



South Gloucestershire Council

South Gloucestershire *design guide*

This is one of a series of leaflets aimed at encouraging best practice in the planning & design of new development. It was adopted in September 2002 to supplement the policies of the Development Plan.



Sustainable Drainage Systems

Towards Sustainable Development

South Gloucestershire Council and the Environment Agency share the ultimate aim of seeking to achieve sustainable development, and within this the conservation and enhancement of the water resource and biodiversity.

Surface Water Runoff - The Problem

Development can cause a range of adverse impacts on our water resources:

- ▶ By diverting rainfall to piped systems the amount of water infiltrating the ground is reduced. This contributes to depletion of ground water and low flows in water courses.
- ▶ Surface water runoff can contain a wide range of contaminants such as oil, organic matter and toxic metals. Although often at low levels, cumulatively these can result in poor water quality in rivers and streams which affects biodiversity and amenity. After rainfall, the first flush can often be highly polluting.
- ▶ Increased runoff as a result of more extensive hard paving and roofing can increase the risk of flooding downstream, as well as give sudden rises in water levels and flow rates as the water is discharged into watercourses.

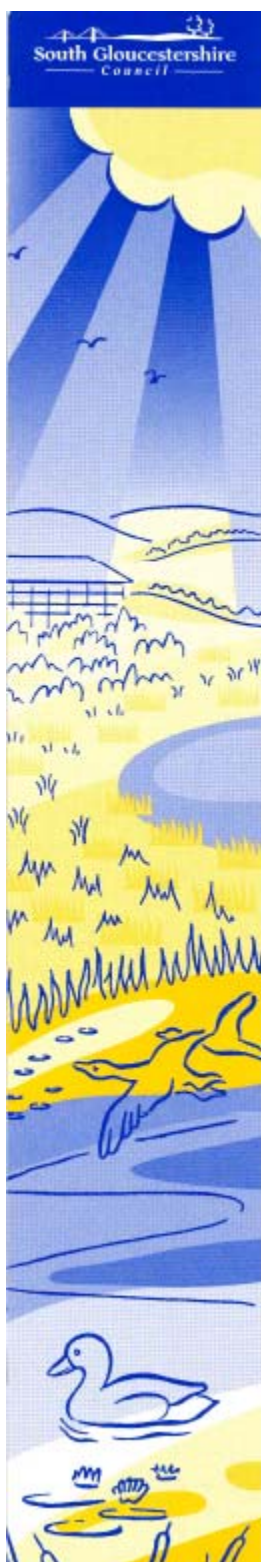
Although some pollution arising from urban runoff may be unavoidable, and water treatment at every outfall may be impractical, by moderating flows and filtering runoff, Sustainable Drainage Systems (SuDS) can deliver significant reductions in impact on the water resource.

What are Sustainable Drainage Systems?

SuDS are physical structures and techniques designed to receive surface water runoff. They can be incorporated into planted and paved areas of the site. The aim is to:

- a) Prevent or remove pollutants by means of ground infiltration, sub base storage and filtration or bio-filtration.
- b) Recharge ground water supplies and aquifers.
- c) Attenuate (storage) to reduce flow and delay discharge to collector watercourses that may be subject to flooding.

A guide for developers August 2003



What are the benefits of SuDS?

The implementation of SuDS may lead to cost savings, by for example avoiding or reducing the need for constructing or requisitioning surface water sewers or for providing piped connections to distant outfalls. SuDS can be cost effectively designed to work with retained natural features such as ditches or ponds and to form an integral part of hard and soft landscaped areas. In this way they can help to produce an attractive scheme which enhances the nature conservation and amenity value of the development while also recycling the valuable water resource. For example, the introduction of water features into new development can improve the quality of the built environment, the quality of life and economic value of the development.

Other benefits include:

- ▶ Reducing the flood risk from development within a river catchment.
- ▶ Minimising dispersed pollution arising from surface water runoff.
- ▶ Minimising the risk of pollution to groundwater.
- ▶ Minimising environmental damage e.g. bank erosion and damage to habitats.
- ▶ Maintaining or restoring the natural flow regime of the receiving watercourse.
- ▶ Maintaining recharge to groundwater.
- ▶ The implementation of appropriate SuDS techniques at the start of a development which can prevent the pollution of watercourses during construction.
- ▶ Eliminating the need for petrol/oil interceptors

The Policy Context

In line with the guidance issued by government in PPG25 South Gloucestershire Council has included a SuDS policy in the South Gloucestershire Local Plan (Revised Deposit Draft). Policies L17 and L17A state that:

Development which would have an unacceptable effect on the water environment, including surface water and groundwater quality and quantity, river corridors and associated wetlands, will not be permitted.

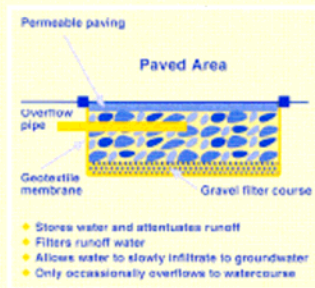
Development proposals will be required to incorporate sustainable drainage systems (SuDS) for the disposal of surface waters. Where this is not practicable it must be demonstrated that an acceptable alternative means of surface water disposal is incorporated.

SuDS also constitute suitable measures for the mitigation of adverse impacts of development, and support the waste conservation objectives set out in Policy 13 of the Joint Replacement Structure Plan.

Sustainable Drainage Techniques

Permeable Pavements

The need for surface water drains and off site sewers can be reduced where runoff is encouraged to permeate through pavements such as concrete blocks, crushed stone, permeable asphalt based or other surfacing. Depending on the ground conditions, the water may infiltrate directly into the subsoil, or be stored in an underground reservoir (e. g. crushed stone layer) before slowly soaking into the ground. If necessary an overflow can keep the pavement free of water in all conditions. Pollutant removal occurs either within the surfacing material itself, or by the filtering action of the reservoir or subsoil.



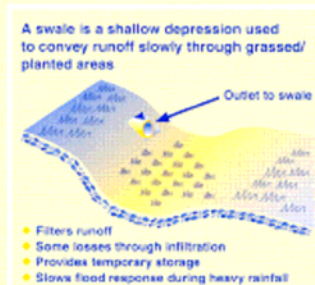
Permeable paving



A South Gloucestershire School

Swales and Basins

These can be created as features within the landscaped areas of the site, or they can be incorporated into ornamental, amenity and screen planted areas where they would be maintained as a part of the normal maintenance contract. They provide temporary storage for storm water, reduce peak flows to receiving waters, facilitate the filtration of pollutants (deposited and incorporated into the substrate) and microbial decomposition as well as facilitating water infiltration directly into the ground. Swales and basins are often installed as part of a drainage network connecting to a pond or wetland prior to discharge to a natural watercourse. They may be installed alongside roads to replace conventional kerbs, therefore saving construction and maintenance costs.



Grassed swale



Nealon Tanner Architects, Bristol

Planted Areas

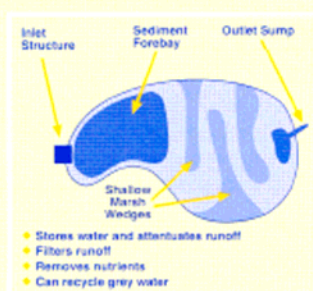
Well vegetated areas play an important role in attenuation by increasing soil organic matter and its ability to retain moisture. The incorporation of planting within a scheme will aid SuDS, whilst visually enhancing the development, promoting its integration within the wider landscape.

Cisterns, Dry Wells & Retention Grading

Runoff can also be stored in cisterns and dry wells for recycling purposes. Cistern collection systems (plumbed into roof drainage), retention grading and driveway dry wells can significantly intercept rainfall. Such solutions are practical and affordable if installed at the initial building stage rather than as an addition to an existing scheme.

Ponds and Wetlands

Although these can be designed as wet or dry ponds, or wetlands, they are most likely to contribute to visual amenity and biodiversity where they include a permanent water body. Ponds or wetlands can be designed to accommodate considerable variations in water level during storms, thereby enhancing flood storage capacity. By allowing adequate detention time, the level of solids removal can be significant. The algae and plants of wetlands can provide a particularly good level of filtering and nutrient removal as well as having the potential to recycle grey water. Ponds and wetlands can be fed by swales, filter drains or piped systems, and the use of inlet/outlet sumps will help reduce sedimentation. Planting of reeds at inlets and outlets will cleanse water as it enters and leaves the pond.



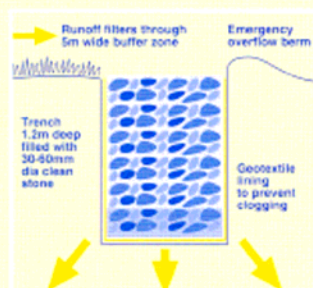
Schematic wetland



University of the West of England

Infiltration Trenches, Basins and Filter Drains

Infiltration trenches comprise stone filled reservoirs to which stormwater runoff is diverted, and from which the water gradually infiltrates the ground. Their longevity is enhanced through the incorporation of a filter strip, gully or sump pit to remove excessive solids at the inflow. Widely used by highway authorities for draining roads, filter drains are similar structures through which a perforated pipe runs. This facilitates the storage, filtering and some infiltration of water on route from the source to the discharge point. Pollutant removal is by absorption, filtering and microbial decomposition in the surrounding soil. Systems can be designed which successfully incorporate both infiltration and filter systems.



An infiltration trench



©Avon Wildlife Trust

SuDS and the Planning Process

SuDS include tried and tested techniques which are already being implemented on a range of projects in South Gloucestershire and elsewhere. They incorporate cost effective techniques which are applicable to a wide range of schemes, from small developments through to major residential, leisure and commercial or industrial operations with large areas of hardstanding and roof. They can also be successfully retro-fitted to existing developments.

As with other key considerations in the planning process, the incorporation of SuDS needs to be considered early on in the site evaluation and planning process, as well as at the detailed design stage. All key existing landscape features should be incorporated into the site layout and it is essential that SuDS be considered at this initial stage.

This Council will expect planning applications, whether outline or detailed, to demonstrate how SuDS will be incorporated into development proposals, and for detailed design information to be submitted at the appropriate stage. Technical officers will be happy to discuss these matters with applicants at any stage before or during the planning application process.

The Council will make use of conditions to secure the implementation of SuDS, where appropriate.

Adoption and Maintenance

Adoption and maintenance of SuDS are associated structures and grills must be considered at the design stage. It is important to incorporate permanent utility vehicle and maintenance access into the landscaping or works. The developer must consider his responsibility, both during and after construction, and submit a management strategy plan to the Council for approval as part of the full planning application. The Council may be prepared to adopt such areas and associated structures under a Section 106 Agreement of the Town & Country Planning Act. However, this would be subject to a commuted sum since the degree of maintenance will be higher than open land.

The Environment Agency and other relevant organisations are working together to ensure that the issue of adoption is resolved. Currently a draft adoption plan is being discussed to ensure that a clear and consistent responsibility procedure is reached leading to an agreed code of practice.

Choosing the right SuDS Mechanism

The choice of SuDS mechanism will depend on a number of factors:

- ▶ *the pollutants present in runoff*
- ▶ *the size of and drainage strategy for the catchment area*
- ▶ *the hydrology of the area and infiltration rate of the soil*
- ▶ *the presence of Groundwater Source Protection Zones*

Large scale ponds and wetlands are generally more appropriate for larger (> 5ha) sites. Infiltration trenches, swales, filter strips and porous pavements are suitable for both large and small sites. Many large sites will incorporate a mix of different mechanisms. SuDS can be incorporated into areas where there is clay subsoil or there is a fairly steep gradient.

Soil Permeability and Hydrology

South Gloucestershire includes a wide range of ground conditions. The area also includes extensive old mine workings which can intercept drainage. Soil permeability can have a significant effect on the selection of SuDS mechanisms. Infiltration techniques may not be effective if the infiltration rate is below 10mm/hr for the upper soil layers. Swales and ponds, working by a combination of filtration and infiltration, are more tolerant of poor soils. In highly permeable soils wet ponds need to be lined. In the vicinity of old mine workings, SuDS must be designed to avoid linking to such features. It is important therefore that developers establish the soil conditions and hydrology of their site at an early stage in the site planning process. The results of such investigations should be provided to the Council as background to the proposals for a drainage system included with the planning application.

Examples of Pollutant Removal Capacity

SuD design	Solids	P o l l u t a n t					Overall
		P	N	BOD	Metals	Bacteria	
Extended detention pond, 24hr detention	●	◐	◐	◐	◐	?	good
As above with shallow marsh	●	◐	◐	◐	◐	?	high
Wet pond, large	●	◐	◐	◐	◐	?	high
Infiltration trench, infiltrates first flush	◐	◐	◐	◐	◐	◐	good
Infiltration basin, infiltrates first flush	◐	◐	◐	◐	◐	◐	good
Porous pavement, infiltrates first flush	◐	◐	◐	◐	◐	◐	good
Filter strip, 6m wide (grass)	◐	○	○	○	◐	?	low
Grassed swale, low gradient	◐	◐	◐	◐	○	?	low

Key ○ 0-20% removal ◐ 20-40% removal ◑ 40-60% removal
 ● 60-80% removal ● 80-100% removal ? insufficient knowledge
 P Phosphorous N Nitrogen BOD Biochemical Oxygen Demand

Soil Type Constraints

BMP	Soil Infiltration Rate (mm/hr)				
	200-12 (sandy)	12-7 (loam)	7-2 (silty)	2-1.5 (silt/clay)	1.5-0.5 (clay)
Extended detention pond	✓	✓	✓	✓	?
Wet pond	?	✓	✓	✓	✓
Infiltration trench	✓	?	✗	✗	✗
Infiltration basin	✓	?	✗	✗	✗
Porous pavement	✓	?	✗	✗	✗
Swale/filter strip	✓	✓	✓	?	?

Key ✓ Feasible ? Marginal- needs careful design ✗ Not Feasible

Source: Protecting the Quality of our Environment:
A Guide to Sustainable Urban Drainage: SEPA/Environment Agency ISBN 1-901322-01-7

Further Information

Protecting the Quality of Our Environment:

Sustainable Urban Drainage - An Introduction - SEPA and the Environment Agency - Rio House, Waterside Drive, Aztec West, Almondsbury, Bristol BS12 4UD. (Tel 01454 624400) ISBN 1- 901322- 12- 8.

Environment Agency website:

<http://www.environment-agency.gov.uk> contains initial assessment on current research on SuDS

Scope for Control of Urban Runoff:

CIRIA Report 124. Construction Industry Research and Information Association, London SW1P 3AU (Tel 02072 228 891)

CIRIA's two SuDS manuals:

C522 Sustainable urban drainage systems - design manual for England and Wales and C523 Sustainable urban drainage - best practice handbook.

Urban Drainage - the Natural Way:

Hydro Research and Development, Clevedon, BS21 7RD (Tel 01275 878371).

South Gloucestershire Council, Planning, Transportation & Strategic Environment:

Castle Street, Thornbury, Bristol, BS35 1HF (Tel 01454 868686) www.southglos.gov.uk

Groundwater Source Protection Zones:

For further information contact your local EA office

This guidance should not be read in isolation, but with all other relevant planning policies of the Council.

Consultation Process

This guidance was published as an interim advice note in 1999. It was subject to advertisement and public consultation from 17th December 2001 to 17th January 2002. As a result of comments received a revised leaflet was considered by the Council and the final version was adopted on the 30th September 2002.

Full details of the consultation process are available from the Council.



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