Water Societies and Technologies from the Past and Present

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Published by University College London

Altaweel, Mark and Yijie Zhuang.
Water Societies and Technologies from the Past and Present.
University College London, 2018.
Project MUSE. muse.jhu.edu/book/81912.

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Framing urban water sustainability: Analysing infrastructure controversies in London

Sarah Bell

Abstract

Water infrastructure embodies social and cultural values, delivers a vital natural resource for everyday consumption and provides a physical buffer between city-dwellers and changeable natural environments. At global, national and local scales, water policy and debate are framed according to assumptions about nature, water, technology and culture. Analysis of urban water sustainability literature reveals five distinct but overlapping framings: sustainable development, ecological modernisation, socio-technical systems, urban political ecology and radical ecology. Applying these frameworks to an analysis of controversies in London’s water infrastructure related to desalination and the construction of an intercepting sewer tunnel shows the underlying values and knowledge in environmental debates. Decisions about water infrastructure are consistent with ecological modernisation theories and policies, but other framings are evident within debates and draw attention to alternative technology options and wider consequences for the environment and society.

Introduction

Water is an essential element of cities, shaping culture, urban form, public health and environmental quality. Water infrastructures of drainage, supply and waste disposal are among the most ancient urban technical systems. Infrastructures are designed, built and managed according to
physical laws and technical expertise, and they are subject to political, social and cultural choices. Culture, technology, nature and politics are all entwined in analysis, discussion and debate about urban water systems.

Urban water infrastructure can be conceived of as an assemblage of technologies, institutions, hydrological resources and ecosystems. Critical philosopher of technology Andrew Feenberg (1993) links the social purpose and the technical form of technologies:

[S]ocial purposes are embodied in the technology and are not therefore mere extrinsic ends to which a neutral tool might be put. The embodiment of specific purposes is achieved through the ‘fit’ of the technology and its social environment.

The technical form of urban water infrastructure is shaped in relationship to its social and natural environment. Questions about water infrastructure therefore cross technical and political boundaries. Who deserves access to water and sanitation, and at what price? What is an appropriate use of water? What is the role of the state, the private sector and citizens in water services? Who pays for water infrastructure? How much water should be allocated to maintaining natural ecosystems? What quality of water should be returned to the environment?

Water infrastructure embodies social and cultural values, just as it delivers a vital natural resource and provides a physical buffer between city-dwellers and changeable natural environments (Gandy, 2004). In this, water reflects wider environmental discourse and politics (Dryzek, 2013; Myerson and Rydin, 1996). Since the 1970s water has been a key element of international deliberations about sustainable development and sustainable cities. At the national and local scales, water policy and debate are framed according to assumptions about nature, water, technology and culture. Analysis of urban water sustainability literature reveals five distinct but overlapping framings: sustainable development, ecological modernisation, socio-technical systems, urban political ecology and radical ecology. Here, a summary of the key elements of each of these frameworks provides a general overview, which is then applied to two recent technical controversies in London’s water infrastructure: combined sewer overflows and desalination. The use of the five frameworks to describe specific cases shows how contrasting analysis of the same problem leads to different priorities in solutions. It shows gaps and contradictions, as well as complementarity, between different framings. Framing urban water sustainability through different discourses and theories can
expose fundamental political differences, but it may also be the basis of more transparent and informed deliberation about future water systems.

**Frameworks for sustainability**

Sustainability is a contested concept. How to protect and restore the environment while maintaining human well-being and development is a long-standing question for political deliberation, science and engineering (Dobson, 2000). The role of technology in achieving sustainability is also widely debated, some promoting technology as the answer to environmental problems and others pointing to industrial technologies as the root cause of the global ecological crisis (Davison, 2001).

A range of political and analytical approaches to addressing environmental problems have emerged since the 1960s (Dryzek, 2013). Five distinct frameworks can be seen to operate in professional, academic and policy discussions about urban water systems. Sustainable development originates from international negotiations aimed at ensuring continued economic and social development within ecological and resources limits (United Nations World Commission on Environment and Development, 1987). Ecological modernist approaches seek to use technology and the market to reduce environmental impacts without undermining economic growth or disrupting modern lifestyles (Mol and Sonnenfeld, 2000). Socio-technical-systems approaches highlight relationships between technology, society and the environment to reveal barriers and opportunities for sustainable transitions (Brown and Farrelly, 2009). Political ecology analyses socio-environmental problems to show the relationships between political power, capital accumulation and environmental degradation, highlighting uneven distribution of environmental costs and benefits under the dominant capitalist model of development (Swyngedouw et al., 2002). Radical ecology calls for a restructuring of human society based on ecological principles and deep respect for nature (Zimmerman, 1987).

These five frameworks reflect the dynamic nature of environmental discourse, including debate about urban water infrastructure. There are overlaps, complementarity and contradictions between different framings of how to solve environmental problems. The frameworks provide analytical lenses through which to see different alignments of the technology of urban water infrastructure within its social and natural environments. This helps to reveal the political and ethical choices to be made in selecting technologies and designing policies to achieve urban water sustainability.
Sustainable development

Sustainable development was famously defined in the UNCED *Our Common Future* report of the Brundtland Commission as ‘development that meets the needs of the present without compromising the ability of future generations to meet their own needs’ (United Nations World Commission on Environment and Development, 1987: 8). This definition reflects efforts to address environmental problems such as loss of biodiversity, pollution and desertification without undermining the processes of global development that are the basis for alleviating poverty and delivering basic needs such as food, health care and education. It represents a pragmatic trade-off between environmentalist calls to constrain population and economic growth and the dominant model of industrialisation as the basis for development. Sustainable development was conceived of as a universal objective and promoted through Agenda 21 and other international agreements reached at the UNCED Conference on Environment and Development in Rio di Janeiro in 1992 (United Nations, 1992). While achieving development without undermining the quality of the environment and resources in the future remains globally relevant, more recent discussions have focused on the Global South, governments of the Global North generally reducing emphasis on sustainable development as a policy framework.

Water has been an important element of global discussions about sustainable development since the 1977 UN Conference on Water in Mar del Plata, Argentina (Falkenmark, 1977). Universal access to clean water and safe sanitation has long been an objective of development, and was affirmed as a human right by the United Nations General Assembly (2010). Management of water resources for agriculture and industry as well as for municipal supply led to the development of the concept of integrated water resources management, which has underpinned global policy approaches to water since Agenda 21. Universal access to water and sanitation, within the framework of integrated water resource management, is one of the Sustainable Development Goals agreed by the United Nations (2015). Sustainable Development Goal 17 is to ‘[e]nsure availability and sustainable management of water and sanitation for all’.

The preceding Millennium Development Goals – to reduce by half the proportion of people without access between 2000 and 2015 – were achieved for water but not for sanitation (United Nations World Water Assessment Programme, 2015). In 2015, 800 million people lacked access to water and 2.5 billion lacked access to sanitation. Provision is better in cities than in rural areas, but 18 per cent of people living in cities, that is, 700 million urban residents, don’t have access to improved sanitation.
Sustainable development as a framework for urban water sustainability emphasises the importance of universal access, particularly for the urban poor. It directs international efforts towards developing infrastructure and technologies to achieve universal provision, including financing and appropriate governance structures. Water and sanitation are the foundation for good public health, upon which other goals such as education and economic development can take place. Sustainable development recognises the need for integrated management of water, within the limits of local hydrological and ecological systems, and confirms the importance of economic growth to achieving development and environmental objectives.

Ecological modernisation

Ecological modernisation theory developed in Germany, the Netherlands and the United Kingdom in the 1980s and 1990s as a counterpoint to the environmental politics that pitted environmental protection against modernisation and industrialisation (Huber, 2005; Mol and Sonnenfeld, 2000; Hajer, 1995). Rather than conceiving of modernisation as the root cause of environmental problems, we frame it as the basis of solutions. Environmental harm is the outcome of incomplete modernisation, and so modern institutions such as the market, government, and science and technology need to be reformed, rather than abandoned, in order to better account for the environment (Mol, 1996). Technology has a particularly important role in ecological modernisation, and the role of government is largely to create the conditions in which markets and industries can innovate to improve resource efficiency and solve environmental problems, rather than to impose strict regulation to reduce environmental impacts (Huber, 2005). Environmental modernisation is evident in policies such as emissions trading, subsidies for environmental technologies, industrial ecology and behaviour change, and green consumer campaigns.

A similar approach is evident in the United States in the movement for resource and energy efficiency. The book *Natural Capitalism* outlines four key principles for improving resource efficiency and restoring the natural environment (Hawken et al., 2000):

- radical resource productivity to dramatically improve the efficiency of technologies and manufacturing,
- biomimicry to design technologies inspired by natural systems,
- a service and flow economy decoupling economic growth from resource extraction, and
- investment in natural capital to restore ecosystems.
In 2015 the US-based Breakthrough Institute published the *Ecomodernist Manifesto*, which emphasises the role of technological innovation in decoupling human development from environmental impacts and resource use (Asafu-Adjaye et al., 2015). Technologies such as desalination, nuclear power and agricultural intensification are promoted as means of delivering continued benefits to humanity, including poverty reduction and improved standards of living, while reducing human impact on the environment and leaving more space for non-human nature.

In contrast to the 2015 manifesto, European developments in ecological modernisation theory have responded to criticisms of technological optimism by giving greater attention to the need for institutional reform and to the demand for resources as well as efficiency in supply (Mol and Sonnenfeld, 2000). Sustainable consumption complements earlier efforts to devise sustainable production systems, addressing the role of individual behaviour, choices and lifestyles. Sustainable consumption may include technological innovation, but also new business models, and incentives for consumers to reduce the environmental impacts and resource use.

Ecological modernisation frames urban water sustainability as a problem of efficiency and a technical challenge for developing new sources of water. Demand management programmes, particularly those that emphasise economic incentives for reducing consumption and improving water use efficiency, are consistent with ecological modernisation theories. Desalination has also been framed as the ultimate, modern, technical solution to water scarcity, particularly when powered by renewable energy. Within an ecological modernisation framing, water sustainability can be achieved without major reorganisation of infrastructure and culture, but requires improvements in efficiency and technical innovation to develop new water supply.

**Socio-technical systems**

Theories of socio-technical systems come from systems science and engineering and the social studies of science and technology. Methods such as soft systems methodology and system dynamics provide frameworks for incorporating human and social systems, along with natural and technical systems, into models to allow for deliberation about current and future scenarios (Checkland, 1999). These approaches have their origins in systems engineering, systems theory and cybernetics, starting from biophysical and technical systems and broadening the approach to
incorporate social and human elements. Socio-technical theories also incorporate the work of sociologists, philosophers and anthropologists who study the role and function of science, technology and innovation in society, and as social phenomena in themselves. They include actor–network theory, large technical systems theory, the social construction of technology, social practice theories and transitions theory.

Actor–network theory analyses social, technical and natural entities in the same terms (Latour, 1993). Rather than dividing the world into social and technical, or natural and cultural, elements to be understood using different theories and methods, actor–network theory analyses the material relationships between human and non-human networks. Such analysis reveals the role that non-human actors play in shaping society, and the social values and interests that are embodied in technologies and in human interaction with natural systems.

Large technical systems theories explain the co-evolution of infrastructures, associated technical norms, standards and institutions, and political and social change. Thomas Hughes’s study of power networks traces the evolution of electricity supply from local production and distribution to complex, interconnected systems operating on the national and continental scales (Hughes, 1993). While technology is central to large technical systems theories, it is only one element of a much broader analysis of networks and systems that underpin modern, industrial society.

The social construction of technology draws attention to the social groups involved in the development of technologies and the process of stabilising particular social and political values and contexts (Bijker, 2009). The history of key technical developments, such as the bicycle and electricity, shows that technologies took many different forms in their early days (Bijker, 1997). The stabilisation of a particular technical form is not just the outcome of technical efficiency and optimisation but reflects the relative power and influence of different social groups. What appears to be a neutral, technical object is the outcome of social processes of design and development choices.

Social practice theories emphasise the interactions between technologies, infrastructures, cultures and everyday life (Shove, 2003). Consumption of resources such as water is enabled and constrained by particular forms of infrastructural provision. Technologies, such as automatic washing machines, fit into wider infrastructural systems of water supply and sewerage. The availability of water in turn makes laundry a convenient, daily practice which drives up social and cultural expectations regarding the cleanliness and freshness of clothing. Cultural norms about body odour and definitions of hygiene are therefore shaped by
technologies and infrastructure. Water consumption is associated with everyday practices that co-evolve with cultures and technologies, rather than as a direct or conscious individual decision about resources or the environment.

Socio-technical transitions theories analyse the emergence, diffusion and stabilisation of innovation within institutional and social contexts. The multi-level theory consists of niches in which new technologies and practices first emerge in a specific local context, regimes of professional and policy institutions that set standards and technical norms, and in the broader landscape of the economy, culture and politics in which socio-technical systems are situated (Geels, 2011). Transition to sustainable socio-technical systems requires reform across all three levels, and the success or failure of particular innovations can be explained by their alignment or incompatibility with dominant regimes and landscapes.

A socio-technical systems framing of urban water sustainability draws attention to the relationships between technical, social, cultural and political factors. As technical systems co-evolve with social and cultural norms and institutions, the achievement of sustainability requires simultaneous analysis and action that can account for different social groups, technical options and institutional forms.

Political ecology

Urban political ecology recognises that society and environment are co-constructed, in processes of socio-environmental change (Swyngedouw et al., 2002). Cities are not separate from ‘nature’, just as rural landscapes and ‘wilderness’ areas are shaped by social processes and cultural meanings (Swyngedouw, 2009). Political ecology draws attention to the uneven distribution of the costs and benefits of socio-environmental change, linking social and economic inequality to environmental problems and infrastructure decisions. In particular, it analyses the role of capital and neoliberal policies in driving urban ecological processes, with unequal consequences. Processes of environmental harm are linked to social and economic exploitation and disenfranchisement (Loftus, 2009).

In highlighting the political nature of socio-environmental problems and their solutions, urban political ecology rejects depoliticised representations of sustainable development (Swyngedouw, 2010). Sustainability and justice cannot be achieved without addressing the power of dominant actors and discourses, which requires a fundamentally political analysis to inform activism and policy alternatives.
The role of the private sector in water infrastructure is a particular concern of urban political ecologists (Bakker, 2010). Linking the provision of basic services to private profit taking undermines the goal of universal provision of water as a human right, and leads to forms of infrastructure and service contracts that maximise return on investment rather than benefits to society and the environment. 'The financialisation of the water sector' refers to the growing role of water infrastructure as a vehicle for international investment (Loftus and March, 2016). Infrastructure decisions tend towards capital-intensive options which increase the value of assets and the opportunities for returns from complex capital financing arrangements. Government regulation and policy can provide constraints and incentives for infrastructure finance, but financial drivers may override the goals of environmental protection and social benefit in decision making.

Political ecology is critical of neoliberal policy on water infrastructure, including privatisation and commodification. Demand management based on water metering, and pricing without adequate regulation, can have a disproportionate impact on low-income households, while high-income households are associated with high per capita consumption (Gandy, 2003). It also shifts responsibility for resource management away from infrastructure managers and onto individual consumers, undermining collective responsibility for the universal provision of basic water services and environmental protection.

While political ecology is critical of the privatisation of water infrastructure, its analysis of power in relation to water as a socio-environmental problem in cities reveals the limitations of public and communal approaches to provision (Bakker, 2010). Municipal and communal ownership of infrastructure tends to reflect the interests of powerful actors, to the detriment of the environment and vulnerable citizens, and is prone to problems arising from mismanagement and poor technical and economic capacity. Analysing water infrastructure provision as a socio-environmental process highlights the political nature of decisions and discourse, on the local, regional and global scales.

Radical ecology

Since the 1960s environmental activists and scholars have considered the environmental crisis in modern, industrial society to be the outcome of a fundamentally exploitative and destructive relationship with nature. In contrast to reformist approaches, radical ecology looks for the root cause of environmental problems in the basic structures of Western society and
culture. Deep ecologists call for an ecocentric world view, which places the needs of non-human nature at the centre of human culture (Naess, 1986). Social ecologists point out the connection between the exploitation of nature and the exploitation of people under capitalism (Bookchin, 2005). Ecological feminists specifically link the oppression of women and of nature in Western culture.

Deep ecology is most closely associated with movements to protect ‘wilderness’ areas from development, including anti-logging and anti-dams campaigns (Sessions, 1998). Deep ecology was first defined by Norwegian philosopher Arne Naess in 1972, who contrasted it with ‘shallow ecology’, which characterised reformist approaches that focused on pollution reduction, resource depletion and other environmental issues from an anthropocentric, or human-centred, viewpoint (Naess, 1984). Deep ecology is the deep questioning of human relationships to the natural world, and leads to proposals for bioregional communities as the basis for human development, with deep connections to local landscapes, ecological processes and non-human nature. Deep ecology has been criticised within and outside the environmental movement for focusing exclusively on human relationships with nature, without addressing inequality and patterns of domination within society.

Social ecologists and ecological feminists more explicitly address connections between domination of nature and structures of power within human society and culture. Social ecologist Murray Bookchin (2005) proposes that the ecological crisis is the outcome of the hierarchical structure of modern capitalism, which requires reorganisation of society into more decentralised, self-organising communities. Ecological feminists, including Karen Warren, Val Plumwood and Carolyn Merchant, have analysed the specific association of women and nature in the exploitative structures of Western culture. Women are classically associated with nature, while men represent culture. Women and nature are therefore both subject to domination by masculine culture, so that ecological politics must also be feminist (Warren, 1990). In moving away from hierarchical power structures based on domination and submission, ecological feminist responses to the ecological crisis emphasise negotiation of relationships with the ‘other’, accommodating difference (Plumwood, 2003).

Radical ecologists therefore emphasise the value of water for nature in cities and their catchments. Water as a natural material, a force in shaping landscapes and fundamental to all ecological processes, is an important element for understanding human relationships with the natural world. Modern construction of dams, treatment works, pipe
networks and flood defences represents efforts to control and dominate water. More sustainable approaches ‘make space for water’ and recognise its value to human well-being as part of natural systems that can be integrated into urban landscapes.

Water controversies in London

With a growing population, limited resources and ageing infrastructure, London, like many major cities, faces considerable challenges in achieving water sustainability. London receives an annual average rainfall of 640 mm. The current population of 8.9 million people is forecast to grow to 11 million by 2050 (Greater London Authority, 2017). Without the development of new water sources or significant reduction in per capita water use, demand is forecast to outstrip supply of water by 2020 (Thames Water, 2015). More than 20 per cent of the water supplied to London is lost through leakage in the distribution network, which includes pipes that are more than 150 years old in some areas (Carrington, 2017). London’s basic sewer system was also constructed in the nineteenth century, and sewer overflows into the River Thames are a major source of pollution.

London’s water infrastructure is owned by a private company, Thames Water, and is regulated by the Office for Water (Ofwat), the Environment Agency (EA) and the Drinking Water Inspectorate. The privatised water sector in the UK brings benefits and constraints in achieving sustainability. Privatised water companies are able to raise capital for investment in major new projects, including environmental improvements. However, investment must be shown to deliver value for money to water customers. Integration of the water infrastructure with wider goals for urban sustainability is more challenging than for cities where the water utility is municipally owned and operated (Dolowitz et al., 2018).

In recent years, two water infrastructure projects have generated controversy in London: the desalination plant at Beckton, which was opened in 2011, and the Tideway Tunnel, which at the time of writing is under construction as a solution to the problem of combined sewer overflows. Analysis of these projects using the five frameworks for urban water sustainability shows that debates about infrastructure reflect different values and conceptions of the nature of environmental problems and solutions.
Desalination

The Thames Gateway Water Treatment Works, also known as the Beckton desalination plant, was completed in 2011. With the exception of periods of operation for testing and maintenance, the plant has never supplied water to London. It was originally planned in response to low reservoir levels following dry winters in 2004–2006, but more recently has been justified as a ‘resilience measure’ to provide a backup water source in times of extreme drought (Loftus and March, 2016).

Controversy over the plant centred on the refusal of the Greater London Authority under Mayor Ken Livingstone in 2006 to grant planning permission for its construction. The permission was refused on environmental grounds, and a judgement that Thames Water had not adequately considered other options for preventing London’s future water shortages, including water recycling and leak reduction. When Boris Johnson was elected Mayor in 2008, one of his first actions was to approve the desalination plant, and construction began soon after.

Desalination is an energy-intensive and expensive source of clean water, with the potential to cause local environmental harm by entraining marine life in the intake and discharging highly saline water into receiving environments. The Beckton plant won a Sustainability Award from the Global Water Awards in 2009 for its environmental protection measures and use of renewable energy (Global Water Intel, 2009). The plant is located in the Thames Estuary, and is designed to treat brackish rather than saline water, which reduces the energy required for treatment compared to seawater desalination, which is more common in other parts of the world. The operating conditions set by the Environment Agency for the Beckton desalination plant require that a drought is declared and specific low-flow conditions are met in the River Thames (3,000 million litres per day (ML/d) or less for 10 consecutive days at Teddington Weir; Thames Water, 2015). These conditions have not been met since the plant opened in 2011, and so the plant has yet to operate as designed.

Sustainability was a core concept in the controversy about the Beckton desalination plant. Mayor Ken Livingstone argued that the plant was unsustainable, particularly compared to less energy-intensive alternatives such as water reuse. The global water industry recognised the plant’s sustainability credentials with an award. This shows the contested nature of sustainability, and its discursive flexibility in debates about water technologies and infrastructures.

From the point of view of sustainable development, the cost, energy-intensity and local environmental impacts of the Beckton desalination
plant must be considered in balancing the social need for a secure water supply. Assessment of the plant against these basic elements of sustainable development, particularly in comparison with alternative strategies for drought response and water resource management, shows it to be a costly and resource-intensive solution to the risk of future water scarcity. Concerns about the environmental and energy impacts of the plant can be seen in Mayor Livingstone’s objections, and in the operating conditions imposed by the Environmental Agency to ensure that it is only used as a source of water in times of extreme drought, not as an element of normal water supply to London.

Desalination is often presented as the ultimate technical solution to water scarcity, producing freshwater from the vast oceans, which account for 97 per cent of the water on Earth (Shiklomanov, 2000). The Ecomodernist Manifesto promotes desalination as one of a suite of technologies that will decouple human development from environmental impacts (Asafu-Adjaye et al., 2015). Using renewable energy to power desalination, as is the case in the Beckton plant, is seen as further evidence of the capacity of technology to solve environmental problems and avert resource shortages (Ghaffour et al., 2015). Although more costly than conventional water resources, desalination follows the basic law of substitution for scarce resources, refining ever more contaminated reserves as higher-quality sources of the resource are exhausted. Desalination as a resilience measure aims to minimise the disruption of society caused by natural events. Social functions, including water consumption, are maintained as technology is utilised to solve the problem of environmental uncertainty and greater demand for water from growing populations.

The socio-technical systems concept of ‘lock-in’ refers to the stability of existing technologies, practices and institutions, creating conditions in which particular forms of innovation are favoured over those that require greater disruption. Anique Hommels uses the concept of the ‘obduracy’ of urban infrastructure and form to describe the endurance of dominant systems and approaches (Hommels, 2005). As a supply-side solution to water scarcity, owned and operated by the incumbent utility, the desalination plant represents a relatively minor change to London’s water infrastructure. It fits within existing economic and environmental regulatory processes for the water industry, and avoids the need for dramatic changes to water consumption or more socially challenging alternatives such as potable reuse or distributed supplies such as greywater recycling and rainwater harvesting. Although more energy-intensive and expensive than some alternatives, desalination is favoured because it is most compatible with the existing socio-technical form of water infrastructure in the city.
Alex Loftus and Hug March have analysed the Beckton desalination plant as an outcome of the financialisation of the water sector in the UK (Loftus and March, 2016). They show that the plant’s credentials as an ecological modernisation and industrial ecology solution to drought in London are only possible because of a vast network of international capital investment. The availability of investors as diverse as an Australian bank, a Canadian teachers’ pension fund and Chinese and Middle Eastern sovereign wealth funds to provide capital for infrastructure projects provides important context for the decision making about water in London. The desalination plant is not merely a response to localised resource shortages, but a global investment opportunity and market for international engineering consultants and technology providers. The project was constructed by a consortium of the UK-based Interserve and Atkins Water, and the Spanish water company Acciona Agua, using membrane technologies from the Dutch firm Norit and the US-based Hydronautics. A political ecology analysis of the Beckton desalination plant highlights the role of international investors and firms, and the logic of capital growth through infrastructure expansion as key drivers for desalination as the preferred option for addressing the risk of water scarcity during drought.

The technical promise of desalination to provide a limitless source of water for human use runs counter to radical ecological goals of living within local ecological and hydrological systems. While radical ecologists promote alternative patterns of human settlement and society based on living in partnership with nature, desalination expands the boundaries of the control of nature using advanced technology. Through desalination, all water on Earth becomes a potential resource for human use, perpetuating a culture of exploitation that radical ecologists claim is the root cause of the environmental crisis. As a supply-side option it reduces incentives for citizens in London to adapt their lifestyles and live within local environmental variability and limits. While ecological modernisation measures such as the use of renewable energy and techniques to minimise the environmental impacts of the abstraction of the raw water and the discharge of the brine by-product, industrial-scale desalination is fundamentally incompatible with radical ecological approaches to sustainability.

The international recognition of the sustainability of the Beckton desalination plant reflects an ecological modernisation framework, which is consistent with engineering and industrialist culture and discourse. Criticisms of the desalination plant are also grounded in alternative framings of sustainability, pointing out the expense and energy
intensity of the technology, the financial benefits to international investors and suppliers, and the distraction from a more fundamental reorganisation of London society and culture to change its water use to live within local hydrological limits.

Combined sewer overflows

Combined sewer overflows (CSOs) are a significant environmental problem for a number of cities, particularly those with sewerage infrastructure built during the nineteenth century (Dolowitz et al., 2018). Combined sewers receive both waste water from buildings and surface water run-off from roofs, streets and hard surfaces. In order to prevent sewers flooding streets and buildings, these systems are designed to overflow into local rivers during heavy rainstorms. In London the sewers were originally designed by the Metropolitan Board of Works in the mid-nineteenth century to overflow into the Thames on average four times per year (Bazalgette, 1865). By the beginning of the twenty-first century overflows were occurring 50 times per year on average. The increased frequency of overflows is the result of the reduced permeability of urban surfaces, which is due to paving and building over open space, and the increased baseload flow of waste water from an increased population. In 2012 the European Court of Justice ruled that the UK was in breach of the European Union Urban Waste Water Treatment Directive, with respect to combined sewer overflows in London.

In 2000 Thames Water commissioned the Thames Tideway Strategic Study to evaluate the options ‘to protect the Thames Tideway from the adverse effects of wastewater discharges’ (Thames Tideway Strategic Study, 2005: 5). The study was overseen by a steering committee chaired by independent engineer Chris Binnie and included members representing the EA, the Department for Environment, Food and Rural Affairs (DEFRA), the Greater London Authority and Thames Water, with an observer from Ofwat. The committee reported in 2004, recommending the construction of a 35 km tunnel from Hammersmith in west London to the Crossness Sewerage Treatment Works in the east, and a separate tunnel to receive CSOs from the River Lee. The study investigated alternative options, including sustainable drainage systems (SuDS), which prevent inflow of surface water to the sewers by increasing infiltration and storage across the city. SuDS features include ponds, swales, rain gardens, green roofs and rainwater harvesting (Woods-Ballard et al., 2007). The report concluded that SuDS were not a suitable solution to CSOs in London because of the highly urbanised nature of the city, the impermeability of
its clay soils, excessive costs and a lack of natural receiving waters for surface water run-off. The route originally recommended for the Tideway Tunnel was subsequently revised to include the Lee Tunnel, reduce the overall length of the Tideway Tunnel to 30 km, and discharge at Beckton, rather than Crossness treatment works.

The proposed Tideway Tunnel was the subject of considerable controversy, particularly during public consultation over the Development Consent Order for the project to be approved by a government minister as a nationally significant infrastructure project. In 2011 the Thames Tunnel Commission was formed by local authorities likely to be impacted by its construction (Thames Tunnel Commission, 2015). The commission investigated SuDS as an alternative to the interceptor tunnel, or as a complement to a smaller tunnel. They questioned the water quality standards set by the Thames Tideway Strategic Study as unnecessarily strict, thereby effectively ruling out SuDS as a potential solution, despite their wider environmental benefits. The commission also pointed out that SuDS were more difficult to implement than an interceptor tunnel in London, despite the environmental benefits, because planning and financing structures were more favourable to large infrastructure projects than to distributed interventions that controlled surface water at source. Other criticisms of the project included a report by Chris Binnie, the original chair of the Thames Tideway Strategic Study, questioning the increasing cost estimates for the tunnel, from £1.7 billion in the original study to £4.1 billion by 2014, and claiming that developments in SuDS techniques and upgrades to the sewer infrastructure since 2004, including the construction of the Lee Tunnel, meant that the tunnel was no longer required (Griffiths, 2014).

The Tideway Tunnel received its Development Consent Order in August 2014. In June 2015 a new company, Bazalgette Tunnel Ltd (operating as ‘Tideway’), was formed to construct, own and operate the tunnel. Major contracts for the construction were agreed in 2016. Construction is underway and is expected to be completed by 2023. SuDS are now promoted through local planning requirements and the Greater London Authority’s Sustainable Drainage Action Plan, primarily for the wider benefits associated with reducing run-off and increasing urban greening, rather than as the solution to CSOs in London (Greater London Authority, 2016).

The framing of different arguments in the debate about the Tideway Tunnel in London reflects wider debates about urban water sustainability. While stakeholder interests, such as profitable operation for the water company and avoiding the disruption caused by construction for
riverside local governments, are important in determining particular positions within the argument, wider debates about the suitability of the tunnel or SuDS to solve the problem of CSOs in London demonstrate the intersection between technology and values in environmental decisions.

As an environmental protection measure to restore the health of the River Thames in the context of growing population and urbanisation in London, the tunnel is consistent with a sustainable development framing of urban water sustainability. The tunnel was largely supported by recreational river users, fishers and environmental organisations. It promises that London can continue to grow, without adversely impacting the local environment. The Thames Tideway Strategic Study addressed environmental, economic and social factors, including public health. The consultation and enquiries undertaken as part of the Development Consent Order process also addressed economic, social and environmental factors, albeit within a planning framework in the UK in which the principles of sustainable development are of less significance than maintaining economic growth.

Sustainable development principles were also invoked by opponents to the tunnel and proponents of SuDS (Thames Tunnel Commission, 2015). Local councils and residents argued that the tunnel would cause unfair disruption to local communities. It was argued that SuDS could deliver a wider range of environmental benefits and local employment opportunities than the tunnel, representing a more sustainable option.

The tunnel is a large technical solution to a persistent environmental problem, and is therefore consistent with ecological modernisation policies and theories. The idea of an interceptor tunnel itself is not innovative, but detailed modelling and design of the tunnel and associated surface facilities show the use of innovative, technical tools in demonstrating the sustainability of the project. The use of private finance and private ownership is also consistent with ecological modernisation, with the state acting as a regulator to ensure economic efficiency and environmental outcomes.

London’s sewerage system was designed and built as a series of interceptor sewers in the nineteenth century by Sir Joseph Bazalgette and colleagues at the Metropolitan Board of Works (Bazalgette, 1865; Halliday, 2001). The Tideway Tunnel is a continuation of the infrastructural logic laid down in the strategy for managing waste water and surface water in London more than 150 years ago. The tunnel can therefore be considered an outcome of infrastructural lock-in, with engineers, owners and regulators driven towards the solution that is least disruptive to existing arrangements within the city. With the creation of a new
private company to construct and own the tunnel within the established regulatory frameworks of the water sector in England, it can be seen to be consistent with long-established processes of infrastructural provision in the city. By contrast, the legislative, planning and ownership structures for SuDS are less stable in England, requiring more complex arrangements and oversight. The socio-technical and institutional landscape of London is therefore more conducive to large centralised infrastructure solutions to water-management problems than decentralised systems such as SuDS.

The formation of Bazalgette Tunnel Ltd shows the value of the project to international investors and the capacity of the private sector to raise capital to deliver infrastructure projects. From a political ecology point of view this is an indication of the financialisation of the water sector (Loftus and March, 2016). Bazalgette Tunnel Ltd is owned by a consortium including German insurance company Allianz, the multinational Amber Infrastructure Group, UK-based fund manager Dalmore Capital, Dutch fund manager DIF, International Public Partnerships and Swiss Life Asset Managers. The £4.1 billion investment with guaranteed income provided by regulated water bills paid by London customers, and investment risks guaranteed by UK Treasury, provides a stable return to international capital fund managers. Water infrastructure is therefore as important as an investment vehicle as it is as a solution to an environmental problem, with significant financial benefits accrued to international investors.

A radical ecology approach to CSOs in London emphasises SuDS as the means to bring nature into the city, manage surface water locally and reduce impacts on the River Thames. From this perspective the tunnel is a continuation of nineteenth-century engineering models based on domination and control of water and nature for human benefit, while SuDS involves working within local hydrological systems to create wider benefits for environmental and human health and well-being. SuDS is part of a strategy of ‘making space for water’ in cities, while the interceptor sewer maintains separation of people from water, far below ground.

Conclusions

Water infrastructure is largely taken for granted in modern cities, yet it is increasingly subject to controversy. Water networks must adapt to changing populations, environmental conditions, cultures and politics.
Debates about the sustainability of current and future water infrastructures reflect wider environmental discourse, politics and culture.

Desalination and combined sewer overflows in London show the dominance of ecological modernisation as the key framework for urban water sustainability. This emphasises technological innovation and the role of the market in delivering solutions to environmental problems with minimal disruption to existing lifestyles and institutions. However, controversy over the Beckton desalination plant and the Tideway Tunnel demonstrates the existence of alternative framings of the role of technology and culture in determining the sustainability of water infrastructure in the city. Political ecology analysis focuses on the financialisation of the water sector as a driver for large capital investment in centralised infrastructure solutions over decentralised technologies. The concept of socio-technical lock-in explains the power of existing infrastructures to determine the viability of proposals for future development, including the stability of institutions and cultures as well as the physical obduracy of the pipes and treatment works themselves. Sustainable development has been deployed in favour of and against the proposed projects, depending on where the balance of trade-offs between ecological, economic and social costs and benefits is drawn. Radical ecology perspectives on water infrastructure in London despair at the continuation of nineteenth-century models of engineering based on domination of water for human benefit, and at the loss of opportunities to enhance natural solutions and live within local hydrological limits.

Infrastructures are more than mere technical systems for delivering materials and services to society. The form of infrastructure reflects the social world it inhabits, and in turn shapes cultural and political possibilities. Decisions about infrastructure reflect complex interactions between technology, culture and nature, which may be understood through theoretical and political frameworks that reflect different knowledge and values. The recent history of water infrastructure in London reveals that these complex relationships are far from settled, and pose ongoing challenges for democratic decisions and hydrological sustainability.

References


