Guide to Sustainable Drainage Systems (SUDS)

Practical guidance for developers on achieving sustainable drainage

This guidance document provides practical advice to developers seeking to deploy the use of sustainable drainage systems (SUDS).

SOUTHAMPTON CITY COUNCIL ®

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1. Introduction

Context

The occurrence of current global climate change has caused previously rare environmental issues to rise to prominence in the UK. In the past year extreme weather events have led to devastating flash floods and forecasters are predicting more of the same.

Progressive urban development and changing climatic patterns have resulted in a major increase in surface run-off to water courses. This is partly due to the increase in flooding events.

The city of Southampton is situated in the catchment of the rivers Test and Itchen, both of which drain into Southampton Water. The low-lying city centre is located directly on the coastline of Southampton Water, much of which faces a severe flooding threat.

Amplifications in the volume of surface run-off increase the probability of water pollution and risks exacerbating flooding further downstream. In the case of Southampton, downstream is the city centre, ensuring drainage issues remain priority.

Achieving a sustainable way of managing water resources is one way of dealing with hazard and risk. The ability to provide sustainable drainage is the key to the long-term stability of water resources.

Purpose of this Guide

The purpose of this guidance document is to assist developers in the deliverance of sustainable drainage systems (SUDS). The information includes individual methods and techniques available for use and site suitability advice.

The overall aim is to provide detailed insight into constructing site specific Sustainable Drainage Systems.

Format

This guide is structured into four main sections covering the current urban drainage system, the concept of sustainable drainage, the varying SUDS available for use and the site specific selection of SUDS.

2. Urban Drainage

Built-up areas need to be drained to remove surface water. The conventional approach to draining surface water has been through underground pipe systems that convey water from built up areas. These traditional urban drainage systems focus on quantity as they aim to remove excess water away from urban areas as quickly as possible to avoid possible flooding incidents.

Traditional drainage systems have not been designed with sustainability in mind. The majority do not pay sufficient regard for flood control, water quality, water resources or biodiversity requirements.

Urban drainage systems have caused an alteration in natural flow patterns, not necessarily having an effect locally, but do cause problems elsewhere in the catchment area.

Water quality has become an increasingly significant issue as surface run-off from urban areas results in the contamination of the watercourse. A polluted watercourse is extremely difficult to resolve and is an important issue that drainage systems must take into consideration.

As urban areas become increasingly developed, continued water management is a necessity and for this to be sustainable, a broad approach to the issue of drainage must be adopted. This approach will seek to avoid future impacts upon the surrounding natural environment.

3. Sustainable Drainage

Sustainability can exist in the complex network of the urban drainage system. Implementation of sustainable design techniques will serve to produce a long-term viable drainage system.

Surface water drainage systems which consider quantity, quality and amenity issues are referred to as Sustainable Drainage Systems (SUDS). These drainage systems are more sustainable than traditional systems because they:

- Control the flow rate of surface run-off, reducing the impact of urbanisation.
- Protect and / or enhance water quality.
- Give consideration to the natural environment and community needs.
- Create new wildlife habitats among the watercourses.
- Promote natural groundwater recharge.

This sustainable approach to urban drainage is a success because the systems aspire to deal with surface run-off at the point of which it occurs and to manage potential pollution at its source. The introduction of SUDS into an area allows future development to take place in areas where the capacity of the traditional drainage system is full.

The philosophy behind SUDS is to mimic natural drainage processes, remove pollutants and manage flood risk at source, whilst proving to be a significant contributor to increased biodiversity.

4. SUDS Techniques

Introduction

The SUDS approach to drainage includes a wide range of methods. As a consequence of this, there is no one correct drainage solution for a site. In the majority of occasions a combination of techniques results in best practice.

SUDS techniques can be divided into four categories; Control of rainwater at the source, Infiltration trenches and filter drains, Swales and basins and Ponds and wetlands.

Source Control

Green roofs

Green roofs are multi-layered systems comprising of vegetation cover or landscaping above a drainage layer.

Their aim is to intercept and retain precipitation which then results in less surface run-off.

Advantages:
- Effectively remove pollutants
- Suitable for high density developments
- Ecological, aesthetic and amenity benefits
- No land take necessary
- Air quality improvement

Disadvantages:
- More expensive than traditional runoff
- Not suitable for steep roofs
- Roof vegetation needs maintenance
- Waterproofing vital as is roof acts as a sink
- Provide building insulation
- Sound absorbers

Rainwater Harvesting

Rainwater from impermeable surfaces is stored and used.

The purpose of rainwater harvesting is to reuse water and reduce the rates of surface run-off.

Advantages:
- Control the flow of surface run-off
- Reduces the demand for mains water

- Methods such as water butts are cheap and easy to install

Disadvantages:
- Pollution risk
- Underground storage tanks can be complex and costly
- Unsightly if storage is above ground

Permeable Pavements

Permeable pavements provide a durable surface which allows surface water to infiltrate through the pavement and into the soil beneath. The water can be temporarily stored in the pavement before it is infiltrated or released into a drainage system.

Advantages:
- Remove pollutants
- Reduce the rates of run-off
- Low maintenance
- No land take

Disadvantages:
- Cannot be used in areas at risk of being swamped by large sediment loads
- Untested in areas of high speed and large traffic volumes
- Ice prevention
- Prevention of surface ponds

Infiltration and Filtering

Infiltration Trenches

An infiltration trench is a shallow, excavated channel that has been filled with stone aggregate to create an underground storage reservoir.

The purpose of these trenches is to allow run-off to infiltrate into the ground as it enters the trench.

Filtration Trenches / Drains

Filtration trenches or drains are similar in construction to that of infiltration trenches apart from a perforated pipe runs through the narrow channel.

The purpose of this is to allow water to filtrate into the surrounding soil and into the pipe which then transfers the water to a disposal unit.

Advantages:
- Infiltration reduces run-off
- Water pollution is reduced by filtration through the soil
- Trenches can be built into the landscape

Disadvantages:
- Blockages are common and difficult to find

- Build-up of pollutants difficult to see
- Limited to small catchments
- High replacement cost

Swales and Basins

These variations on SUDS can be created as features within the landscaped areas of a site or incorporated into ornamental pieces. The features can be installed as part of a drainage system connecting to either a pond or a wetland area.

Swales

A swale is a grassed area of depression which guides surface run-off overland from the source area to a storage or discharge system.

Swales can be incorporated into the landscape as roadside kerbs avoiding alternative construction methods. Swales are wide, shallow like ditches which provide temporary storage, transport, treatment and the infiltration of surface water.

Basins

Basins are designed to hold back water for a few hours to ensure a settlement of solids.

Basins are only temporarily in use, and outside of storm periods they remain dry. They provide short-term water storage and the settlement of solid ensures water filtration reducing contamination.

Ponds and Wetlands

Ponds and wetlands are natural ecosystems and in their original form are valuable parts of the drainage system.

The construction of these permanent water bodies will contribute to visual amenity and biodiversity and can form an intrinsic link in a network of sustainable drainage systems.

Ponds and wetlands can be designed with the potential to store various levels of water at different times. This makes them features which deal with surface run-off and enhance the flood-storage capacity for a particular drainage system.

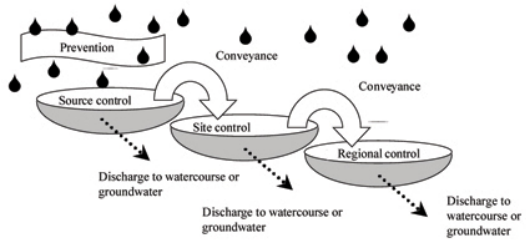
The use of existing wetlands or ponds for the treatment of surface water is unlikely to be acceptable, but this does not inhibit the creation of new water features.

5. Selection of SUDS

SUDS Management Train

The surface water management train addresses the issue of drainage in stages, in conjunction with the processes occurring in a natural catchment.

The process begins with the prevention on an individual basis and progresses to local and regional control. Surface run-off does not have to pass through all stages of the management train. The aim is to deal with the problem locally and then return the water at its source. If this is not possible then the water can be conveyed elsewhere using the additional stages of the management train.



Surface Water Management Train, (Ciria, 2000).

SUDS Selection

SUDS are designed using the same principles of hydrology as traditional drainage systems, but different methods of application.

Equal consideration must be given to the issues of quality, quantity and amenity resulting in a multi-disciplinary approach to drainage.

SUDS are selected in accordance with the Surface Water Management Train. The preferred technique is to deal with surface run-off close to the source and to manage it locally. The management train recommends using a variety of techniques to deal with the issue of drainage. Drainage systems are part of a wider cycle of water and consideration of this is a must in terms of the development process.

Site Suitability

Site variation identifies the need for the usage of different types of SUDS. Site location, size and urban density all inhibit the type of SUDS that can be implemented.

The selection of drainage systems is not a clear-cut process and the table below only gives a generic answer to a far more complex question. Assessments of site capability must be considered in a wider context with a broader geographical focus rather than limited technical details.

Source control is the preferred method of water resource management. The key to source control is prevention instead of mitigation, if hazards are not realised then risk does not have to be managed.

Site Suitability for SUDS

	Residential	Commercial / Industrial	High Density	Retrofit	Contaminated site
Green Roofs	Yes	Yes	Yes	Yes	Yes
Rainwater Harvesting	Yes	Yes	Yes	Yes	Yes
Permeable Pavements	Yes	Yes	Yes	Yes	Yes
Infiltration Trenches	Yes	Yes	Yes	Yes	No
Filtration Drains	Yes	Yes	Yes	Yes	Yes
Swales	Yes	Yes	No	Yes	Yes
Basins	Yes	Yes	No	Yes	Yes

Further Information

Natural England: http://www.naturalengland.org.uk/
Environment Agency: http://www.environment-agency.gov.uk/
CIRIA: http://ciria.org.uk/suds/
OFWAT: www.ofwat.gov.uk

Green Roofs: http://www.livingroofs.org/

Example of some SUDS:
http://www.britanniaservices.co.uk/rainwater/about.html
http://www.ecofirst.net/Rainwater-Harvesting.asp

Example of green roofs:
http://www.greenroof.co.uk/
http://www.icb.uk.com/

Contact: Rob Crighton, Sustainability Officer, 023 8083 2322
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This written information is available on request in other formats or languages. Please contact 023 8083 4262 for help.

www.southampton.gov.uk/sustainability

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