STORMWATER SHOCK ABSORBERS

Rainwater Retention and Detention Tanks, an Architectural Solution to Mitigate Urban Stormwater Runoff





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"The combination of more rain in a short period of time, and more hard surfaces, will result in more runoff than our existing stormwater infrastructure can manage."

INTRODUCTION

There is growing pressure on the current drainage infrastructure due to more intensive rain events and more impervious surfaces from rising residential densities. Like a shock absorber, the detention rainwater tank can absorb the immediate impact of the rainwater event, storing that water and releasing it over the following hours.

On-site rainwater retention and detention systems are an effective and economical method of controlling increased stormwater runoff in existing urban areas.¹ Accordingly, many councils are

requiring retention and detention tanks for new developments to accommodate the runoff generated from the increase of hard surfaces in the urban environment.

The main distinction between rainwater retention and detention is that a retention tank's purpose is to hold onto the water for future use, whereas a detention tank empties the water slowly after it is collected. Kingspan On-Site Detention (OSD) Tank Systems can be easily adapted to cater to both of these functions and meet your project requirements.

UNDERSTANDING RAINWATER HARVESTING AND STORMWATER

Rainwater harvesting is the term for precipitation that falls on roofs and can be collected into storage tanks before it hits the ground. Rainwater quality is significantly higher than that of water that reaches the ground and other surfaces. Surface water has contaminants like dirt, organic matter, garden fertilisers, and oil residue from driveways.

Urban households will typically use a mains water supply for most of their water consumption needs, but they may save costs by harvesting rainwater in a rainwater tank. Rainwater can be used for many purposes, such as flushing toilets, washing clothes, watering gardens, filling swimming pools, and washing cars.

Stormwater is rainwater that runs off hard surfaces and is carried away by stormwater drains that flow into local waterways.² This includes rain falling on roofs, flowing into drains or onto land via gutters and downpipes.

As noted, the increased amount of stormwater runoff due to urban development is a major problem. The drainage systems in urban areas are frequently old or overburdened, which increases the risk of flooding and water pollution.



WHAT IS AN ON-SITE DETENTION AND RETENTION SYSTEM?

Kingspan OSD Tank Systems are designed to have two functions, as shown in Figure 1. Typical On-Site Detention and Retention System.

The upper section of the rainwater tank collects rainwater from the roof and releases it slowly into the stormwater system until the rainwater falls below that level. This is called a rainwater detention tank. The design advantage is that this space is then free to capture rainfall from the next rain event.

Like a shock absorber, the rainwater tank absorbs the immediate impact of the rainwater event, storing that water and releasing it

Figure 1. Typical On-Site Detention and Retention System*

over the following hours. The detention tank function uses an orifice plate with a small hole to release the water that restricts flow to the rate specified by hydrologists.

The lower section of the rainwater tank collects rainwater from the roof for use in the house and garden. This is a standard rainwater retention tank. Garden uses are seasonal, but household uses, such as flushing toilets and washing machines, are regular everyday uses, and rainwater can be reliably used to reduce the demand for expensive chemically treated water across the whole city. A rainwater retention tank also has important stormwater benefits, provided there is a regular drawdown by using the rainwater.







WHAT IS THE BENEFIT OF RAINWATER DETENTION?

The rainwater detention process removes some of the volume of stormwater when it rains to reduce the peak flow and increases the confidence of council stormwater engineers that volume will be available for the next event. When it rains, the flow in the stormwater system is not linear. The flow builds up as more and more water flows into the system, until it stops raining and then the flow drops again. The worst impact of the stormwater occurs around the peak flow when stormwater pipes and channels are overwhelmed and water rushes into sensitive waterways.

Detention systems can reduce and delay the peak flow. This is illustrated in the below diagram.

Our cities are urban systems, and we need to understand them as systems. While a single building's rainwater tank may only have a small impact, thousands of buildings' rainwater systems can fundamentally transform the city's overall stormwater performance.³

Figure 3 shows the cumulative impacts of changes across an integrated water cycle system where the modified outputs of small local catchments have a significant whole-of-catchment impact.

Figure 3. Cumulative and distributed impacts across an integrated water cycle system, including local attributes and solutions shown as cumulative changes in stormwater hydrographs (stormwater run-off on vertical axis versus time on horizontal axis)



Source: Daniëlle Dresch, Civil Engineer Kentucky (via LinkedIn).

Figure 2. Impact of Stormwater Detention on Stormwater flow



Source: Coombes, 20183

TIME TO ACT IS NOW

When we think about water management solutions, rainwater detention systems are only one of a large range of measures we can undertake. We can expand the areas in our cities—greenspaces, wetlands, parks, and backyards—where water can be securely stored and allowed to seep into the ground. We can also build more drainage infrastructure to support increasing flows. In existing urban areas rainwater detention is one of the simplest and most cost effective ways to manage increasing stormwater volumes. One thing is clear: we need to act quickly.

Australia's cities are in danger because we will not be able to control all our stormwater in our metropolitan areas. Firstly, we are replacing our gardens and open spaces with more buildings, concrete and hard surfaces. At the same time, we are setting aside fewer places for water to soak into the ground. These factors will increase the amount of runoff we will need to manage.

Figure 4 shows the impact of urbanisation on the natural water cycle. Increased hard surfaces reverse the natural order; instead of 80% of rainfall becoming groundwater and evaporation, 80% of rainfall becomes runoff. Rainwater tanks can reduce this impact by diverting and retaining rainwater for household uses, urban greening and groundwater replenishment.



The second issue is a science problem. Our air is becoming warmer, and it holds more water. For every one-degree Celsius increase in temperature, air can hold 7% more water. So, if the air in a rain event is four degrees warmer, it can hold nearly 30% more water.

Rainfall is becoming more intense, with more rain in a shorter period of time. The combination of more rain in a short period of time, and more hard surfaces, will result in more runoff than our existing stormwater infrastructure can manage. In Adelaide, reports note that the volume of stormwater will be 2.5 times more than what the infrastructure was designed for.⁴

We tend to focus on major floods when we think about stormwater, but they are pretty rare. One of the problems we are facing is the small events that might occur once a year, or every six months which may now be resulting in flood damage. These events are still expensive, both in damages and insurance premiums, and we cannot afford for them to happen regularly.

Additionally, even in small events, the impact of fast-moving stormwater on our beautiful waterways can be irreversible if it happens regularly. Fast-flowing water scours out the bed and banks of natural streams, removing the natural habitat for plants, fish and platypus. If we do not slow down our stormwater, these natural habitats will be gone forever.⁵





SOLUTIONS FOR ON-SITE RAINWATER RETENTION AND DETENTION FROM KINGSPAN

Kingspan Water Tanks are not just saving water; they're helping to save our cities and our waterways.

Kingspan Water Tanks manufactures long-lasting, quality, madeto-measure Bluescope AQUAPLATE® steel water tanks and accessories for Australian homes and businesses. The Kingspan range includes Slimline, Round, Modline and Square models in hundreds of sizes, with capacities ranging from 500 litres to 34,000 litres. Tanks are available in galvanised steel or in a large range of Colorbond® colours.

Made-to-measure tanks are WaterMark certified, meet the requirements of AS 4020, and come with a 20-year corrosion warranty and a 10-year construction warranty.

Kingspan Detention Kits fit quickly and easily on existing rainwater tanks. Kingspan's made-to-measure system allows easy

adjustment of the proportion of detention and retention. This means you can tailor the OSD System to meet your hydraulic specifications.

Kingspan's innovative free online tool, the 3D Water Tank Builder, allows a client to build their own water tank to suit a project and see it come to life in augmented reality. Try it today at www.kingspanwatertanks.com.au.

Kingspan Water Tanks offers a free CPD course online for architects, Designing Residential Rainwater Harvesting Systems. Here you will learn some of the elements of best practice ideas for rainwater harvesting.

Visit our Architects and Specifiers page to download our BIM files and complete our free CPD course. www.kingspanwatertanks. com.au/architect-and-specifier-solutions/



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