

## Chapter 7.14

# Sustainable Water Provision: Challenges, Alternative Strategies and Sources in the Era of Climate Change

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### ABSTRACT

As a result of rapid urbanisation, population growth, changes in lifestyle, pollution and the impacts of climate change, water provision has become a critical challenge for planners and policy-makers. In the wake of increasingly difficult water provision and drought, the notion that freshwater is a finite and vulnerable resource is increasingly being realised. Many city administrations around the world are struggling to provide water security for their residents to maintain lifestyle and economic growth. This chapter reviews the global challenge of providing freshwater to sustain lifestyles and economic growth, and the contributing challenges of climate change, urbanisation, population growth and problems in rainfall distribution.

The chapter proceeds to evaluate major alternatives to current water sources such as conservation, recycling and reclamation, and desalination. Integrated water resource management is briefly looked at to explore its role in complementing water provision. A comparative study on alternative resources is undertaken to evaluate their strengths, weaknesses, opportunities and constraints, and the results are discussed.

### INTRODUCTION

Is the world running out of water? Climate change induced drought, patterns of urbanisation and unsustainable withdrawal from natural aquifers are only some of the problems faced today when

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trying to source freshwater to sustain population and economic growth, while at the same time maintaining the integrity of the environment (Mitchell et al., 2004). Aquifers are overdrawn to the extent that groundwater is becoming increasingly saline, while in some parts of the world, there are months where deltaic rivers such as the Colorado, the Yangtze, and soon the Nile, do not reach the sea (Boutkan & Stikker, 2004). In Europe, countries on the coast of the Atlantic Ocean are facing increasing droughts, while water intensive tourism and agricultural practices are compounding water problems on the Mediterranean (Dickie, 2006). In the US, groundwater is already being extracted to a point where it is no longer replenished, while other surface water sources are increasingly threatened by contamination (Dickie, 2006). Even in Asia, where rainfall has been historically high, growing population and unevenness of rainfall can mean that there are surprisingly low levels of water available per capita, such as in Japan (Dickie, 2006).

Australia is suffering from the worst drought in decades. In a country where all the capital cities have been well served by surface water supply for the past century, there is currently a large gap between the supply of freshwater and its urban demand (PMSEIC, 2007). In the summer of 2007, all capital cities, with the exception of tropical Darwin, were under some form of water restrictions due to low rainfall in catchment areas, leading to dangerously low levels in reservoirs (Marks, 2005).

### **Sustainability in Water Provision**

The concept of sustainability was first raised by the Brundtland Report in 1987 (WCED, 1987). In recent years, sustainability has been made one of the most vital issues. This follows the increasingly concrete evidence that the impacts of climate change and the effects of the modern urban lifestyle will threaten both manmade and natural water supply systems, with long term

consequences which may be irreversible (Jabareen, 2006). Although vague, with its definition varying depending on its source, sustainability is a useful concept, forcing everyone to consider where development is heading environmentally, economically and socially. It has been widely stated that current practices and lifestyle cannot continue if we are to leave a living planet for the generations beyond the next (Granault, 2008). To achieve this, there are difficult and drastic measures that must be undertaken. Cities must be redesigned and habits reformed, and the concept of conserving and reusing our natural resources are keys to achieving sustainability (Jabareen, 2006). For this reason, the current open looped, single purpose design of infrastructure is not sustainable and cannot be maintained; the provision of water can no longer be linear, flowing from the tap to the sea. It is vital that society, policy-makers and planners introduce and incorporate sustainable features into energy intensive, but 'invisible' facilities. It is easy for the public to ignore or not realise the extent of the ecological footprint of the infrastructure due to its size and the fact that it is usually 'hidden' or located far away. There is also a need to recognise that the concept of 'sustainability' is not purely about environmental concerns; it also incorporates economic and social elements (Davidson, 2007).

### **THE FRESHWATER CHALLENGE**

The 1992 Dublin-Rio Principle highlights that freshwater is a finite and vulnerable resource, and that its provision is integral to sustain life, economic development and the wellbeing of the environment (Thomas & Durham, 2003). While 71% of the earth's surface is covered by water, freshwater only makes up 2.5% of this amount. The remainder is essentially salty or brackish water locked up in oceans, salt lakes and saline groundwater reservoirs (Bidlack, 2004). Of this 2.5%, only 0.8% is accessible, as the rest are

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