water. Without careful collection and monitoring of data on ground and surface water resources, there is a danger that pressure will be put on areas not currently prescribed. This is the reason that the Board has initiated surface and ground water monitoring programs. Without monitoring, surprises can occur as over-exploitation of the resource can occur quite quickly. However, the decision to prescribe the entire water Catchment (board area) lies with the Minister.

The state of the art in such circumstances is to provide early and strong signals as to the direction and timing of policy change so that investment remains efficient and over development does not occur. Clarification of the rules on how water will be used in the region that acknowledges the interaction between ground and surface water in the watershed and the relationship between the Onkaparinga Catchment (board area) and the Adelaide metropolitan region is a necessary precondition. Even if the resources are not stressed today, the fundamentals can be laid out correctly now so that everyone knows the rules for the next round of play.

Another consideration is the value that well-defined property rights confer to property owners. Even if not all the water is allocated immediately,

uncertainty is reduced. By prescribing the area and formally setting out rights to water through water licences and allocations, property owners will be in the position to transfer water according to well-defined rules once all the water is allocated. The rules are clear and opportunities transparent.

4.4 Farm Dams

Farm dams throughout the watershed are now controlled by permit system through the Onkaparinga Catchment Water Management Board. For areas other than the Mount Lofty Ranges watershed or a prescribed area in the Onkaparinga Catchment (board area), a farm dam that is considered a development would be assessed on merit. Conceivably, a dam is likely to be approved if the land use is consistent with the Development Plan. There are some "loop-holes" because under the *Development Act 1993*, a farm dam is not a development if the walls are under 3 metres and the dam is under 5 megalitres capacity. This type of rule encourages shallow dams and this may not be the most efficient means of storing water. The State of Queensland has been receiving a great deal of negative national attention for this type of dam building occurring.

PERU

Farms in the watershed area are allowed to store up to 50% of the run-off that occurs on their property provided that water quality and quantity are maintained and the dam is not in an ecologically sensitive area or subject to erosion. As well, the capacity of any existing dams on the property has to be taken into consideration to ensure that total capacity will be under the 50% rule. This rule may be revised if the environmental flow study provide evidence supports setting the rule otherwise.[19] An interesting option to consider is the introduction of agreements to enable individual landholders to reduce capacity and contract to stay, for example, 20% under whatever current rules require for X years and receive a catchment levy rebate.

In the next report, one of the topics that will be taken is how farm dams can be brought into a system of managing water quantity and quality through the Catchment. There may be merit in using market solutions such as water trading with appropriate safeguards in place to encourage efficient use of water. Water in shallow dams might be deemed too valuable to evaporate.

[19]The 50% rule was put in place until scientific information was assembled about what the appropriate level would be.

5 MOVING BEYOND MINIMUM STANDARDS

The State of South Australia is doing many things that are consistent with best practice. First, the State, through its Catchment Water Management Boards, has been at the forefront in Australia with respect to developing Plans that set out the standards for how water resources will be managed. These Plans are consistent with the State Plan.

Second, the Department for Water Resources is moving into pro-active problem solving mode by moving to clarify the rules. An example discussed in another section of this report is the review of recharge-affecting activities, such as forestry. The level of activity could not have been anticipated in the drafting of the *Water Resources Act 1997*.

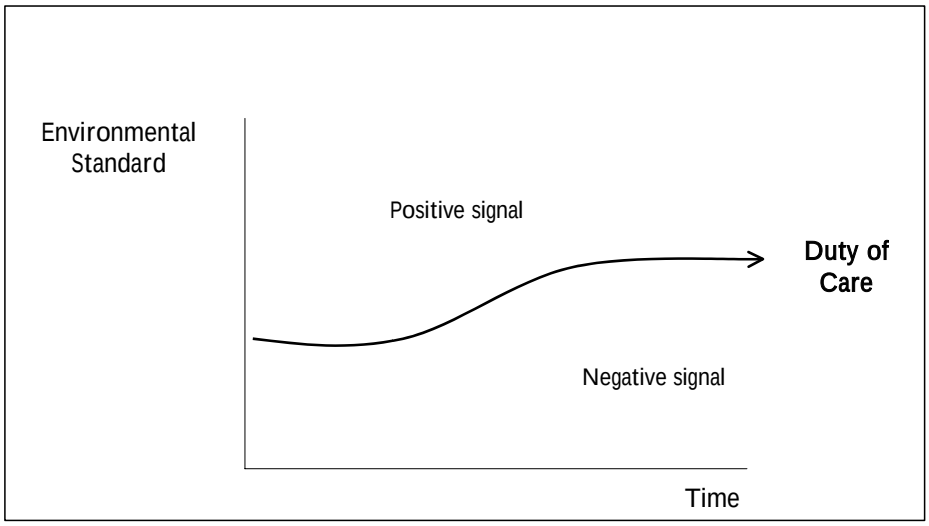
Third, the Department has moved to improve enforcement by hiring more people to investigate water use. This improves the ability of the Department to stand behind the rules.

PERU

In an environment where Catchments have put in place their Management Plans and the State has put in place the fundamental building blocks with the *Water Resources Act 1997* and the accompanying body of regulations, there is an opportunity to put in place mechanisms to move beyond minimum standards. Figure 5.1 depicts how environmental standards could evolve over time. Negative signals or penalties could be augmented to ensure there is no "back-sliding" but positive signals are used to encourage individuals and firms to invest, innovate and achieve a standard of performance that is over and above the minimum. The next report will begin to outline these concepts in greater detail and introduce a portfolio of mechanisms that have the potential for directing change.

At this point, however, we note that without access to revenue streams likely to become available through extensions of the National Heritage Trust or through the National Action Plan for Salinity and Water Quality, the capacity of the Board to send positive signals to water users and those whose actions affect water will be limited.

Figure 5.1 Evolving Standards over Time



5.1 Negative Signals

5.1.1 Penalties for Cheating

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The Department has moved to enhance the enforcement of rules by hiring more people to investigate water licensing. This improves the ability of the Department to stand behind the rules and gives the Catchment Water Management Boards more confidence in the process. Water is valuable in this State and the system depends on compliance with allocation rules. Widespread "cheating" on allocations would severely undermine the system and lead to further degradation of the resource.

Penalties for exceeding one's allocation (without purchasing temporary water) are declared by the Minister. Penalty arrangements have been applied in several prescribed areas (River Murray, Northern Adelaide Plains, Barossa and Angas Bremer). If penalties are to have meaning, the penalties need to be set at a level which has the potential to alter behaviour. For instance, if a penalty is set too low, it may be worthwhile to exceed the allocation and pay the penalty, rather than enter the temporary or permanent markets for water.

The Department for Water Resources is currently reviewing the penalty structure. Options being considered include variety of penalties such as a flat rate penalty, a stepped penalty and a linear progressive rate based on percent excess. The Department does not support even temporary

reductions in allocations, as it believes that it may seriously affect viability of some operations.[20]

Monitoring and enforcement is expensive and any government agency with this responsibility is faced with balancing the cost of enforcement with the cost of cheating. This is the case for Department for Water Resources, Environmental Protection Agency, Primary Industries, Resources South Australia and Planning SA. However, as development pressure within the Catchment increases, the cumulative effect of minor infractions of rules may prove large.[21]

5.2 Positive Signals

5.2.1 Securing Property Rights

Economic thinking continues to support using the market, where appropriate, to move towards social and environmental goals.[22] One of the keys to getting private interests to work in the same direction as societal interests is to ensure that the underlying property rights are fully specified.

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Within the McLaren Vale Prescribed Wells Area, water is an incredibly important and valuable asset. To secure interests in this asset, there needs to be a significant improvement in the paper trail of records. At present, South Australia has an old water registration system. South Australia, the home of the Torrens Title registration system, is a world leader in the development of “new system” registration arrangements. Under the Torrens Title system, titles are registered centrally and any dealing associated with these titles is valid only when the dealing is recorded on that central register. The Department for Water Resources is moving towards such a system but it is not yet fully in place. Transition to a full Torrens Title-like registration system has yet to occur.

At present, there is considerable mismatch between the procedures used to buy and sell land and those used to buy and sell water. Dealing and settlement arrangements for all trades associated with permanent water trading need to be made consistent with established conveyancing practices

[20] Harsh penalties may put pressure on the Board to consider revising rules regarding trading arrangements. Young and Hatton MacDonald (2000) in a report entitled "Who Dares Wins" have set out some ideas about how to allow trade while maintaining environmental standards.

[21] There is a growing literature within the field of environmental economics on what is known as optimal enforcement. A great deal of thinking has been put into designing incentives to get economic agents in a market to report truthfully and to behave in the right way so as to reduce monitoring costs.

[22] This does not mean that standards are not enforced.

as quickly as possible. There remain a number of opportunities for strengthening the approach to managing water. The opportunities reside with encouraging movements away from minimum standards, reducing the cost of transfers and separating volumetric rights from use rights. The lack of such arrangements impedes opportunities to develop the region's water resources and to reduce administrative costs.

Another form of positive signals might include the selective waiving of levies, charges and rebates to reward behaviour. Environmental accreditation schemes can also be used to achieve this end.

5.3 Managing for Water and Environmental Quality throughout the Catchment

The Onkaparinga Catchment Water Management Board has been working with a number of agencies to compile large detailed datasets concerning ground and surface water systems within the Catchment. Ongoing development of these datasets will provide key information on the health of the Catchment and present critical benchmarks for evaluation of progress towards goals and objectives.

PERU

For natural resource management to effectively achieve goals, scientific research programs need to reflect the important policy issues in the questions that are asked. The health of the Catchment requires a broad perspective. If researchers are not cognisant of the various economic and social forces, then they will miss the opportunity to harness or mitigate these forces and fail to achieve the desired ends.

These are not easy straight forward objectives but they start one thinking about the difficult choices that emerge when thinking about the health of the Catchment and water dependent ecosystems. Examples from SA Water will illustrate some of the trade-offs. SA Water uses the Onkaparinga River as an aqueduct to transfer River Murray Water. The increased flows are likely to be beneficial but there remain a number of questions about the pattern of water flow. Is it desirable from the perspective of the health of the waterways to have relatively constant flows or is it desirable to mimic natural patterns with episodic flooding? Are people in the community comfortable with periodic flooding? Is periodic flooding compatible with SA Water operations?

As another example, SA Water has a sewage treatment plant at Hahndorf. Treated water is put into the Hahndorf Creek, and ultimately this water reaches the Onkaparinga River. The Hahndorf Sewage Treatment Works currently serves the townships of Oakbank, Balhannah and Hahndorf. The facility was built in phases with plant no.1 built in 1977 and plant no.2 was added in 1992-93. The second plant was required with the increase in

population in the area. Sewage enters the plant and is treated and reclaimed water is treated and discharged into Hahndorf Creek and then into the Onkaparinga River and from there to Mount Bold Reservoir. The water from Mount Bold reservoir is then directed into the Happy Valley Reservoir and from here filtered and distributed to the southern suburbs of Adelaide.

With the Hahndorf plant, there are concerns being expressed within the Catchment regarding whether the location of the plant is appropriate. While the average level of phosphorus, oxidated nitrogen, etc is low[23], is the optimal cost/health of the Catchment trade-off being achieved? Could the same type of re-use initiatives used at Bird in Hand be possible at Hahndorf? These are questions which do not have immediate answers but do require consideration.

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[23] See Appendix II

6 CONCLUDING REMARKS

This report has identified several areas which may restrict or impede the ability of the Board to manage the water resources of the Catchment. The INRM Bill may represent the most serious impediment, depending on the model that is adopted. In particular, the Board could lose access to positive instruments such as funding. The other impediments identified in the report will constrain the ability of the Board to contemplate new strategies such as efficient use of reclaimed water.

The next report will consider the various mechanisms that could be used to move the management of water away from the minimum to provide incentives to engage in management strategies to exceed the standards. Considerable scope exists for mechanisms that move people to respond to signals and exceed targets.

PERU

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APPENDIX I

WATER RESOURCES ACT 1997—SECTION 92

92. (1) A Catchment water management board must prepare a draft Catchment water management plan in relation to the water resources of its Catchment area.

(2) The s must be in a form approved by the Minister and must comply with this Division.

(3) The plan must-

(a) include information (which must be, as far as practicable, accurate at the date of publication of the draft plan) of a kind prescribed by regulation as to-

(i) the quantity and the quality of the water comprising the water resources of the board's Catchment area; and

(ii) the health of the ecosystems that depend on that water; and

(b) assess the need for water of those ecosystems; and

(c) identify the water resources (if any) in the board's Catchment area that are suitable for recreational use and should be preserved or enhanced for that purpose; and

(d) outline the relevant economic, environmental and social considerations relating to the management of water resources in the board's Catchment area; and

(e) set out the board's goals in relation to water resource management in the board's Catchment area and explain how achievement of those goals will implement the object of this Act; and

(f) set out the method or methods the board will use-

(i) to assess the extent to which it has succeeded in implementing its plan; and

(ii) to assess the extent to which implementation of its plan has succeeded in achieving the board's goals; and

(iii) to monitor the quantity and quality of the water in its water resources and the health of the ecosystems that depend on that water; and

(g) set out the board's program for implementing its plan including, if applicable-

(i) the diversion of water from, or to, a specified watercourse, lake or underground aquifer; and

(ii) the holding of water in a specified lake or underground aquifer; and

(iii) modification of a specified watercourse or lake or excavation of an artificial lake; and

(iv) methods for improving the quality of water of the water resources in the board's Catchment area and the health of ecosystems that depend on that water; and

(v) drainage of specified land; and

(vi) methods for encouraging the sustainable use of water; and

(h) take into account any relevant bushfire prevention plan prepared under the Country Fires Act 1989; and

(i) identify the changes (if any) that are necessary or desirable to-

(i) a Development Plan under the Development Act 1993 or to any Act or subordinate legislation; or

(ii) any activity of a constituent Council or controlling authority or to the manner in which, or the means by which, a constituent Council or controlling authority performs its functions or exercises its powers; or

(iii) the activities of any other person,

to further the object of this Act; and

PERU

(j) identify land that adjoins or is adjacent to a watercourse or lake the use of which should be vested in the board by proclamation; and

(k) identify the infrastructure the use of which should be vested in the board by proclamation; and

(l) set out the matters that the board will consider when exercising its power to grant or refuse permits for activities affecting water; and

(m) if staff are to be employed by the board-identify the number that the board is likely to employ, the qualifications they will require and the likely salary range for each position; and

(n) include an estimate of the expenditure necessary in each year of the first three years of the plan for the implementation of the plan; and

(o) state the source of funds necessary to meet the expenditure for each year and, if more than one source, the proportion of the funds to be raised from each source; and

(p) if the source, or one of the sources, of those funds is a levy under Division 1 or 2 of Part 8-include an assessment of the expected social impact of the imposition of the levy; and

(q) include such other information or material as is contemplated by this Act or is required by regulation.

(4) The program to be set out under subsection (3)(g) must relate to a period of three financial years which must be specified in the plan.

(5) If a plan is adopted after 1 July in a financial year the period from its adoption to 30 June in that year will be regarded as the first year for the purposes of subsection (4).

(6) A plan must be consistent with the State Water Plan.

(7) A plan, when adopted, and amendments made to a plan must, as far as practicable, be consistent with-

(a) any relevant management plan under the Coast Protection Act 1972; and

(b) any relevant Development Plan under the Development Act 1993; and

(c) any relevant environment protection policy under the Environment Protection Act 1993; and

(d) any relevant plan of management under the National Parks and Wildlife Act 1972; and

(e) any relevant district plan under the Soil Conservation and Land Care Act 1989; and

(f) guidelines relating to the management of native vegetation adopted by the Native Vegetation Council under the Native Vegetation Act 1991; and

(g) such other plans, policies or guidelines as are prescribed by regulation.

PERU

(8) The board must inform the Minister of the inconsistencies (if any) between the plan and plans, policies or guidelines referred to in subsection (7).

APPENDIX II

Table 7.1 Comparison of Raw Sewage and Treated Wastewater

DATE	RAW SEWAGE					TREATED WASTEWATER						
	BOD (mg/L)	SS (mg/L)	NH_3 (mg/L)	TKN (mg/L)	TP (mg/L)	TDS (mg/L)	BOD (mg/L)	SS (mg/L)	NH_3 (mg/L)	TKN (mg/L)	OxdN (mg/L)	TP (mg/L)
3/06/1997	210	226	38	51	10	650	< 2	15	3.5	6		
17/06/1997	220	300	58	73	9	680	< 2	17	3.5	6	0.7	0.6
1/07/1997	265	355	66	85	12	690	< 2	15	5.3	8		
22/07/1997	300	300	53	65	12	700	< 2	18	6.2	8	0.9	0.5
19/08/1997	253	308	41	54	12	770	< 2	15	2.2	6	1.5	0.5
1/09/1997	158	215	30	42	8	810	< 2	14	7.1	9		
15/09/1997	215	308	47	63	9	820	< 2	14	2.0	5	0.5	0.5
13/10/1997	263	330	37	55	13	860	< 2	10	0.4	2		
21/10/1997	110	142	13	23	8	860	< 1	12	0.2	2	0.6	0.4
3/11/1997		225			11	770		11				
17/11/1997	345	390	42	65	13	830	< 2	15		2	0.1	
16/12/1997	213	193	46	56	11	810	< 2	8	< 2	3	0.6	0.4
19/01/1998	238	253	53	72	14	790	< 2	6	< 2	1	0.6	0.4
3/02/1998	235	255	45	62	13	770	< 2	5	< 2	< 2		
17/02/1998	295	266	44	55	14	780	< 2	7	0.4	< 2	0.5	0.4
AVG	**221**	**254.13**	**38.33**	**51.67**	**10.56**	**724.38**	**< 2**	**11.38**	**1.2**	**4**	**0.7**	**0.5**

PERU

BOD Biochemical oxygen demand is an indirect measure of the pollutional strength of a wastewater (ie the concentration of putrescible organic matter present). Organic matter may be present in particulate form or dissolved.

SS Suspended solids concentration – the fine, suspended particulate organic and inorganic matter present in wastewater.

NH3 Ammonia concentration (ammonia nitrogen).

TKN Total Kjeldahl nitrogen – the total concentration of organic nitrogen (proteins etc) and ammonia (inorganic nitrogen) present in a wastewater. Total nitrogen TN = TKN + Oxidised nitrogen

OxdN Oxidised nitrogen – nitrate ($NO3^-$) and nitrite ($NO2^-$) forms of nitrogen. In activated sludge processes, ammonia is biologically oxidised to nitrite then nitrate, a process

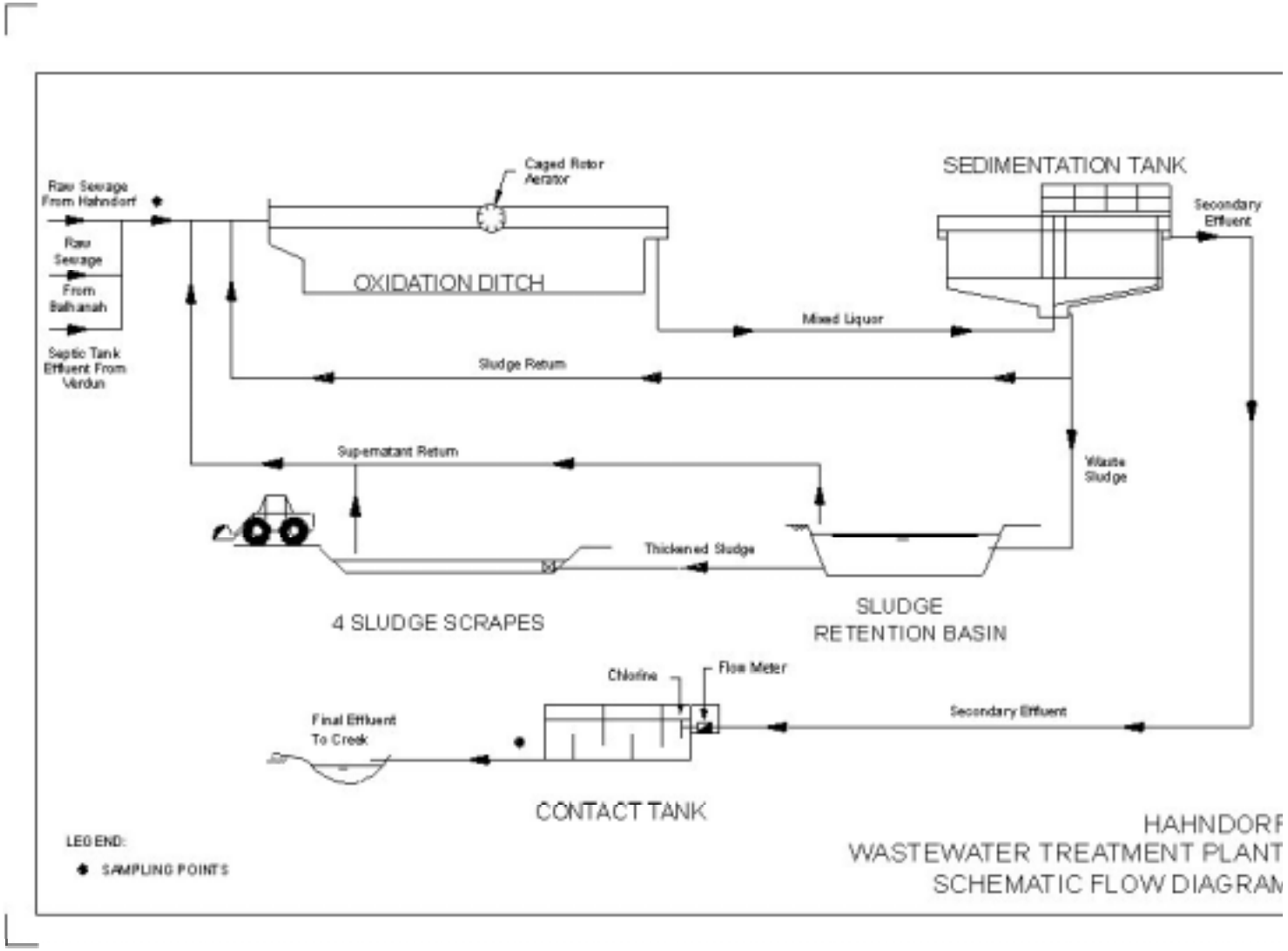
referred to as nitrification. Denitrification consists of biologically reducing oxidised nitrogen to the harmless gaseous nitrogen form (N2).

TP Total concentration of phosphorous (dissolved and particulate forms).

TDS Total dissolved solids concentration – one measure of salinity.

Source: SA Water

Figure 7.1 Schematic Diagram



File Reference:

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