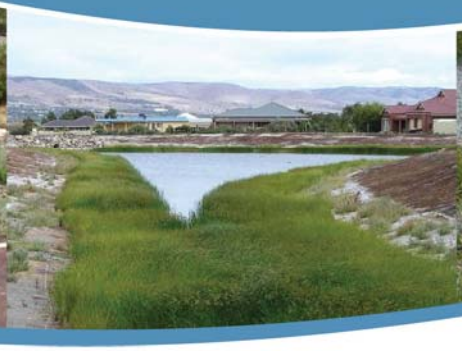
Summary Sheet

Bioretention Systems 10


Runoff is treated in a bioretention system through a vegetated filter media.

A bioretention system is most commonly undertaken as:

- Bioretention swales (or biofiltration trenches) which involve a continuous layer of bioretention along the length of the swale, or a portion of bioretention prior to the outlet of the swale; or
- Bioretention basins which provide flow control and water quality treatment functions. A bioretention basin is characterised by the ability to detain/retain runoff in a depression storage (or ponded area) above the bioretention system.

The most common application of bioretention systems is to recover the runoff using perforated under-drains for discharge or reuse. Bioretention systems are generally not designed to enable runoff exfiltration from the bioretention filter media to the in-situ soil. Exfiltration is appropriate where soil properties, site terrain, building set back and local groundwater requirements permit.

What is Water Sensitive Urban Design?

Water Sensitive Urban Design (WSUD) is an approach to urban planning and design that integrates the management of the total water cycle into the urban development process. It includes:

- Integrated management of groundwater, surface runoff (including stormwater), drinking water and wastewater to protect water related environmental, recreational and cultural values;
- Storage, treatment and beneficial use of runoff;
- Treatment and reuse of wastewater;
- Using vegetation for treatment purposes, water efficient landscaping and enhancing biodiversity; and
- Utilising water saving measures within and outside domestic, commercial, industrial and institutional premises to minimise requirements for drinking and non-drinking water supplies.

There are many different WSUD measures which together form a 'tool kit' from which individual measures can be selected to form a specific response suiting the characteristics of each development (or redevelopment).

Those measures are described in detail in the WSUD Technical Manual, which can be found online at www.planning.sa.gov.au/go/wsud

Bioretention systems are one such measure.

Bioretention systems can provide both runoff treatment and conveyance functions including:

- The removal of coarse to medium sediments and associated pollutants;
- The removal of fine particulates and associated contaminants by infiltration through the underlying filter media layers;
- Protection of natural receiving waterways from frequent storm events by delaying runoff peaks, providing retention capacity and a reduction in peak flow velocities;
- Swale components can be designed to convey runoff as part of a minor and/or major drainage system; and
- Potential aesthetic and biodiversity benefits.

Application and Scale

Bioretention systems are best suited to small (i.e. less than 5 hectare) catchments with high percentages of impervious areas. Bioretention systems can be appropriate in areas where runoff is insufficient or unreliable, evaporation rates too high, or soils are too pervious to sustain the use of constructed wetlands.

The limitations to the use of bioretention systems include the need for adequate sunlight and pre-treatment for coarse sediments to prevent clogging.

Design Considerations

- Bioretention systems can perform a valuable landscape function. It is important to ensure the planting design addresses runoff quality objectives by incorporating appropriate plant species for treatment of runoff (particularly those with a biologically active root zone);
- Bioretention systems can provide a relatively maintenance free finish if the design considers the type of inorganic mulch, density and type of vegetative plantings and water requirements during dry periods;
- The hydraulic design should prevent scour of the bioretention surface and provide uniformly distributed flow over the surface area. Flow velocities should be below 0.5 metres/second in a minor flood event and not more than 1.0 metres/second for a major flood event to prevent scour;
- Where exfiltration of runoff is not desirable from the drainage layer and the saturated hydraulic conductivity of the bioretention filter media is less than 10 times that of the local soils, it may be necessary to provide an impermeable liner;
- Vegetation that grows in the filter media enhances its function by trapping and absorbing physical pollutants and by preventing erosion of the filter medium. Suitable vegetation characteristics include dense planting, drought tolerant perennial species and no requirement for mowing;
- Selection of bioretention filter media should consider the saturated hydraulic conductivity required (preferably 150-350 millimetres/hour), the depth of extended detention above the filter media and its suitability as a growing medium;

- During construction and operation, access should not be given to traffic. Building materials should not be placed on the bioretention system to avoid compaction of the media; and
- The design must not compromise the width provided in the road verge for services, not allow services to be located below the system invert and should provide sufficient space for maintenance to be performed.

Design Process

The key steps in the design process include:

- Consider site suitability and catchment characteristics (e.g. soil characteristics, local sediment sources, suitability for recharge, traffic volumes, service locations, groundwater depth and quality);
- Establish design objectives and targets. Objectives and targets will differ if the system is designed for detention or infiltration but are likely to include an adequate hydraulic residence time to retain sediments and pollutants;
- Meet with local council to discuss the design objectives, any site constraints and whether approval is required from the council or any other authority;
- Identify land and asset ownership to ensure that maintenance and management responsibilities are clearly understood;
- Consider the design tools available for designing various components of the system;
- Select the type of bioretention system (i.e. swale or basin based on the site constraints and management requirements);
- Size the bioretention system addressing factors including the longitudinal and side slopes, vegetation height, provision of crossings, allowances for services and flow delivery to the system. Consultation with a landscape architect is recommended when selecting the vegetation to ensure the treatment system design integrates with the local area;
- Design the kerb inlets to the system. The inlet must prevent scour while maintaining road safety. Kerbs with gaps are a common design;
- Design the bioretention system components. The design method is determined by the primary function (i.e. conveyance, detention or conveyance and infiltration);
- Check that the bioretention system design meets the design objectives; and
- Develop maintenance and construction plans which contain measures to prevent damage to the system during construction and to assign maintenance tasks and responsibilities for ongoing operation.

Legislative Requirements and Approvals

A thorough investigation of required permits and approvals should be undertaken as part of the conceptual design. This can be assisted through discussions with your local council. A proposed system needs to meet the requirements of the following legislation:

- *Development Act 1993*;
- *Environment Protection Act 1993*;
- *Public and Environmental Health Act 1987*; and
- *Natural Resources Management Act 2004*.

Maintenance Requirements

The most intensive period of maintenance is during the plant establishment period (over the first two years) when weed removal and replanting may be required. The following critical items should be monitored every one to three months during this period:

- Ponding, clogging and blockage of the filter media;
- Establishment of desired vegetation/plants and density; and
- Blockage of the outlet from the bioretention system.

Other ongoing maintenance includes removal of debris from inlets and outlets, mowing or slashing if required and maintenance of plant health and density.

Further Information

While there is a large range of useful resources and further information available on bioretention systems, in the first instance it is suggested that people read Chapter 10 of the *Water Sensitive Urban Design in Greater Adelaide Technical Manual*. Further information is available at www.planning.sa.gov.au/go/wsud

Other Summary Sheets

Other Water Sensitive Urban Design Summary Sheets for the Greater Adelaide Region are available in this series. To download the summary sheets, visit www.planning.sa.gov.au/go/wsud

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