THE BRITE PROJECT

Innovation Case Study No 7

Managing Stormwater with Storage Gutters and Infiltration

This series of innovation case studies has been developed by the BRITE Project of the Cooperative Research Centre for ***Construction Innovation****. The case studies demonstrate the benefits of innovation and successful implementation strategies in the Australian property and construction industry. Many highlight the strengths of small and medium-sized businesses in regional areas.*

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Managing Stormwater with Storage Gutters and Infiltration

A new way of dealing with urban stormwater run-off facilitates more sustainable use of available water resources. Rain storage gutters with an infiltration system offer benefits to:

- building owners and occupants
- the community
- the environment.

Storage gutter and outlet plugs

Selected Project Participants

Client	Hunters Hill Council
Contractor	Johnson Fisher Constructions
Sub-contractor	Rainsaver Pty Limited
Hydrology consultant	Urban Water Resources Centre, University of South Australia
Sponsor	Stormwater Trust of NSW

This report is based on interviews with Hunters Hill Council, Rainsaver Pty Limited and Urban Water Resources Centre.

Cover photo: Side view of the Gladesville Road Community Centre

The Project

After an arson attack in 2002, Hunters Hill Council decided to use the Gladesville Road Community Centre refurbishment to:

- demonstrate simple water saving devices
- show the value of retrofitting these devices to an existing building.

The project was partially funded by a grant from the NSW Stormwater Trust. It received the NSW Sustainable Water Challenge Retrofit Award for 2003, along with three other demonstration sites in the Lower Parramatta River Catchment.

The Centre reopened in November 2002 and is now part of a program that promotes community awareness of rain harvesting and water sensitive design.

The Achievement

Australian cities and towns need new strategies to counter local flooding, due to urban consolidation and increased pollution of streams and coastal waters. There is also a need to redress problems with adequate fresh water supply.

The storage gutter system addresses these problems from two angles. Firstly, it reduces reticulated water usage by substituting rainwater for purposes such as toilet flushing. Secondly, overflow water during heavy or sustained rainfall infiltrates the soil, replenishing the water table and slowing the passage of water to urban waterways.

The rain storage gutters at the Gladesville Road Community Centre, which are connected to toilet cisterns, have reduced the mains water demand by 26%. In addition, because rain overflow is directed by a stormwater diffuser into the garden soil, 100% of the rain that falls on the roof is used on-site, except under very severe storm conditions.

Independent costing of the gutter system has confirmed that these savings can be achieved at a cost which is between 5% and 27% less than the installation of traditional guttering plus an equivalent-sized rainwater tank.

The Innovation

Rainsaver Pty Limited is a small company, largely owned by one family, which holds patents on its system for rain storage roof gutters in seventeen countries and has five full- and part-time staff. Patent searches indicate that the storage gutters may be unique and it appears there are no direct competitors as a system for the "collection and storage of water in a container at the drip line of roofs".

Frank Smith, the inventor of the storage gutter system, developed it after observing the need to better manage rainwater when living with a young family on tank water in the Nowra district of NSW. After analysing patterns of rainfall statistics from the Bureau of Meteorology, he developed an oversized

Frank Smith
Managing Director
Rainsaver

'big ideas and their benefits are not the monopoly of big companies'

gutter that would replace a water tank and use all the rainwater that fell on a roof. Instead of downpipes feeding into the street drainage system, the overflow from the storage gutters would be returned to the soil through the process of infiltration.

The storage gutters come in three sizes: a small model (15 litres/metre) suitable for retrofit projects; a medium model (25 litres/metre) for new houses and a large version (48 litres/metre) for heavy demand situations. The gutters are made from folded steel colorbond sheet, however, there are plans to have them roll-formed to reduce manufacturing costs. This plan has been aided by a close relationship with the steel supplier.

The gutters are fitted with lids, and leaf guards for easy maintenance. Medium and large gutters are fixed to roof trusses with purpose-designed internal steel brackets. Lengths are joined with rivets and silicone sealed. The gutters are then coated internally for improved water tightness.

Currently, *Rainsaver* or its franchisees usually install the gutters. The installers provide plugs at suitable points for plumbers to connect the gutters to toilet cisterns or other outlets. Overflow holes are situated where excess water can flow directly into garden beds. Alternatively, the gutters are connected to a diffuser system that transfers the water to areas of the garden with suitable soil porosity and permeability.

Site characteristics are assessed before the installation, and the infiltration area needed for the roof catchment is calculated.

In times of low rainfall or high usage, the storage gutters can be recharged from the mains water supply if they are connected to a toilet or washing machine.

The Gladesville Road Community Centre project demonstrates that water storage gutters are capable of replacing existing roof gutters, downpipes and rainwater tanks. They also reduce the need for stormwater retention systems. They do this while returning moisture to the soil to aid vegetation growth and replenishing the water table.

The Benefits

The savings in mains water usage achieved by storage gutters depend on the:

- amount, distribution and intensity of rainfall
- water usage by the occupants of the building
- collection area of the roof.

Assuming a 200 m² building with average occupancy levels, Professor John Argue of the Urban Water Resources Centre at the University of South Australia estimates that water storage gutters could save between 30% and 60% of mains water usage, depending on gutter size and location, each year over the life of the gutters (estimated to be a minimum of 15 years).

Water stored in the gutters is gravity fed to toilet cisterns. The gutters can also act as an emergency water supply for the householder if a water main is broken. It is also possible to fit an activated carbon filter to the gutter outlet and feed a filtered drinking water tap. In a bushfire, storage gutters can provide emergency water supply for fire fighting and they can be used to create a curtain of water around a building under threat from bushfire.

As an integral part of the roof plumbing system, storage gutters are less aesthetically intrusive than rainwater tanks and pumps.

They require no ground space on a restricted site and they collect 100% of the water falling on the roof, as opposed to water tanks which commonly only collect from the roof plane facing the side where the tank is located.

Storage gutters can reduce stormwater run-off during a rainstorm by up to 85%. Most installations, including the one at Gladesville Road Community Centre, have natural on-site infiltration of excess stormwater from the roof. There is no need for a separate detention tank and little need for downpipes. As a consequence there is less water flowing into the street gutter system. This makes the gutters an effective mitigation measure against urban flooding. Along with the use of 'Water Sensitive Urban Design', storage gutters allow for the elimination of much of the costly piped stormwater drainage systems that are typical of suburban subdivisions.

Benefits to the building owner include:

- reduced consumption of mains water resulting in lower bills
- little maintenance and longer gutter life due to leaf guard system
- less need to water the garden due to the overflow infiltration system.

Benefits to the community include:

- lower demand for reticulated water leading to less pressure to build new dams
- less need for piped street drainage and area retention systems and consequently lower cost of developing land for housing
- greatly reduced cost of stormwater management and flood mitigation.

Benefits for the environment include:

- a more natural level of water infiltration into the soil
- replenishment of the water table in urban areas
- reduction in nuisance flooding and in the erosion hazard from high speed run-off in storms.

The Implementation Process

A key driver in the adoption of water storage gutters at the Gladesville Road Community Centre was Hunters Hill Council's desire to improve stormwater management in their Sydney harbour-front municipality. Council officers gained a grant from the NSW Stormwater Trust for four demonstration projects in the Lower Parramatta River catchment area. The Gladesville Road Community Centre renovation was one of the four demonstration projects.

After investigating cutting-edge water-saving techniques, Hunters Hill Council identified water storage gutters as a system with great potential and a means to educate the community about suburban stormwater management. Both the water storage and the management of infiltration were significant issues. The inventor, in turn, was keen to demonstrate the validity of the system for a non-domestic application.

The medium sized gutter (25 litres/metre) was selected for the community centre, where it is used to flush all toilets. One section of guttering feeds a pond that is planted with macrophytes to improve the water quality and provide habitat for frogs. A solar powered pump runs a small fountain in the pond. When the water storage gutter reaches capacity, a diffuser directs overflow into garden beds where the water can infiltrate back into the soil. Except during extremely heavy rainfall, no stormwater runs off the site. To date, no rain has left the site.

More generally, implementation has been assisted by the inventor's strong connections with university research bodies concerned with water resources. Professor John Argue of the University of South Australia and Dr Chris Walsh of Monash University have worked on validating the theory behind the need to reform stormwater management practices. The inventor has delivered papers and exhibited at conferences such as the 'Cities as Catchments Conference' in Adelaide in 2004, as a way of informing local and state government authorities and persuading them to have the system included in stormwater management codes.

Regulations also play a key role in making implementation possible. In NSW, BASIX, the new environmental planning scheme for housing, allows credit for installing water storage gutters towards the required 40% water reduction target. In South Australia, from 2006, all new houses must have 1000 litres of rainwater storage connected to a toilet cistern. These legislative changes are driving adoption of the innovation at a state level, although, as discussed below, inventors and innovation champions often need to persuade regulators that proposed changes will be beneficial.

Diana Kureen
(Formerly) Bushland Environment Officer
Hunters Hill Council

'the intent is that there be no run-off from the site'

Don Cottee
Manager Public Works and Infrastructure
Hunters Hill Council

'we wanted to use the refurbishment as a demonstration of simple water saving devices and I think we have succeeded'

Overcoming Difficulties

The main difficulty experienced at the Gladesville Road Community Centre was managing the rate at which the toilet cisterns refill. In a community centre, as opposed to a private residence, there are periods of peak load on the toilets, for example, at the end of meetings. At first the cisterns did not fill quickly enough to handle this peak load. Some adjustment of the system was necessary to make it work effectively. Larger inlet pipes would be used in any future application of a similar nature.

In addition, the position of the gutter overflows had to be adjusted so that they did not fall in areas where Centre users were likely to walk. This was done with diffusers to take water into the front and rear garden beds. These post-occupancy changes have optimised the system.

Generally, storage gutters are well received by consumers as an alternative to rainwater tanks. However, the inventor has experienced some difficulty communicating their other important role in managing overflow stormwater infiltration. In some areas, notably in South Australia, unmanaged gutter overflow is not permitted because of possible interaction with the footings of the building. This obstacle was overcome at Gladesville Road Community Centre by diffusers.

Innovations like the water storage gutters are a departure from standard practice and local building regulations are still largely based on prescriptive standards, which can be a barrier to implementation. This means that acceptance by local authorities is often critical to their adoption. The inventor of the storage gutters has liaised with local council officers over a long period of time to reduce their perception of risk, by seeking to demonstrate that water storage gutters can be used to lessen stormwater nuisance flooding rather than increase it.

The system has also met with resistance from builders. The gutters need to be fixed level, rather than with falls to downpipes as is the case with traditional gutters. Builders need to understand how the system works before they install the gutters, rather than discovering critical requirements, such as the need for accurate roof edge lines, after installation. Installation problems have largely been overcome by refining the detail of the gutter fixing bracket design, based on feedback from builders.

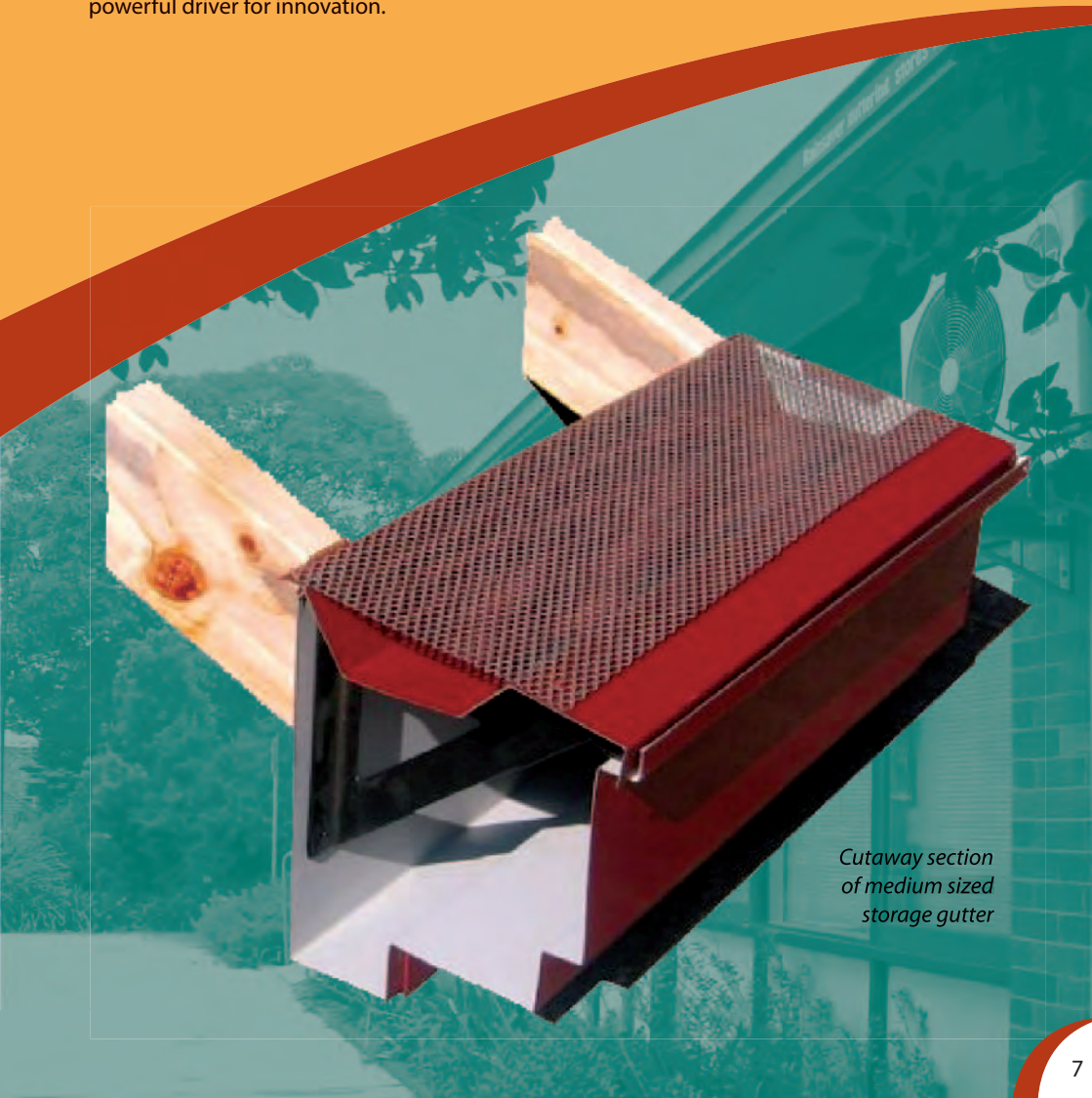
Some builders still resist change but this is being overcome by successful demonstrations such as the Gladesville Road Community Centre. The inventor is also developing educational packages so that storage gutter installation can be included in TAFE courses on roofing and roof plumbing. This is considered likely to reduce industry resistance to the system.

John Argue
Adjunct Professor
University of South Australia

'widespread application of innovations, such as the Rainsaver system, can help urban communities live within their natural and financial limits

Lessons Learned

- Regulators play an important role in influencing opportunities to implement innovations.
- Inventors and commercialising companies often need to convince regulatory authorities of the validity of their offerings – and this requires considerable patience.
- Small firms are key players in driving industry innovation.
- A pressing environmental need such as stormwater management can be a powerful driver for innovation.
- Links with research bodies can be useful in developing innovations and independently validating their worth.
- Trade education has to be sufficiently flexible to accommodate new technological and systems developments.
- The successful introduction of an innovation that changes widespread industry practice is likely to require a long term commitment from the innovation champion.



Cutaway section of medium sized storage gutter

Storage gutter and outlet plugs

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