

BUILDING DESIGN FOR SUSTAINABLE HOMES & CITIES: THE BENEFITS OF RAINWATER HARVESTING



Lomani, Byron Bay

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INTRODUCTION

With population numbers growing and an increasingly unpredictable climate, Australian cities will face challenges with water supply. The Australian government estimates that more than two-thirds of the country live in capital cities,¹ and these numbers are on the rise. Sydney alone is expected to grow by 1.6 million people in 20 years, with forecasts suggesting it could be eventually overtaken by Melbourne as the most populous city in Australia.²

During periods of low rainfall, urban water infrastructure in Australia struggles to meet the demands of its growing population. In 2018, Australia's nationally-averaged annual rainfall was approximately 412.8 mm,³ notably below historic and global averages, and which may fall even further due to the effects of climate change. In 2017, Perth's water storage levels fell to 40.4% due to steep declines in rainfall and catchment runoff while Melbourne's supply hit a dangerously low 26% in 2009.⁴ At the same time, the occurrence and intensity of extreme rainfall events are predicted to escalate, leading to more incidents of flash flooding in urban areas that can pollute waterways and decrease water quality.⁵

Putting further strain on traditional water supplies, the demand for water is rising across the country. Statistics show that Australians

consume an average of 340ltrs of water per person per day,⁶ which is among the highest consumption rates when compared to other developed nations.⁷

Against this backdrop, the need for sustainable water services has never been greater. Integrated urban water management has emerged as a holistic approach to managing the urban hydrological cycle with the aim of creating communities that are liveable, productive and sustainable.⁸ Rainwater harvesting is the primary element of integrated water management systems and plays a vital role in reducing pressure on public water utilities and infrastructure, while also making cities more resilient to the effects of climate change.

In this whitepaper, we discuss the critical role of rainwater harvesting in integrated urban water management and the benefits it can deliver to homeowners, urban communities and the natural environment. In doing so, this document illustrates why architects and designers have a social and environmental responsibility to consider rainwater harvesting as part of a set of sustainable design choices that bring energy, water and green infrastructure into the home and help secure the future of our communities.

UNDERSTANDING INTEGRATED URBAN WATER MANAGEMENT

Defining "Integrated Urban Water Management"

An alternative to traditional water supply and management, integrated urban water management emerged as a response to growing populations, rapid urbanisation, climate change and the resulting water challenges at regional, national and local levels. It has been defined as "a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems."⁹ In other terms, it offers a holistic and linked approach to managing water sources, infrastructure needs and maintaining healthy waterways.

In Australia, state, territory and local governments have developed integrated water management frameworks. Such frameworks and policies rely less on limited natural water sources and focus on less-polluting water services, conservation and efficient water use.¹⁰

The Role of Rainwater Harvesting

Rainwater harvesting is the collection and storage of rainwater before it is lost as surface runoff.¹¹ Typically, this process involves "collection of precipitation running off roof surfaces into cisterns or other storage vessels."¹²

Rainwater harvesting is the first step in integrated urban water management.¹³ One of the most common forms of alternative water supply, rainwater harvesting can play a critical role in reducing pressure on water supply infrastructure.¹⁴ This is because rainwater harvesting is inherently efficient; it is a localised

water supply that is collected where it is used. Furthermore, collection occurs on roofs, which are non-trafficable spaces, meaning treatment costs are low while overall water quality is high. Accordingly, rainwater harvesting can be used for a wide variety of purposes and in urban areas potable water can be used as an automatic back-up supply.

Harvested rainwater can be used for non-potable uses such as toilet or urinal flushing, laundry and irrigation.¹⁵ As another alternative water source, rainwater harvested from non-residential buildings can be used for public gardens and other municipal or commercial purposes.¹⁶

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BENEFITS OF RAINWATER HARVESTING

In addition to providing an efficient, supplemental source of water for non-potable uses, rainwater harvesting is recognised by Engineering Australia as a stormwater management solution for peak flow reduction, water quality improvement and stormwater harvesting.¹⁷ Rainwater harvesting also contributes to infrastructure savings, enhanced sustainability outcomes and a range of other benefits for homeowners and the wider community. These benefits are discussed further below.

Sustainable and Efficient Homes

Consideration of rainwater harvesting systems should occur in the context of increasing consumer demand for “green” and “sustainable” homes. Property owners are more environmentally conscious and also increasingly aware of the economic benefits of energy efficiency. Harvesting rainwater can reduce water bills as water is already being delivered to the site via natural processes – a rainwater storage tank simply captures it for later use without the need to pump it up from the mains system.

The financial savings derived from rainwater harvesting can be significant. Mains water use can be reduced by up to 100% depending on climate, how the tank is used, water efficiency and tank size.¹⁸ The Australian Bureau of Statistics reported that rainwater tanks provided 8% of national household water consumption (approximately 156 billion litres) in 2013-14, which amounted to \$507 million in water bill savings for that period.¹⁹ In terms of consumer satisfaction, a CSIRO report in 2015 found that 93% of Melbourne homeowners surveyed were satisfied with their tanks and 95% were seeing benefits.²⁰

Implementing rainwater harvesting solutions also means homeowners are less affected by water restrictions during periods in which community water supplies are under strain.

Some local governments mandate the use of rainwater tanks in new homes or otherwise require new homes to meet stringent water and energy standards that make incorporating rainwater harvesting into the building design almost a necessity. For example, the Building Sustainability Index (BASIX) planning measures in New South Wales sets mains water reduction targets that can be more easily met using rainwater harvesting solutions.²¹ BASIX is one of the most successful sustainability programs in the country and has consistently achieved 40% water savings in NSW since 2004.

Liveable, Productive and Resilient Cities

Rainwater harvesting reduces a building’s dependency on main water use, which has several broader benefits. When implemented throughout an urban community, rainwater harvesting reduces the need to build new dams or desalination plants, protects environmental flows into rivers and cuts water infrastructure operating costs.²²

Rain and stormwater harvesting can also mitigate the environmental impact of urbanisation on stormwater drainage systems and receiving water bodies.²³ In urban areas, the vast amount of non-permeable surfaces leads to high levels of runoff, which collects pollutants such as fertilisers and trace metals and produces flows that natural waterways are ecologically unable to manage. This runoff pollutes waterways and ultimately leads back to the ocean. Excess runoff can also cause flooding, putting additional pressure on city infrastructure.

The widespread use of rainwater tanks in an urban area increases the retention potential of the catchment and reduces the frequency, volume and peaks of storm water runoff.²⁴ This eases the strain on stormwater infrastructure and reduces the impact on the

Kingspan galvanised round water tank



environment into which the stormwater is discharged. The harvesting of rain and stormwater also increases the opportunity for sustainable water management, particular in terms of water reuse and recycling.²⁵

One of these reuse opportunities is providing new, efficient water sources to create urban “green” spaces. Urban green spaces, including domestic and rooftop gardens, parks and woodlands, are critical to a healthy urban environment by limiting the impact of rising temperatures and climate change. “Urban Heat Island effect”

(UHI) refers to an urban microclimate that is significantly warmer than surrounding areas due to less green cover and the prevalence of hard surfaces which absorb, store and radiate heat.²⁶ Urban green spaces reduce the UHI effect through provision of shade and by cooling air through a process called “evapotranspiration.”²⁷

Due to irrigation requirements, urban green spaces can be water intensive. Rain and stormwater harvesting can provide a sustainable source of water to irrigate green spaces and reduce the demand on potable water for non-drinking purposes.



Kingspan galvanised slimline water tank

THE FUTURE OF URBAN WATER MANAGEMENT

Rainwater harvesting is an essential component of integrated water management frameworks and will be a major policy issue in the 21st century. This trend is reflected in the range of planning policies, water efficiency standards and rebates targeted at encouraging the proliferation of rainwater tank use across the country. Schemes such as BASIX encourage the use of rainwater water tanks to meet mandatory requirements for energy and water efficiency in new homes and major renovations.

Architects and designers should consider incorporating rainwater harvesting into new projects as the effects of urbanisation, population growth and climate change will make traditional, centralised water supplies less viable. The growth in apartment

living creates further opportunities to incorporate rainwater tanks and other sustainability features into rooftop spaces. In this market landscape, building industry professionals need to have the skills and knowledge to create smart, sustainable homes and urban spaces to stay competitive.

A well-designed rainwater harvesting system can provide water for all domestic uses. Rainwater harvesting benefits from good roof design, in which roof pitch, gutters and surface materials are all carefully considered. Prepared by Urban Water Cycle Solutions and Rainwater Harvesting Australia, the Rainwater Harvesting Residential Design Specification guide provides design and specification requirements for effective rainwater harvesting systems.²⁸

KINGSPAN WATER & ENERGY

Kingspan Water & Energy are the largest manufacturers of rainwater tanks in Australia. A pioneer of new technologies and award-winning design, this company also offers services in the form of rainwater harvesting, wastewater treatment, water storage, and wind and solar building solutions.

Sustainability is at the core of all Kingspan's activity in Australia. The company recognises the widespread benefits of a more sustainable built environment, and has consistently endeavoured to develop products and systems that best enable more resilient, economically efficient and environmentally friendly cities.

Beyond manufacturing and supply, Kingspan also maintain a service division for rainwater harvesting, which offers expert advice, assists in problem analysis and provides maintenance and repair solutions. The company recognises that any integrated urban water management system will benefit the most from integrated support.

For architects and specifiers, Kingspan have made all of their standard water tanks available for download for use in Building Information Modelling (BIM) programs and provide comprehensive, end-to-end support throughout the entire

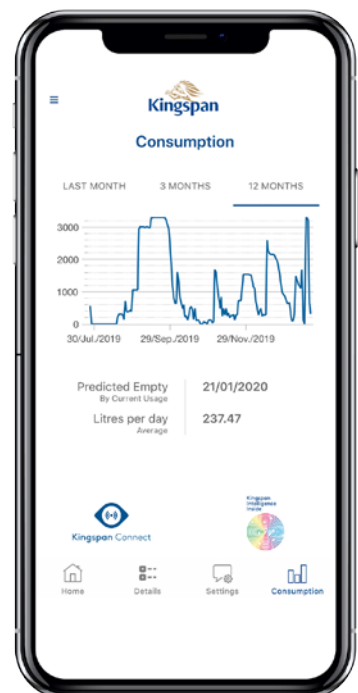
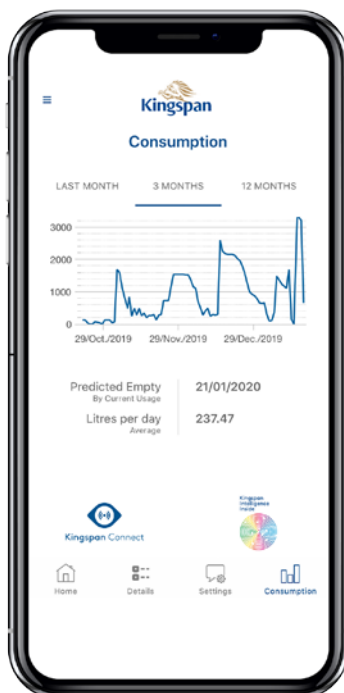
product lifecycle. Through their service division, consumers are able to find expert advice on the upkeep of their rainwater storage tank and associated components, assistance in problem analysis, and maintenance and repair solutions.

Kingspan has recently announced the Smart Tank: a new digitally based product providing home and building owners with real-time data on tank levels, rainfall events and rainwater tank consumption. The Smart Tank simplifies the processes associated with rainwater harvesting and water use, as well as acquiring adequate information and assistance for its maintenance and repair.

Kingspan and Continuing Professional Development for Architects

Recognising rainwater harvesting as a significant opportunity to improve the sustainability and resilience of our urban environments, Kingspan has invested in continuing professional development (CPD) programs for architects and specifier. These programs are based on the successful Rainwater Harvesting Residential Design Specification guide prepared by Urban Water Cycle Solutions and Rainwater Harvesting Australia.

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Remote monitoring with the smarts to alert you when there are changes to your rainwater levels. Smart Tank allows you to monitor your rainwater usage, levels and history.

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