

Briefing Paper

Investing in Catchments as Water Infrastructure: the case of Blue Lake, Mount Gambier

One of the greatest challenges facing water managers the world over is to continue to provide clean and regular water supplies to their customers, while offering them an affordable service which is also cost-effective for the company. In few places is this challenge so great as in South Australia. Serving a rapidly growing customer base and facing intensifying water shortages, SA Water must continuously look to ways of balancing the need to manage its costs, maintain and improve its asset portfolio, and at the same time ensure that there are sufficient revenues generated to invest in the infrastructure that is necessary to deliver on its core mission: to “provide water services for South Australians”.

For SA Water, as for most water utilities, investment priorities have conventionally focused on the built facilities and equipment that are required to abstract, store, treat and distribute water. These are obviously vital. But traditional definitions of water infrastructure, and the bulk of investments in it, have ignored one particularly important component. This is the ecosystems such as wetlands, forests, grasslands and other natural habitats that store, treat and regulate water for downstream users, as well as guarding against natural and human-induced hazards such as erosion, pollution, landslides, floods and droughts.

Unfortunately this omission has often proved extremely costly in economic terms. It is frequently far cheaper to invest in maintaining the “natural” water infrastructure base than to take action once ecosystems are degraded and their services are lost. In the Lockyer Creek Catchment in SE Queensland, for example, it has been found that maintaining natural vegetation around rivers and streams saves up to \$20,000 a month in water treatment costs.

It is rare for built water infrastructure to operate efficiently, according to its intended capacity and lifespan, without a well-functioning upstream environment. In terms of returns to investment, the gains in revenues and savings in costs from ecosystem conservation almost always far outweigh the expenditures required.

Having recognised the importance of investing in ecosystem management, SA Water commissioned a study that would help to further define and operationalise these concepts. The aim is to find ways of integrating the value of catchments as assets into SA Water’s internal planning and evaluation processes, and as external justification for future pricing regulators. This briefing paper summarises the findings of the project.

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The role of catchment ecosystems in delivering water quality

For SA Water, water quality parameters are guided by the Australian Drinking Water Guidelines and the National Water Initiative. These propose a “multiple barrier approach” to securing drinking water quality – and specify that source protection is the first and most important (as well as the most effective) barrier. They thereby mandate catchment ecosystem management as a key part of SA Water’s water supply investments.

Before looking in more detail at the economic value of catchment ecosystems for water, it is useful to consider just what we are talking about when we refer to catchments. *Catchments* are defined by water drainage patterns. They are basically the areas that drain surface runoff and groundwater into a river, stream, lake, urban stormwater drainage system, or any other type of watercourse.

In management terms, a catchment is therefore a given land area, incorporating all the resources and infrastructure in it (including those below and above ground), the various species of fauna and flora it contains, the people who live in it and use it, and the various economic activities that take place in it. These different elements, and the complex biophysical and socioeconomic linkages and interconnections between

them, can be termed the *catchment ecosystem*.

In turn, well-managed ecosystems deliver a wide variety of economically valuable services to humans. *Ecosystem services* can be defined as “the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfil human life”. These include important water services. Ecosystems help to maintain water supplies (for example through replenishment of water sources, water storage and regulation of flows) as well as to regulate water quality (for example through wastewater purification and control of sedimentation and siltation). A second important set of ecosystem services protects against water-related hazards and disasters (for example, guarding against floods and landslides, and maintaining water supplies in dry seasons and droughts).

There are many examples of the ways in which well-managed catchment ecosystems deliver water services to Australia. Natural vegetation in the Lower Gouldburn Catchment in Victoria, for example, has been found to play a key role in attenuating flooding. In the drylands of Sheep Pen Creek the ecosystem makes an appreciable contribution to regulating and maintaining riverflow and groundwater levels, and reducing the sediment and nutrient loads carried downstream. Of course the exact nature and magnitude of these services will depend on the type, size, physical characteristics, complexity and management regime of the ecosystem in question – as well as its environmental health.

Taken together, catchments ecosystems therefore provide important infrastructure for water quality, water supply and protection against water-related hazards. A multiple barrier approach recognises this role, because it is founded on ensuring that catchments are maintained in a state where they are able to continue to provide water services. If catchment ecosystems are managed sustainably, and sufficient investments are made in their maintenance, then water of higher quality and more regular flow will be delivered. In contrast, if they are degraded or polluted, waterflow and quality will suffer.



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Valuing catchments as water infrastructure

Despite the statutory provisions for catchment management as a key component of the multiple barrier approach, it is rarely considered to be an economic investment option. Unlike “built” water infrastructure, there is little information about the *monetary value of catchment protection* for water quality and other services. This means that it is very difficult for utilities such as SA Water to weigh up the costs and benefits of catchment protection, to compare its profitability or cost-effectiveness in relation to other infrastructure and technologies, to justify it as a beneficial use of funds, or to make decisions about how much to invest in catchments as part of an integrated package of measures for the maintenance of water quality and water flow.

Ecosystem under-valuation remains a persistent problem in water decision-making. The reasons for this are complex, However one important cause is the fact that most ecosystem services are not priced at all, or are subject to highly distorted market prices. Whereas it is relatively easy to estimate the returns from agriculture or to assess the water quality benefits delivered by a treatment plant just by looking at the market prices involved, it is virtually impossible to carry out a comparable calculation for wetland wastewater treatment services or for the waterflow services delivered by natural grasslands.

The net result is that most economic and financial decisions, whether they are made by the public or private sector, tend not to account for the value of ecosystem services when they are weighing up what would be the “best” use of their land, resources or funds. This is the case even though there are typically considerable economic benefits to be gained from ecosystem conservation, and substantial economic costs arising from their degradation.

In Portland Oregon, Portland Maine and Seattle Washington, for example, it has been found that every US\$1 invested in catchment protection can save nearby towns and cities anywhere from US\$7.50 to nearly US\$200 in costs for new water treatment and filtration facilities. In Australia, the algal blooms resulting from ecosystem degradation and pollution

cost more than \$75 million a year in additional water treatment, and around \$45 million in extra land and water rehabilitation measures.

The failure to account for the value of ecosystem water

services gives rise to what economists term *externalities*: the consequences of an economic activity that is experienced by unrelated third parties. These occur when ecosystem costs (such as loss of water quality or reduction in waterflow) are imposed by one group on another without any compensation being paid, or, alternatively, ecosystem benefits (such as improvements in downstream water quality and flow) are generated by one party for others without any reward or recompense being given. For SA Water, and the consumers who depend on the water services it delivers, under-valuation and externalities can be very costly indeed.

It is against this background that the project took place, responding to these gaps in information and understanding. Its basic objective was to develop and apply methods for catchment ecosystem valuation. The project documented the theoretical and conceptual underpinnings of catchment valuation, established methods which could be used to value catchment ecosystems, and demonstrated how such techniques could be used to generate information for water sector planning and policy-making.

The following section of this briefing paper looks at how the ecosystem valuation framework developed under the project was applied to the Blue Lake Catchment Ecosystem in Mount Gambier. The aim was to identify how investing in catchment ecosystem management could provide cost-effective solutions to water problems. A separate briefing paper describes the catchment ecosystem valuation methodology developed under the project, which was applied in this case study.



Most decisions do not account for ecosystem costs and benefits



Ecosystem values in the Blue Lake Catchment, Mount Gambier

Although a clear economic case can be made for using catchment valuation to improve water decision-making, to do this it is necessary to generate information about ecosystem costs and benefits which can actually be used to point to management solutions which can deliver enhanced, cost-effective water services. In order to illustrate the ways in which ecosystem valuation can be applied to real-world water management decisions, the project carried out a case study of the Blue Lake Catchment, Mount Gambier.

Several agencies cooperate in the management of the Blue Lake Catchment and its various water and ecosystem services. SA Water has responsibility for the quality and availability of water drawn from the Blue Lake and distributed to consumers. At the regional level, natural water resources are broadly managed by two bodies: the South Eastern Water Conservation and Drainage Board (SEWCDB) and the South East Natural Resources Management Board (SENRM).

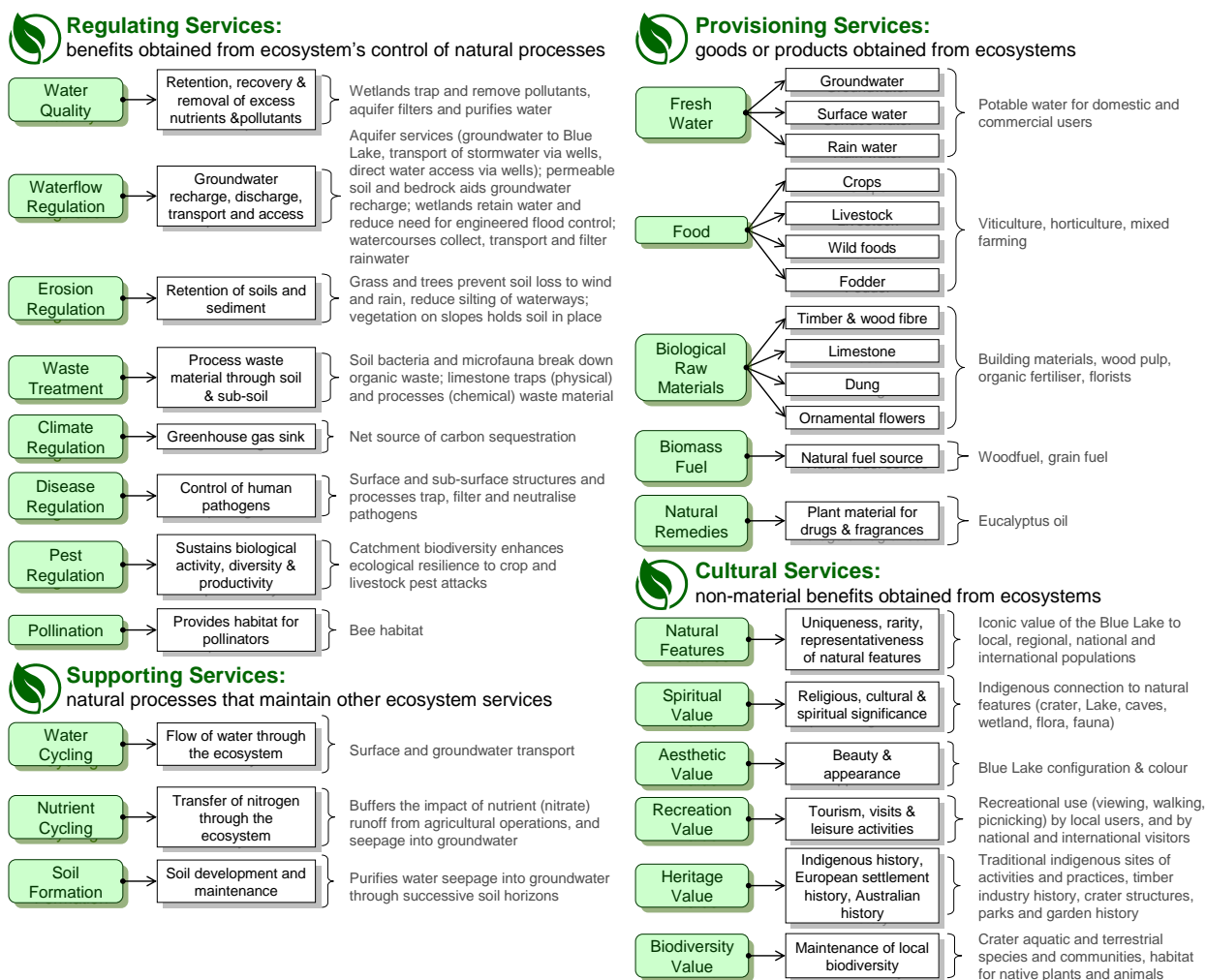
Fed by groundwater from the aquifer system, Blue Lake in the south-east of South Australia covers an area of approximately 70 hectares and contains an average of 36,000 million litres of water. As well as providing most of the domestic, commercial and industrial water for the City of Mount Gambier, it is an important recreational destination, attracting around 400,00 visitors a year. The catchment for the groundwater aquifers which feed Blue Lake (the "Capture Zone") covers an area of 28,610 hectares, and is comprised of a mosaic of grazing land (around 60% of the catchment), urban settlements, plantation forestry and irrigated farms.

In excess of 2,000 wells draw on the unconfined and confined aquifers of the Blue Lake Capture Zone, of which just under 40% are used for stock and domestic purposes and 12% each for irrigation and to supply the City of Mount Gambier. Pine and Blue Gum plantations are also significant water users.

While there is some concern over declining lake levels, water quality is a particularly pressing management issue. The main causes of contamination are nitrates, metals and hydrocarbons. Nitrates are assumed to be associated with agro-chemical runoff and with past urban septic tank systems, while poor industrial practices are presumed to account for the metals and hydrocarbons. Other threats to water quality include pathogens linked to the entry of human and livestock faecal matter in the water (most notably *E. Coli*, *Cryptosporidium* and *Giardia*), as well as endocrine disruptors and sporadic algal blooms.

Natural ecosystems in the Blue Lake Catchment deliver important water quality and supply services. A first step in the valuation study was to identify and investigate these services. In addition to the water quality, waterflow regulation, erosion regulation, waste treatment, water cycling, nutrient cycling and freshwater services which are associated with water quality and supplies, the catchment ecosystem was found to generate many other important values that are linked to human wellbeing and economic processes in the region.

These ecosystem services are illustrated in the figure below.



Ecosystem services in the Blue Lake Catchment (based on the Millennium Ecosystem Assessment framework, 2003)

Having established the different values of the Blue Lake Catchment ecosystem, the next step was to look at the ways in which investments in ecosystem management and conservation could yield tangible economic and financial benefits in terms of water quality and supplies. The aim was to make more precise the trade-offs between different ecosystem management scenarios and water benefits, expressed in monetary terms that would allow direct comparison between them. The study developed a framework for computing the economic returns to ecosystem management investments.

Although hypothetical and constructed for the purposes of the study, the management alternatives considered represent realistic options for enhancing water quality and supply parameters through investments in the catchment ecosystem, towards the target values adopted by the Blue Lake Management Committee. These targets include: the desirability of maintaining a factor of safety on drinking water guidelines; maintaining or reducing nutrient levels; maintaining or improving the

groundwater quality on the perimeter of the lake; maintaining in an oligotrophic state (low biological productivity, particularly low nutrient levels) and biotic species at a safe level; and no acceleration in the decline of lake level (less than 10% of depth over a ten-year period).

Four catchment management options relating to stormwater were evaluated – drainage well management through filtration, cleaning and capping; water-sensitive urban design (permeable pavements, filtration strips, infiltration trenches, vegetated swales, dry detention basins, wet retention basins and bio-retention/reed bed systems) and mini-wetland stormwater management; management of natural wetlands and construction of artificial wetlands for stormwater capture; and residential and commercial rainwater harvesting. These would employ ecosystem management techniques to capture and process stormwater, to recharge the unconfined aquifer, and to improve the quality of water available for consumption.

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One intended outcome of these ecosystem management strategies therefore relates to water availability. The more effective capture and re-use of stormwater has the potential to make available larger volumes of water for immediate use, and thus to reduce the demand on the Blue Lake and aquifers resource. A second outcome relates to water quality. Experience in other South Australian stormwater management schemes indicates that water quality can be enhanced if diverted to appropriately designed wetland schemes.

However, in addition to ecosystem water service benefits, the identified ecosystem investments have the potential to generate a range of other services (for example those relating to food, energy, biodiversity and climate) and to generate benefits and/or save costs for both water consumers and for SA Water.

The results of the ecosystem valuation exercise showed that all of the proposed management options generate considerable economic gains, as shown in the table below.

The first management option, drainage well management, yields an estimated net present value (NPV) of \$4.8 million. Over \$1 million of this figure derives from avoided water treatment costs, and more than \$4.5 million comes from the benefits of avoiding a contaminant outbreak.

The second management option, water-sensitive urban design and mini-wetland, provides gains with a NPV of

just under \$1 million. These benefits are comprised largely of the value of captured stormwater and of avoided treatment costs.

The third management option, management of natural wetlands and construction of artificial wetlands for stormwater capture, generates an overall NPV of \$11.1 million. However while natural wetland management gives a positive value (a NPV of around \$14.8 million) due to the value of captured water, avoided treatment costs and recreational benefits, the costs of establishing and operating constructed wetlands outweigh their benefits and yield a negative NPV of -\$3.7 million.

The fourth management option, residential and commercial stormwater harvesting, yields the largest of the indicative NPVs, \$22.8 million. This is largely due to avoided water treatment costs.

The Blue Lake Catchment case study therefore points to clear conclusions. Ecosystem valuation techniques can be used not only to point to cost-effective ways of enhancing water quality and supplies, but also to promote management decisions which create additional economic benefits (positive externalities) for local residents and water users. In most cases, the value of ecosystem water services generated exceeds the investment costs required to implement them. Clearly, an integrated catchment approach to improving water quality and availability outcomes in the Blue Lake Capture Zone can yield positive economic outcomes both for SA Water and for its customers.

	Catchment ecosystem management options			
	Drainage well management	Water-sensitive urban design and mini-wetlands	Natural and constructed wetlands	Rainwater harvesting
Water service values	Reduced risk of water supply contamination	More efficient stormwater capture and re-use	Water replenishment and purification	Water capture and use
Other ecosystem service values		Recreation, amenity and aesthetic	Recreation, amenity, aesthetic, biodiversity, carbon store, fuel and other products from reed crop	
Net Present Value	\$4.8 million	\$0.9 million	\$11.1 million	\$22.8 million



Using catchment ecosystem valuation for water management: lessons for SA Water

This briefing paper began by looking at the “bigger picture” background and rationale to catchment ecosystem valuation. It went on to illustrate how this approach could be applied, using the Blue Lake Catchment in Mount Gambier as a case study. The paper now concludes by identifying more general lessons learned during the course of the project about how valuing and investing in catchment ecosystems can help SA Water to deliver on its goals.

Doing better business

SA Water has a somewhat unique corporate mandate, which spans both commercial and public service goals. Thus while on the one hand the corporation strives to operate in a way that is commercially successful, competitive and cost-effective, SA Water must also balance these business interests with social and environmental responsibility.

Investing in catchment ecosystems is one way of better achieving this triple bottom-line. Ecosystem valuation shows how it is in the financial interests of SA Water, and the broader public economic interests of SA Water’s customers, to invest in catchment ecosystems so as to better deliver water supplies and other benefits.

Managing business risks and opportunities

Ecosystem degradation and the loss of important water services poses a substantial risk to SA Water’s corporate profits and production, as well as to the broader social benefits it is mandated to provide. Valuation points to ways of managing these risks through investing in catchment management, and to the economic wisdom of doing so. It can indicate where investments in catchments can provide a cheap and cost-effective way of delivering on given water supply and quality goals, and the likely costs of failing to invest in maintaining ecosystems in a healthy state.

At the same time, catchment ecosystem valuation shows that investments in catchment management can also present lucrative new business opportunities. It is self evident that anything which improves the product (water) that SA Water is charged with delivering constitutes a business opportunity.



Catchment ecosystem valuation points to ways of maximising business opportunities and sustaining revenues

Sustainable catchment management provides for many other economic opportunities. This is particularly the case when catchments are managed to optimise the delivery of multiple ecosystem services which include but are not limited to clean drinking water supplies. These positive economic externalities can often be achieved at low or zero incremental cost when managing catchments for drinking water goals.

Investing in catchment ecosystems also creates business opportunities relating to recreation, biodiversity conservation, sustainable products, markets for ecosystem services, community development, carbon offsets, and many others. Some of these may have the potential to generate income streams for SA Water. Perhaps more importantly, all provide opportunities for other land and resource managers in catchments to capture income.

Generating these wider benefits is an important way of building relationships with the catchment stakeholders whose actions bear on SA Water’s core business outcomes. It is also a way for SA Water to demonstrate its commitment to “greening” its core businesses operations, and to delivering water services in an environmentally sustainable manner.



Catchment ecosystem valuation points to ways of minimising business risks and avoiding costs

Investing in catchment ecosystems

Valuation thus underlines the financial (for SA Water) and economic (for South Australian residents) wisdom of investing in catchment ecosystems. The delivery of water services provides the primary rationale for ecosystem investment. At the same time, SA Water as a publicly-owned water utility subscribes to the concept of “duty of care” as it pertains to native vegetation management on private and public land, and the equitable distribution of costs and benefits of providing water.

A key question is how SA Water can use ecosystem valuation to stimulate investments in catchments as assets, so as to better capture these gains. A key shift is to work to integrate catchment ecosystem values into SA Water’s own decision-making processes. At one level this means counting catchments as corporate assets, and factoring the value of ecosystem services into the investment appraisals and cost-benefit analyses that are applied to water investments. At another level it requires that SA Water works to optimise the business opportunities, both water and non-water related, that sustainable catchment management offers.

Stimulating investments in catchment ecosystems as water infrastructure does not however only require SA Water to not just change the way that it carries out water business. It also demands that SA Water work to influence the day-to-day economic behaviour of the other groups and sectors whose activities impact on the status and integrity of catchment ecosystems.

SA Water does not wholly own the water catchments it depends on for the supply of drinking water, only certain components of the infrastructure that are contained in them (such as dams, reservoirs and water supply systems). Many of the lands, resources and infrastructural facilities in catchments are managed externally to SA Water – by other state agencies, the private sector and individuals. How these other components of catchment ecosystems are managed has a major effect on water supplies and quality – yet, in the majority of cases, the delivery of water values is not the primary goal of other catchment stakeholders.

The challenge for SA Water thus becomes to ensure that other catchment stakeholders also invest in managing their own land, resource and infrastructure

assets in a way which (preferably) continues to deliver the water quality and supply services that SA Water requires or (at the least) does not compromise the continued provision of these services. This, in turn, requires that these other stakeholders are adequately rewarded, according to the water values that they generate.

For SA Water, there are therefore multiple dimensions to “catchment investment”. One of these is the funds and other resources that SA Water allocates to its own catchment assets and infrastructure that it directly owns and controls. The second, and arguably far more important, component is investing in management interventions that will influence other land, resource and infrastructure owners in catchments to carry out their business in a way which sustains water quality and supply. Failure to do so may, ultimately, undermine the goal which SA Water is currently devoting so much time, funds and resources to achieving: to “provide water services for South Australians”.



This paper was produced as part of the “Catchments as Assets” Project.

Carried out as a collaborative exercise between UniSA and SA Water, the project aimed to generate information which would assist in integrating the value of catchments as assets into SA Water’s internal planning and evaluation processes, and as external justification for future pricing regulators. It ran between June 2008 and July 2009.

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