Splintering Urbanism and Sustainable Urban Water Management

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ABSTRACT

The sustainable management of water in Australia's cities is an important and urgent goal that is, in most cases, not being achieved. Climate change, inefficiency, drought, ageing infrastructure, rapid development and population growth are all contributing factors. Overcoming the challenges posed by these factors is essential for the future well being of this country's citizens and ecosystem health.

This research is concerned with the response of institutions to the water dilemmas faced by Australia's cities. Here institutions include government agencies, the water and urban development industries and associations, "green city" advocates and researchers. Much of this institutional response has focused on:

- Technological solutions (water recycling, desalination, rainwater tanks);
- Demand management (education, pricing, consumptive restrictions and appliance rebates);
- Best Management Practices in development (Water Sensitive Urban Design); and
- Decentralised or Localised management (on site treatment and provision).

These strategies of sustainable urban water management are all vital, but implementation is slow. Much of the literature in this area argues the most significant barrier is "institutional inertia", or the inability of institutions to take the actions necessary to put sustainable urban water management principles into practice. Institutional inertia is reinforced by an aversion to risk in the development industry and the sheer enormity of challenging the existing system.

I argue that the drivers of "institutional inertia" may not simply be a lack of resources or integration of government departments, as is often suggested. Rather, it could be a symptom of broader political, social and economic shifts occurring in urban infrastructure in Australia, and in industrialised countries worldwide. Accounting for these factors would enhance the understanding of the larger context in which this institutional inertia resides, and aid the implementation of sustainable urban water management. An encompassing framework grounded in both empirical and theoretical bases, applied in an Australian context would reveal an increased understanding of the full range of factors influencing sustainable urban water management.

These trends in urban infrastructure around the globe were analysed in the book *Splintering Urbanism* (2001) by Stephen Graham and Simon Marvin in the United Kingdom. In this paper, I will introduce the concepts from Splintering Urbanism relating to water networks and place them in an Australian context.

> The city cannot survive without capturing, transforming and transporting nature's water. The metabolism of the city depends on the incessant flow of water through its veins.
>
> (Swyngedouw 1996: 390)

INTRODUCTION

The presence of water in our cities is both an essential life force and a potentially destructive one. While cities cannot survive without a water source, that same source can also decimate hundreds of years of infrastructure construction in mere hours, as the recent destruction of New Orleans tragically demonstrated. When we attempt to control nature (particularly water) rather than build within its limits, the system often fails with catastrophic consequences.

We are beginning to experience these consequences in Australia. Supply shortages, flooding, pollution of waterways and unsustainable consumption are just a few of them. Undoubtedly, the sustainable management of the water cycle in Australia's cities is an urgent and essential goal for both human and ecological health.

Not only are there health implications with water issues, but social justice ones as well. With the recent growth of multinational companies that provide privatised water and infrastructure services in developed countries, we must remain vigilant about the equitable provision of water services and its role as a key indicator for social justice.

This research is concerned with the response of institutions to the water dilemmas faced by Australia's cities. Here institutions include government agencies, the water and urban development industries and associations, "green city" advocates and researchers. Much of this institutional response has focused on:

- Technological solutions (water recycling, desalination, rainwater tanks);
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These are all key strategies to advance water sustainability. However, implementation is slow and hindered by "institutional inertia" at the technical, social and professional levels (Brown 2004, Mouritz 1996).

I argue that in order to overcome or at least understand this inertia, current debates on sustainable urban water management need to be cognizant of broader trends in infrastructure in cities around the globe. Currently they are not. Greater awareness of such trends would inform those involved in sustainable urban water management and enhance implementation. These movements are encapsulated in the framework of *Splintering Urbanism*, forwarded by Graham and Marvin in the United Kingdom.

Splintering Urbanism builds on both empirical and theoretical analyses to explore urban infrastructure and its connection to human and environmental justice in cities around the world. Graham and Marvin investigate how social, economic and political trends combine with emerging technologies, and result in the social and ecological "splintering" of metropolitan areas. In short, "splintering" essentially refers to the dismantling of public networks such as water, electricity, transport and telecommunications that were standard in Western cities through the processes of privatisation, deregulation and globalisation. While

Splintering Urbanism discusses all these types of networks, I am concerned primarily with water.

This paper will first describe the types of water problems Australia's cities are encountering, discuss the institutional response of sustainable urban water management, and introduce concepts from *Splintering Urbanism* which may shed some light on why there is inertia in implementing sustainable urban water management.

BACKGROUND TO THE PROBLEM

Water Issues in Australia's Cities

Our current water infrastructure system consists of large-scale supply and treatment networks. In the post war boom years, "pipe and pave" was the motto in dealing with urban water. Delivery from dams to households, then quick disposal through straightening channels was seen as the most efficient and lowest risk way of transporting water out to sea. Unfortunately, it has created many environmental problems, outlined below and in Figure 1 (Coombes and Kuczera 1999: 1).

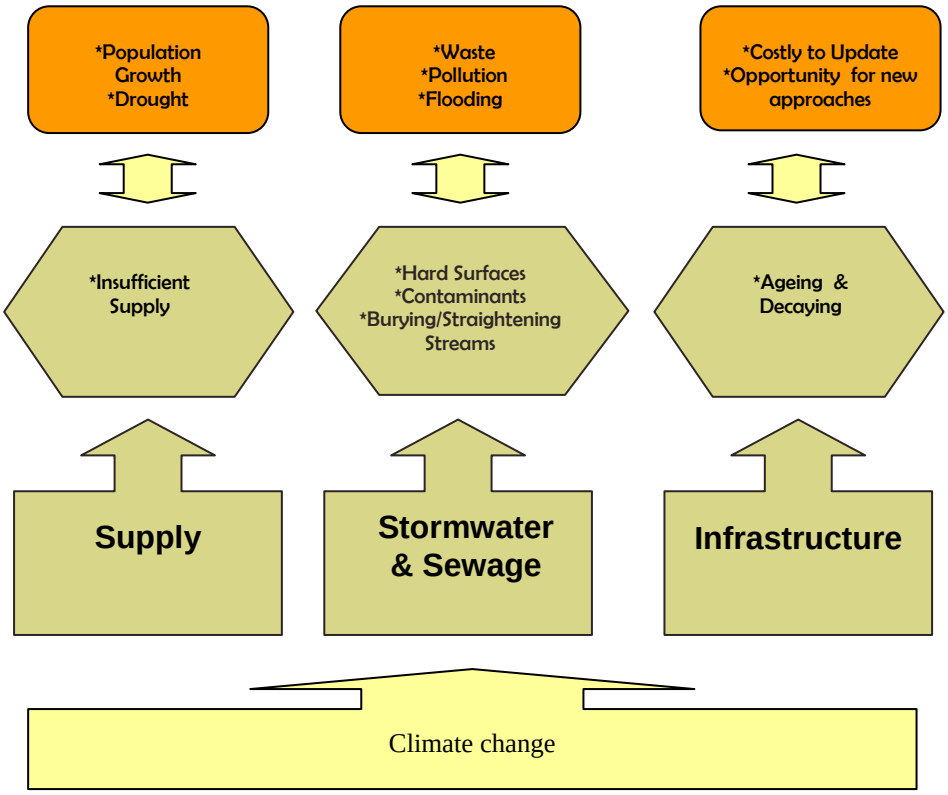

Figure 1. Urban Water Management Issues in Australia

Water Supply

The current configuration of urban water supply in Australia is a "once through and dispose" system whereby a water source has been dammed in a nearby catchment and piped into the city for consumption. Once it has been used, it is then treated and pumped out to sea. This approach incurs severe environmental impacts including loss of wildlife habitat, flooding of the dam area, and resource extraction for dam construction. Overall, it is inefficient and wasteful (Troy 1999).

Moreover, dams are becoming less reliable as a water source. Concern is growing over changing rainfall patterns and climate change impacts on dams, and is in part driving the search for alternative water sources. Increasingly, links between vegetation reduction and decreasing rainfall are being established, making already dry areas even more vulnerable (Houghton 2004). Rainfall is decreasing generally and when it does occur, is not falling in where dams are located. For example, the Southeast Queensland region is experiencing its driest year on record. The three major dams in the region – Wivenhoe, Somerset and North Pine Dam are all at a record low of 35% capacity. If the drought continues with no action, they will be at 1% within three years and National Lakes will be examined for water extraction (The Australian Sept 20,2005).

Supply shortages are exacerbated by rapid population growth in some cities. To meet Sydney's water shortage, the New South Wales Government is planning a desalination plant to meet the demand. It is meeting fierce public opposition, but has controversially reduced community involvement in the planning process, with the former Minister Craig Knowles arguing that the proposed plant is "beyond public debate" (Sydney Morning Herald, October 1-2, 2005).

Stormwater Drainage

Another aspect of the urban water cycle with major environmental impacts is stormwater drainage. Traditionally, the aim has been to transport stormwater away from urban areas as quickly as possible in order to prevent flooding, health risks from contamination and property damage. Meandering creeks were straightened and paved over and concrete drains were put in place to rid the city of water as quickly as possible.

Unintended consequences such as waterway pollution and harm to fish populations from contaminants in stormwater runoff are common (Gregory 2002: 620). As Neutze notes, "much of the rainfall in urban areas is treated as a waste product to be disposed of and, collecting pollutants as it goes, it fouls the water bodies into which it is discharged" (1999:71). In Sydney, stormwater runoff has become a major source of pollution in Sydney Harbour and Port Phillip Bay (Troy 1999: 4).

Sewerage

The sewerage system also incurs environmental damage. The objective of the sewerage system is to carry wastewater away from areas of human settlement, process it in a treatment system and deposit out into the ocean. When large-scale sewer systems are unable to cope during peak loads and heavy rain, they leak, overflow and cause flooding and pollution (Neutze 1999:71).

Further, the current system is inherently inefficient in its use of water. Much of the sewerage is treated to such a high degree that it is practically drinkable. At the very least it is safe for use on gardens and golf courses. Public perception generally rejects the notion of its reuse because of the potential risk to human health and the "yuck factor". The current push by the Mayor of Toowomba to recycle its wastewater and use it for potable purposes has sparked outrage by many of its residents who do not trust it to be safe, despite long time use in many overseas cities such as Singapore and London (WSAA 2005).

Ageing Infrastructure

A related issue driving the need for new approaches to urban water management is the ageing and decaying of physical water infrastructure, mostly built in the post war boom

years and now in need of either significant upgrading or replacement. Indeed, infrastructure replacement was a politically charged issue in the 2005 state election in Western Australia, where the main campaign issue was whether a desalination plant or a 3500-kilometre canal to transport water from the Kimberley should be built to meet the needs of a population in drought since the seventies (Gill 2004). Another example is Brisbane, where it is estimated that Council will have to invest over two billion dollars in the next twenty years in water treatment and stormwater facilities to deal with population growth (Heywood 2003). Clearly, we are being presented with the opportunity to rethink the way in which water is treated in the urban environment beyond simply replacing existing pipes and in dealing with the uncertain but increasingly real effects of climate change (Maher and Lustig 2003).

Climate Change

In addition to the uncertain weather patterns and rainfall discussed with regard to water supply, an overarching concern of climate change impacts on urban water in the city needs to be examined.

Cities, particularly those in cities that are at or below sea level, are particularly vulnerable. They are likely to encounter more frequent and severe flooding events. To counter these effects, development should be oriented toward absorbing stormwater and reducing runoff, preferably banning all new development in floodplains (Houghton 2004), (White 2002). This became tragically clear recently in New Orleans. While it is not certain whether the severity of Hurricane Katrina was related to climate change, there is no doubt that the infrastructure built to control put in place to deal with the water in that city was no match for a storm of that magnitude.

Coastal cities are also more vulnerable to rises in sea level, which can cause problems in land stability from unsustainable groundwater withdrawal. Additionally, soil loss and erosion from vegetation removal in coastal areas will cause landslides (White 2002).

THE INSTITUTIONAL RESPONSE: "SUSTAINABLE URBAN WATER MANAGEMENT"

In recent years, initiatives to address urban water issues have flourished. A great deal of resources have been invested from such varied interests as:

- The development industry;
- The water supply and stormwater industries;
- Local, state and commonwealth levels of government;
- Environmental or "Green City" advocates; and
- Universities and multi stakeholder research centres.

These strategies are typically referred to under the umbrella term of "Sustainable Urban Water Management". I have placed the strategies and their related practices into three broad categories which are outlined in Table 1 and discussed below.

Table 1. Current Focus of "Sustainable Urban Water Management"

Strategy	Practice

Best Management Practice	Water Sensitive Urban Design
Demand Management	Education/Restrictions/Pricing
Technology	Desalination/ Rainwater Tanks/Recycling
Decentralisation	"Off the grid" supply and treatment

Best Management Practices (BMPs)
"Best Management Practices" focus on engineering, planning and design techniques employed during new development (and less commonly redevelopment). This collection of practices and procedures is commonly referred to as *water sensitive urban design* (WSUD). As Wong and Eadie (2000: 1) describe it, WSUD is:

> the integration of urban planning and utilization of best practices which are sensitive to the maintenance of the aquatic environment…[it] recognizes the opportunities for urban design, landscape architecture and stormwater management infrastructure to be intrinsically linked.

A considerable amount of research has been conducted on the technical and design aspects of WSUD, which are now fairly well established (Coombes *et al*.1999, Mouritz 2000, Speers and Mitchell 2000). These include porous pavement; grassed swales; narrow, curvilinear street design; oil traps; and soil, water, erosion & sediment control plans. The main objective of these mechanisms is filtration of pollutants, and flood prevention.

These tools and techniques are being realised in some new developments, often as partnerships between local water authorities and developers in Brisbane, Gold Coast, Melbourne and Sydney (Rahman and Weber 2003: 73, Melbourne Water 2000, Coombes *et al.* 1999).

Implementation that incorporates WSUD principles in daily planning frameworks has not yet been developed. The key barrier in implementing WSUD and sustainable urban water management is the lack of integration among institutions and decision-makers such as Council and State level planners and water authorities (Anderson and Iyduri 2003: 19, Hamnett 2000: 187). As Lloyd *et al*. note,

> knowledge and understanding of WSUD is developing in government, industry and research organizations with technology transfer and capacity buildings activities occurring…increasingly it is our lack of a consistent planning and policy framework with clear requirements for environmental performance that limits progress (2002: 26).

Demand Management
Demand Management focuses on efficient water consumption in residential and commercial sectors. Typically implemented by a water utility or authority, it enforces mechanisms such as:

Cost-reflective pricing;
- Universal customer metering;
- Operational measures such as leakage reduction;
- Community education;

- Incentives for installation of water efficient appliances;
- Use of reclaimed water; and
- Usage restrictions, both temporary and permanent (WSAA 1998).

These measures focus on making consumption as efficient as possible through education, regulation and incentives. For example, Sydney Water and Melbourne Water have both recently implemented permanent water restrictions, and Sydney has raised its water price (Sydney Water 2005). Metering and pricing are also controversial measures as water is viewed as a public good that should be equally accessible to all. However, public reaction can be positive, too, as in the case of the popularity of rebate schemes for water efficient appliances such as washing machines, shower roses and pool covers.

Technology
Technological responses include (among others) desalination plants, grey water recycling systems, and rainwater tanks. These options are increasingly popular as the urgency for solutions places greater pressure on communities. For instance, Sydney is forecasted to run out of water supply in its Warragamba dam in the next twenty years. In response, council now requires rainwater tanks to be installed in all new developments, as administered through the Building Sustainability Index (BASIX) system in New South Wales. Also, Western Australia has installed desalination plants since the 1970s and will continue to do so in order to deal with its inadequate supply. While grey water recycling is not yet widespread, it is increasingly being implemented in socially acceptable areas such as golf courses and public parks (Gill 2004).

Decentralisation
Decentralisation of water supply and treatment is most common on new developments, as it is very difficult to alter existing dwellings. Decentralised systems focus on the supply of water and sewage treatment without connecting to the main "public" network. In order to implement decentralised systems, landowners make use of the most innovative technology such as on site treatment facilities which are expensive. As a result, these developments tend to be unaffordable to most homeowners, and marketed by the development industry as "master-planned and exclusive". For example, lots in the "Eco-Village" development in Currumbin Valley on the Gold Coast begin at $175,000
(http://www.theecovillage.com.au/pricing.php).

THE PROBLEM

These strategies of sustainable urban water management are all vital, but implementation is slow. Much of the literature in this area discusses the most significant barrier as institutional inertia, or the inability of institutions to take the actions necessary to put sustainable urban water management principles into practice (Mouritz 2000, Wong 2004, Brown 2004). Such inertia is reinforced by an aversion to risk in the development industry and the sheer enormity of challenging the existing system.

The drivers of "institutional inertia" may not simply be a lack of resources or integration of government departments, as is often suggested. Rather, it could be a symptom of broader political, social and economic shifts occurring in urban infrastructure in Australia, and in industrialised countries worldwide. Accounting for these factors would enhance the understanding of the larger context in which this institutional inertia resides, and aid the implementation of sustainable urban water management. An encompassing framework

grounded in both empirical and theoretical bases, applied in an Australian context would reveal an increased understanding of the full range of factors influencing sustainable urban water management.

These trends in urban infrastructure around the globe were analysed in the book *Splintering Urbanism* (2001) by Stephen Graham and Simon Marvin in the United Kingdom. This paper, introduces the concepts from Splintering Urbanism relating to water networks and place them in an Australian context.

TRENDS TO CONSIDER

Concepts in Splintering Urbanism

"Splintering" refers to a complex array of processes and outcomes relating to urban infrastructure networks, summed up in Table 2. It begins with a public network city where its transport, telecommunications and water networks are singularly owned and operated by publicly funded monopoly organisations, such as Brisbane Water, the Queensland Department of Transport or Telstra. Then parts of the physical and management components of those networks are sold off or contracted out to the private sector. This occurs as a result of the forces of political ideology (such as Neoliberalism), economic ideology (globalisation) and advances in technology (ability).

As these networks are broken up, they become "splintered" in several ways. First, their physical form may become reconfigured to meet the needs of private companies who now own them. For example, water networks that supply piped water to wealthy residents in South Africa literally act as walking routes for the poor without transportation and who cannot afford to connect to the system and instead pay very high prices for bottled water (Graham and Marvin 2001).

Second, network management is splintered, as they are often taken over by a conglomerate of companies based in cities on several continents. Graham and Marvin argue that this results in a splintering or "fragmentation" of access by the public to such services because the "redistributive, social role of utilities" is reduced, as well as the "erosion of the role of town planning" (Graham 2000). This amounts to an array of "premium networked spaces" that are customised for those who can afford them, while bypassing those who cannot. A particularly visible form of premium networked spaces in Australia is in the flourishing of private roads where a toll is required to access it, and where those who can afford to subscribe to a prepaid electronic or "e-toll" can bypass the already privileged toll users. While governments must provide some universal access, users of the public non toll road are exposed to extreme congestion and stress. An example in Brisbane is the Gateway toll bridge to bypass cars around the city to the airport. The only alternative is to drive through the inner city.

Splintering of the Australian Water Sector

In the Australian Water sector, a major driver toward splintering began in 1994, when the Council of Australian Governments (COAG) set out a strategic framework for reform of the water industry. In April 1995, the *COAG National Competition Policy and Related Reforms Agreement* incorporated the Water Reform Framework and set payments from the Commonwealth contingent on a performance basis for implementation (Planning Institute of

Table 2: Modern and Splintered Urbanisms

Era	Political Ideology	Social Attitudes	Planning Style	Infrastructure Type	Governance
Modern: **1900s to 1960s**	❑ Nation building and economic prosperity through state investment and mega projects ❑ Keynesian welfare state, Fordist production ❑ Water is a public good	❑ Reformers "deodorizing" industrial city ❑ Concerned with public health ❑ Water infrastructure seen as cleansing agent of city ❑ Changing views of personal hygiene-Water consumption skyrockets ❑ Infrastructure provision necessary for growing middle class	❑ Technocratic ❑ Comprehensive, grand visionary plans ❑ Rational, systematic coherent urban areas ❑ Criticised for lack of consideration of social diversity and environmental issues	❑ Large, technical engineered systems ❑ Linear, "once through and dispose" method ❑ Resource Intensive mega projects	❑ Natural monopolies ❑ Vast bureaucracies in local councils and utilities ❑ Segregated water cycle
Splintered: **1960s to present**	❑ Neoliberal reform ❑ Competition maximises benefits for all ❑ Globalised political economy ❑ Liberalised flows of capital, technology and information ❑ Economic Rationalism	❑ Privatisation and segregation of public areas and infrastructure becomes socially acceptable ❑ Disney's "Celebration" has "premium" private infrastructure network separate from public system including water	❑ Modern style collapsed ❑ Consumer oriented ❑ Division of "development assessment" and "strategic" planners	❑ Segmented infrastructure provision, eg. SEQ Water ❑ Technologies opened up to competition ❑ "Premium networked spaces"	❑ Privatisation and deregulation ❑ Decentralisation ❑ Withdrawal of infrastructure networks from public sector ❑ Public Services become private commodities

Australia 2004). This meant that in order for local governments to receive transfer payments to fund its water infrastructure, they had to meet detailed changes to their organisations as outlined by the National Competition Council (Sheil 2000). The National Competition Council conducts regular assessments of compliance with the Agreement to determine whether each state is achieving satisfactory progress in meeting its reform targets. A key target is "reforming the structure of public monopolies to facilitate competition" (Infrastructure Coordination Unit 2002:11).

The agreement and related policy reforms also transformed water authorities from single, government owned Water Boards to State Owned Corporations which require adherence to commercial disciplines. It required them to become commercial entities in their own rights, as they should "have a commercial focus, whether achieved by contracting-out, corporatised entities or privatised bodies" (Sheil 2000: 38). It also resulted in a separation of policy, regulatory and service delivery functions with the aim of increased efficiency and productivity. Many of the local water authorities around the country were restructured to become corporations, including the Sydney Water Board and Melbourne Water.

Since then, corporatisation and privatisation have become prominent goals in the urban water sector. In fact, full public sector provision of infrastructure is now a "rare occurrence" (ICU 2002: 14). For example, in 1995 South Australia contracted out its entire management, operation and maintenance of Adelaide's water and sewerage system including capital works to a consortium of overseas and Australian companies. It also sold its manufacturing division and built 10 private water treatment plants. Victoria sold the scientific and technical services arm of its former rural Water Corporation. Western Australia contracted out the operation and maintenance of Perth's water and wastewater reticulation system. As the Water Services Association of Australia noted this year:

> …state owned monopolies are being broken up…with increased contracting out not only of the construction of new capital works, but also ongoing service provision… the industry is undergoing considerable change in terms of both ownership structures (corporatisation is proceeding apace and privatisation is looming) and the introduction of new technologies (2005:5).

The degree of involvement of the private sector varies greatly between regions. Most commonly, it is part of a public private partnership. A PPP is a type of Special Purpose Vehicle, or Privately Financed Project. Examples of private sector involvement that are frequently applied to water infrastructure include a wide array of arrangements including but not limited to:

- Build-Own-Operate (BOO)
- Build-Own-Operate Transfer (BOOT))
- Long term service provision contracts
- Joint Ventures
- Barter Arrangements (SISP:14)

While infrastructure may no longer be completely provided by government, it is still the responsibility of government, which is ultimately held responsible for public health and welfare. As Neutze argues, "the right to provide infrastructure, and the responsibility to ensure that it is provided, are fundamental aspects of the functions of government

(1997:197). Infrastructure is seen in Australia as an essential service, defined by Troy as those which are "needed by anyone living in an urban area and needed by the community to prevent the actions of individuals creating a nuisance to others" (1999:9).

This does not mean it is mandatory that the public sector provides them, but rather shapes how services are provided and funded. The result is not necessarily less regulation, but a fundamentally altered starting point and "greater delegation of community resources to private operators" (ALGA 2004). The objectives of regulation also changed, replacing the aim to provide a high quality standardised universal national service with the imperative to maximise competitiveness. The Australian Local Government Association warned in the *State of the Regions Report 2004-05*:

> much infrastructure provision has been privatised and fragmented into multiple private companies rather than a single monopoly provider…and…the orientation of providers has altered from a supply driven to demand driven model, where competition and the search for profit leads firms to cherry pick customers, seeking out premium high-return markets while dumping marginal constituencies. The same processes have disrupted the national grids developed in the 1960s and 70s and replaced them with a patchwork of services that feature varying capacities in different places…This has resulted in a greater emphasis on short term considerations" (ALGA 86, 95).

The key concern with this shift is that community interests are valued and protected. Potential consequences of these changes include unequal access to resources, risks to public health and environmental degradation. As Sheil argued in his book *Water's Fall*, the commercialisation (partial privatisation) of Sydney Water and South Australia Water were responsible for the breakdown of Adelaide's sewage treatment system in 1997 and Sydney's drinking water supply in 1998 as the drive to cut costs outshone public health responsibilities.

CONCLUSION

Water in cities is having an increasingly volatile and uncertain relationship. In this time of drought, infrastructure failure and climate change, society is becoming increasingly aware of the dangers of mismanagement of this vital resource. To achieve ecological and social justice in urban water issues, a well informed understanding of barriers to implementing sustainable urban water management must be sought. Frequently, the main barrier cited is "institutional inertia", or the inability of the government, industry, and research sectors to shift gears.

This paper has argued that the drivers of "institutional inertia" may not simply be a lack of resources or integration of government departments, as is often suggested. Rather, it could be a symptom of broader political, social and economic shifts occurring in urban infrastructure in Australia, and in industrialised countries worldwide. Accounting for these factors would enhance the understanding of the larger context in which this institutional inertia resides, and aid the implementation of sustainable urban water management.

These trends in urban infrastructure around the globe, as analysed in *Splintering Urbanism* by Graham and Marvin offer some insight into the analysis of water networks in Australian Cities.

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