Water sensitive development involves simple design and management practices that take advantage of natural site features and minimise impacts on the water cycle. It is part of the contemporary trend towards more 'sustainable' solutions that protect the environment. This Water Sensitive Practice Note gives a general introduction to drainage design and the benefits of using alternative approaches.

Practice Notes

5 Drainage design

Introduction

Stormwater management is a fundamental consideration in the planning and design of urban development. Unfortunately, it is often treated as a subsidiary issue that is not addressed until the final stages of the planning and design process. By considering stormwater management at the initial design phase it is possible to ensure viable stormwater management solutions that are compatible with other design objectives for the site.

Site analysis

The best way to take a 'whole site' approach is to prepare a Site Analysis. For details, see *Appendix A "Site Planning" to the Development Type Guidelines*.

Issues particularly relevant to drainage design are described below.

The site's topography will have a significant impact on the layout design. This is because stormwater drainage systems almost always rely on gravity. The layout of the development must be configured so as to allow excess stormwater to be gravity-drained to a drainage system.

Topography will also affect runoff onto the site from surrounding properties. Existing overland flow paths should be identified and retained. Where modifications to these are unavoidable, they should be designed so as to maintain existing hydrological conditions.

Drainage easements, natural watercourses and flood prone land should also be identified and considered in the design process. It needs to be borne in mind that drainage easements containing underground pipes can operate as overland flow paths during intense rainfall events. Buildings must be kept clear of drainage easements to ensure public safety and to allow maintenance access.

Consideration also needs to be given to local soil conditions. Relevant factors include absorption capacity, erosion potential, soil salinity and the possibility of soil contamination from past activities.

Adjoining properties

One of the basic principles of stormwater management is to avoid adverse stormwater impacts on other properties. Careful consideration must be given to controlling surface runoff and subsoil drainage to adjoining properties.

The redirection and concentration of stormwater flows onto neighbouring properties may constitute a 'nuisance' at common law, giving affected owners a legal right of redress.

Public safety

Stormwater runoff from rare and intense storm events can pose serious risks to life and property. It is essential that the design of overland flow paths, on-site detention storages and other stormwater management measures meet relevant safety criteria. for pedestrians, vehicles and property damage.

Buildings and accessways should be located clear of overland flow paths, or designed to be compatible with the potential flood environment. Fencing and landscaping should be designed so as to minimise the potential for overland flow paths to be obstructed during rare and intense storm events.

Relevant design criteria can be obtained from your local council.

Floor levels and freeboard

Floor levels of habitable buildings must be designed so as to be above the expected water levels for overland flow paths, detention storages and flood prone land. Allowance also needs to be made for 'freeboard'. This is an additional vertical separation between the expected water level and the floor level, the value of which varies according to local conditions and the particular type of flood risk. Floor level and freeboard requirements can be obtained from your local council.

Conventional practices

Conventional drainage practices generally involve rapid discharge of stormwater from the site to a public drainage system. These practices are described in detail in numerous publications (see references).

The main objective is to collect and

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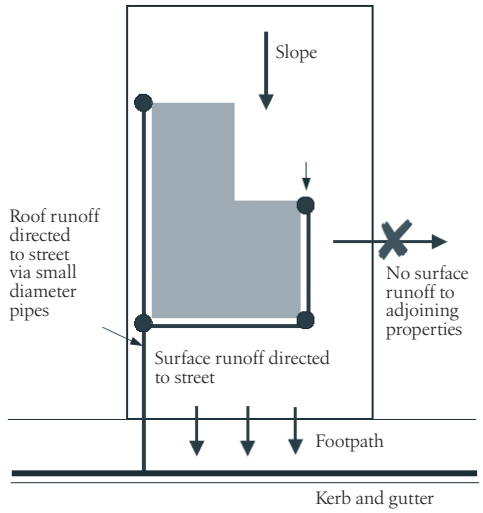

Fig 1: Conventional drainage to street

convey stormwater to the street drainage system with a minimum of nuisance, danger or damage. Roof runoff is discharged via small diameter pipes (usually 100mm diameter), and surface stormwater is usually conveyed by overland flow. The public drainage system usually consists of a system of gutters, streets, pipes, culverts and channels owned and operated by the local council or other authority.

Where the site slopes towards the street, roof runoff and overland flow are drained directly to the street drainage system (see Figure 1). Where the site slopes away from the street, these are connected to the street drainage system or a receiving waterway via a drainage easement at the rear of the property (see Figure 2). The drainage easement generally incorporates a drainage pipe, and may also include a table drain on the ground surface for the collection of overland flow.

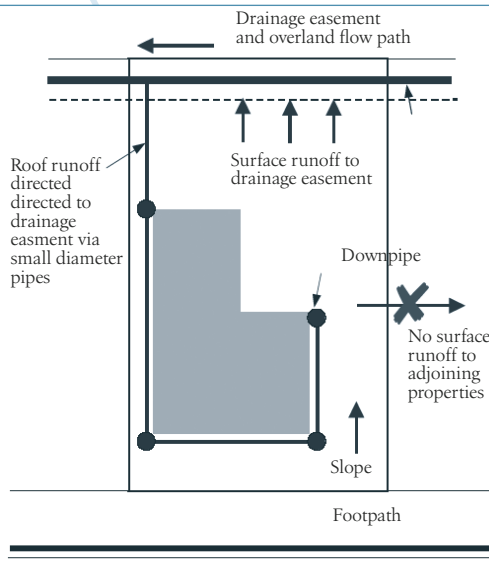

Fig 2: Conventional drainage – to rear of property

Problems with conventional practice

The majority of stormwater runoff in urban area is from impervious surfaces such as roofs, paved areas and roads. Except in the case of major storms, little or no runoff occurs from pervious surfaces such as lawns, gardens and landscaped areas. Urbanisation dramatically increases the area of impervious surfaces. This in turn results in increased peak discharges and greater volumes of runoff per storm.

The direct discharge of roofwater and overland flow to the street drainage system under conventional drainage practices causes rapid and concentrated discharges of stormwater. This contributes to increased flooding, erosion and sedimentation, and

reduced stormwater quality. These problems can be reduced by measures that delay stormwater discharges and that reduce the total volume of stormwater discharged.

What is the alternative?

Alternative stormwater management measures, when used in conjunction with conventional practices, have many cost, aesthetic and environmental benefits. For example, roof runoff can be managed using rainwater tanks and filtration/infiltration trenches. Paved areas can be minimised or replaced with porous paving. A variety of landscape measures and practices can also be applied. These measures reduce the volume of stormwater runoff and the rate at which it is discharged. Figure 3 shows how these measures can be combined on a typical residential lot. For further details on how to implement these measures, see the other Practice Notes in this series.

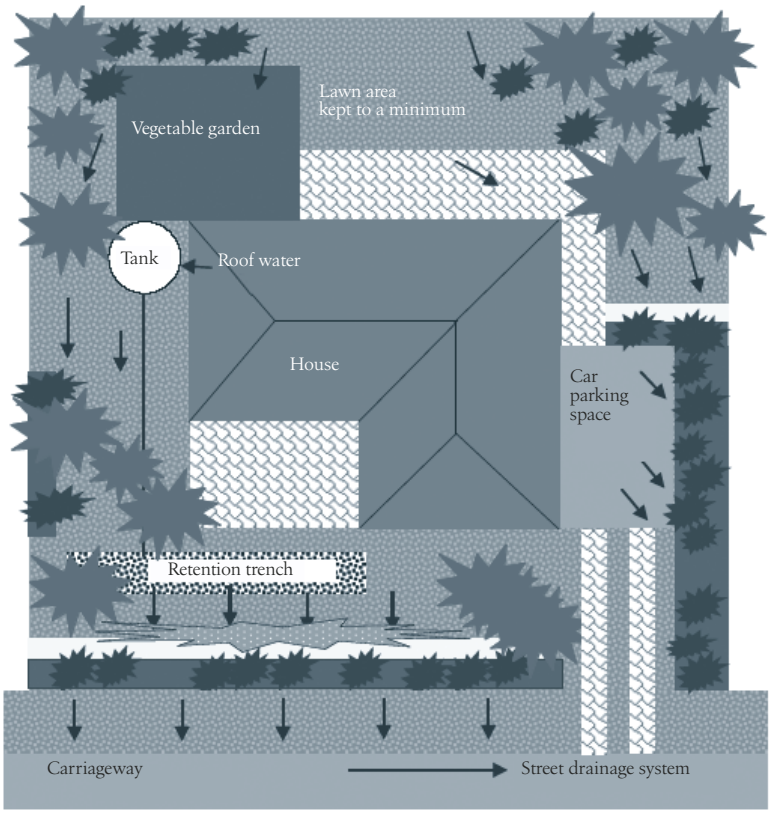

Fig 3: Example of an alternative drainage strategy

Useful websites

www.wsud.org
www.dbce.csiro.au/urbanwater
www.catchment.crc.org.au
www.eng.newcastle.edu.au/~cegak/Coombes

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