TECHNICAL BULLETIN

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Case Study:
Concord Roads Trial Project, NSW
alternative stormwater management systems

I. Introduction

An innovative system for continuous and ubiquitous infiltration of stormwater has been installed in Concord, Australia. The project involved retrofitting an existing street for enhanced infiltration. Tests were conducted to determine the efficacy of the new system and, in terms of stormwater pollutant removal, the results are positive. The system can be installed in two ways: 1) within the context of a traditional curbed road system where the parking aisle is constructed to allow for infiltration, for controlling car migration, and for parking cars; or 2) with infiltration occurring in grassy boulevards astride paved surfaces, outside of the traffic and parking zone. Of the two systems the parking aisle system is the more expensive to install; however, accurate cost data is not available on the boulevard system. Consequently, only the costs associated with the parking aisle system are cited in this bulletin.

II. Project Description

STORMWATER SYSTEM

Type of System Constructed
STORMWATER PURIFICATION SYSTEM

Year
1998

Area serviced
19.62 ACRE 7.94 Ha

Level of Stormwater Management
AVERAGE STORM SITUATION

The site investigated is a residential area in Concord, Australia, a Sydney suburb. We examine the following aspects of the development site: site condition; soil infiltration capacity; installation and maintenance costs; and performance of the system.

The Concord Project is a stormwater purification and recycling system designed to treat and restore stormwater runoff to near drinking water quality. The project was developed with cooperation between the City of Concord council, the Australian Environment Protection Authority (EPA) and the Atlantis Corporation, the manufacturers of the subject system. Prior to the project intervention, the on-site storm system was a typical curb and gutter inlet. Untreated runoff from this Concord neighbourhood and its associated drainage area was directed into storm sewers. The objectives of the project were to establish an ecologically sustainable system to collect and potentially reuse stormwater, ultimately leading to the reduction of stormwater runoff, and costs associated with importing potable water to the site. The project was intended as a demonstration that, if successful, would lead to widespread implementation of alternative stormwater systems.

The system was designed to treat stormwater runoff from the streets and their surrounds to enable the water to be re-used for irrigation, or alternatively, to be safely discharged into Powells Creek. To maximize infiltration, a permeable channel system was installed around the existing curb and gutter. The channel involves the installation of a permeable surface, consisting of a grid-paving block, with turf growing in grid cells, on both the street side and the sidewalk side of the existing

INFRASTRUCTURE SYSTEM

Street Pattern
GRID

Utilities
GRID

System Length
1000 METERS LONG

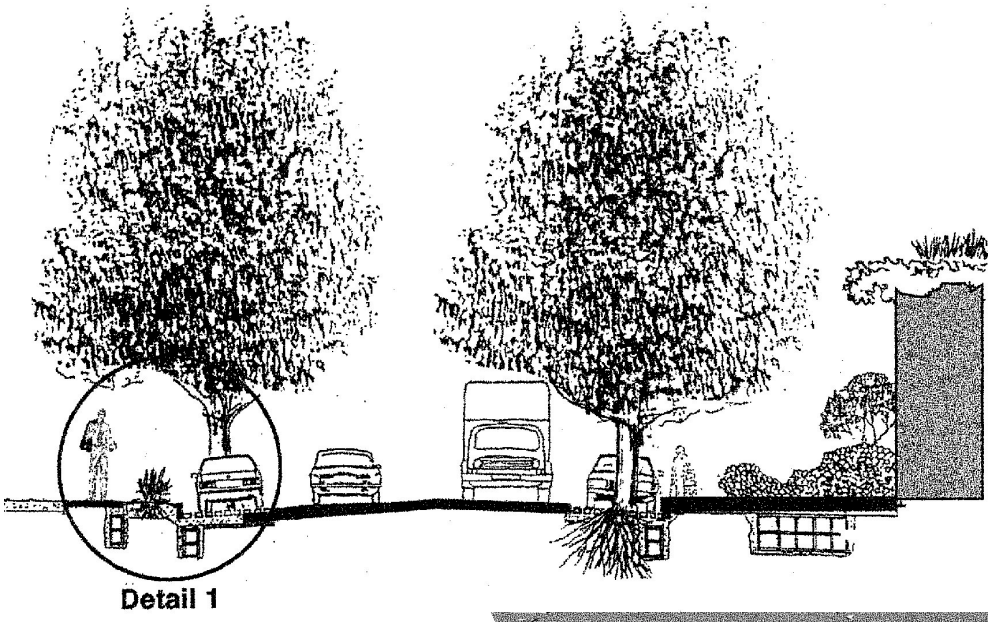
Typical ROW width
20 METERS

curb. The runoff that infiltrates the paving blocks, is filtered and purified through an amended, biologically engineered sand filter, and then passes to a drainage cell blanket layer that diverts the filtered run-off into subsurface percolation tanks. The system design is outlined in Figures 1-1 and 1-2. A specially designed geo-fabric material covers the tanks and drainage cells. The fabric stops soil particles from entering the treatment and storage areas where it could add silts to the stored water.

The retrofit maximizes the amount of stormwater runoff infiltration by allowing for storage in sub-surface percolation tanks. The runoff filters through the surface to biologically engineered sub soil. The runoff is collected into drainage tanks for further purification, and then into retention tanks with any excess water eventually flowing into Powells Creek. The stored water is used to irrigate the surrounding area and/or gradually infiltrated into the surrounding soils. This system reduces the threat of floods and ensures that overflows discharging into the rivers and creeks are nearly completely free of pollutants.

III. Site Condition

The retrofit site is an 8-hectare, five-block area, located in the Concord district of New South Wales in southeastern Australia. The residential area consists of 24



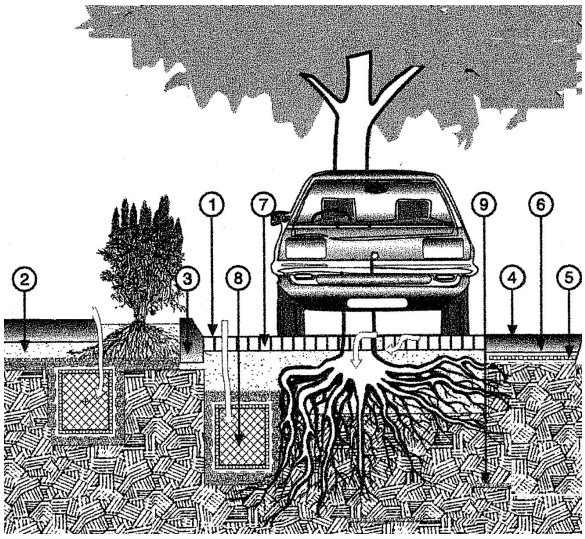


Figure 1-1 and 1-2 - Ecological Curb Gully:

1. Turf,
2. EcoSoil,
3. Concrete curb,
4. Pervious road surface,
5. Drainage cell,
6. Hydronet filter fabric,
7. Grass geo block,
8. Ecologial channel,
9. Heavy soil or clay.

"The type of system is suitable for retro-fitting of existing stormwater drainage systems. The system allows existing infrastructure to be utilized as a surcharge overflow during major storm events, eliminating the major urban floods and allowing water to be recycled naturally or mechanically."

single detached houses on a grid lot pattern. The existing street section had a standard curb and gutter; the retrofit system was installed around the existing curb. Traditionally, residents in this suburb incurred significant costs to irrigate lawns and landscaped areas. Costs associated with use of potable water for irrigation in this water-scarce region, made this demonstration ideal as an alternative approach for the site.

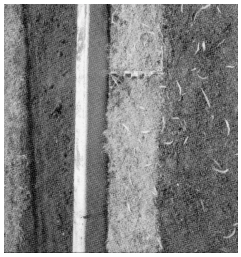


Figure 1-3 and 1-4 - Curb system captures stormwater where it falls, encouraging water retention and infiltration.

IV. Evaluation:

The project improvements resulted in a significant reduction of direct discharge of stormwater runoff from the site. Further, the volume of surface runoff discharging directly in to Powell Creek was reduced by about 75%. Calculated overall removal efficiencies for the project are based on a study (in which water quality data was collected during 10 storm events over a 4-month period at two locations, both upstream and downstream of the project) conducted by Australian Water Technologies (AWT) for the Concord Council. The study provides an assessment of the level of change in runoff quality from upstream to downstream, and is summarized in Table 1-1.

Table 1-1 - % Reduction of Pollutants between upstream and downstream locations

	physical parameters	metals			nutrients		other
	turbidity	copper	lead	zinc	phosphorus	nitrogen	suspended solids
% reduction	90.7	93.6	99.4	97.9	78.6	25.9	82.8

Aesthetically, the condition of the grass on the parking aisle areas was an object of concern, as much of the turf died soon after installation and resulted in the exposure of the cell grid beneath. During the fall and winter months silts and decayed leaf litter clogged grid cells, compromising the infiltration rates in the system. Tests have been preformed and show no tree root penetration through or into the system.

COST

Total cost was $400,000. (Funding for the project was provided by a Stormwater Trust from the New South Wales Government.)

V. Summary

This system captures and treats stormwater at the source and efficiently and effectively enables the treated water to be re-used. Part of the treatment process involves percolation and oxygenation through the system itself. This process is especially useful for sites within close range of the water outlets as it allows for the removal of high pollutant runoff before being discharged. The system is adaptable to high or low water tables and provides the opportunity to control stormwater infiltration and/or detention on site. The load bearing capacity of a single module was found to be 94.52 kN/m3 by the University of Technology in Sydney, Australia. (Single module specifications are 410mm*467mm *610mm with the flow rate of 2280 L/min.)

This infiltration system offers versatile design solutions to urban problems of land cost and stormwater runoff. The stormwater system installed in this case study was a retrofit around an existing curbed road system. For new developments the manufacturer recommends the use of a curbless street section, as shown in Figure 1-5, for economical benefits of decreased infrastructure, and the environmental

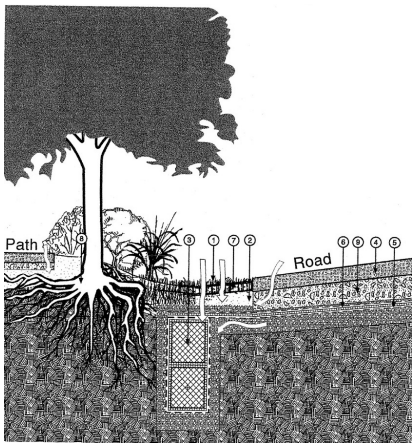


Figure 1-5 - Road drainage system without the curb and gutter:
1. Turf, 2. EcoSoil 3. Atlantis Ecological Channel, 4. Permeable road, 5. Atlantis Drainage Cell, 6. Hydronet Filter Fabric, 7. Atlantis Grass Geo Blocks, 8. Root system, and 9. Road base.

benefits of filtration through the vegetated boulevard. The subsurface system allows water management options, such as water retention, recycling, recharging of ground water, and treatment of stormwater from potentially more toxic industrial sites.

Table 1-2 - System Cost Analysis

Project Description	Concord Project
DEVELOPMENT	
Location	Concord, NSW, Australia
Development Type	residential retrofit
No. of Units	n/a
Developer	n/a
Size (acre)	19.62
Date of Construction	1998
ROAD	
Street Pattern	grid
Typical ROW width	20 m
UTILITIES	
Pattern	grid
STORMWATER	
Type of System Constructed	infiltration/ **exfiltration**/ storage
Area serviced (acre)	19.62
Level of SWM	100-year storm
Large Storm situation	n/a
System Length	1,000 m
Culverts	n/a
Site Condition	
BIOPHYSICAL	
Settlement Patterns	retrofit
Post Development Conditions	residential
HYDROLOGICAL	
Average Rain Event	n/a
GEOTECHNICAL	
Soils Profile - surface	n/a
sub soils	n/a
Site Grades	n/a
Water Table Elevation	n/a
Soil Infiltration Capacity	n/a
HABITAT	
Urban Forest Coverages	n/a
Evaluation	
PROJECT COSTS	1998
Stormwater Installation Costs	$400,000
cost per ha	$50,378
cost per acre	$20,396
cost per linear metre	$400
cost per linear foot	$122
MAINTENANCE COSTS	
Yearly Expenses	n/a
SWS Expected Lifespan	indefinite

Stormwater Installation Costs

Cost per meter:
$400.00 AUS

Resources

AWT Environment, Science & Technology. 1999. "Powells Creek East Catchment Stormwater Quality Scheme." City of Concord Council.

Furguson. 1998. *Introduction to Stormwater: Concept, Purpose, Design*. New York: Wiley & Sons.

Horner, R.R., et al. 1994. *Fundamentals of Urban Runoff Management*. U.S.A.: Terrine Institute.

Internet Articles. 2000 www.atlantiscorp.com

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