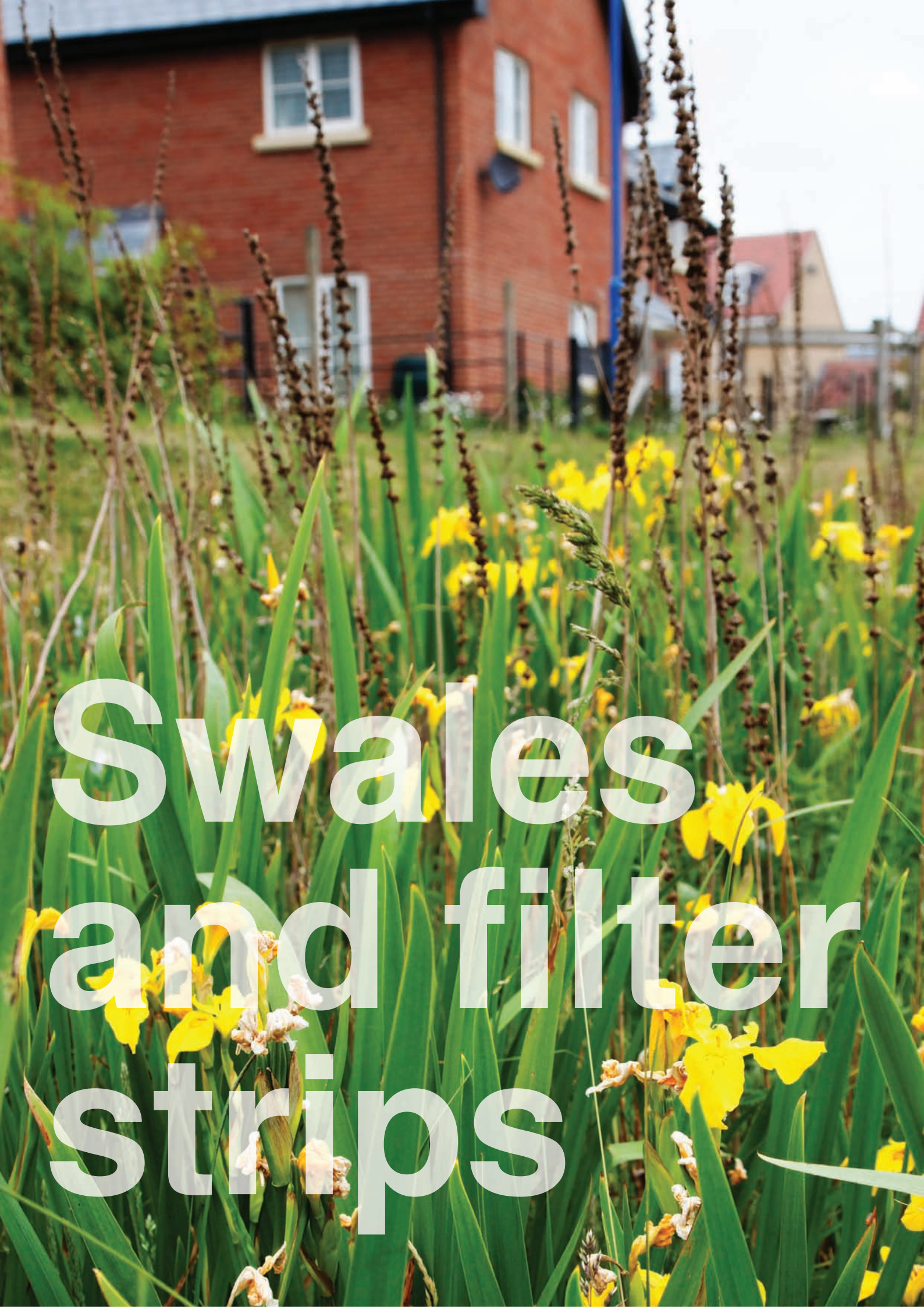


Swales and filter strips

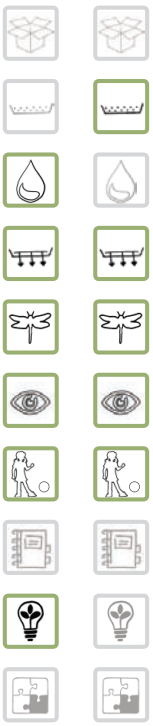
Swales and filter strips

Description

Swales are very shallow channels that are used to collect and/or move water and also remove pollution from it. They can be covered by grass or other vegetation and have shallow side slopes and a flat bottom which means that for most of the time the water flows in a thin layer through the grass or other vegetation.

Filter strips are gently sloping areas of grass that water flows onto and across, usually towards a swale or filter drain. The main purpose of the filter strip is to remove any silt in the water so that it does not clog up the swale or filter drain.

Benefits

Swales	Filter strips
	

Shallow swale in a housing development, Malmo, Sweden

Filter strip leading to a filter drain. The filter strip removes silt and reduces the maintenance required for the filter drain, Hopwood services, M42

How they work

Swales and filter strips are source control elements of SUDS. They are simple and yet are very effective in managing surface water runoff. The grass or other vegetation slows water down and also traps some of it by allowing it to soak into the ground. In addition, the plants help evaporate some water and filter out pollution from the water.

Swales can have a wet base, in which case they will behave like a wetland. In areas where a wet base is not desirable (for example along the edge of streets) a perforated pipe and sand or gravel can be installed below the bottom (under drain). A particular type of under drained swale can be constructed with enhanced vegetation and filtration; these are known as rain gardens, bioswales or bioretention areas. They are essentially landscaped areas that are depressions to collect and treat rainwater.

Small filter strips that are 1m to 2m long, leading to the side slope of a swale, are an ideal way of allowing water to enter the swale.

Recently constructed rain garden (bio retention) in a car park, Maryland, USA

Cambridge specific design considerations

The exact profile of swales will depend on the specific ground levels, topography, and ground/soil conditions present at the site, as well as its orientation, aspect and proximity to other landscape features, buildings, etc. The swale should have an appropriate scale and form to suit the surrounding landscape character. In green open spaces they should have a natural feel with soft edges and forms that flow into the surrounding area. Hard edges and straight lines may be appropriate in some hard urban landscapes.

The design should contribute to the amenity of the local communities.

There should be an assumption to retain all existing native trees and vegetation. The layout of the swales should respect the presence of trees, and in particular, ensure that their root systems are not compromised. Proposals should accord with BS5837 2005 and take account of any implications resulting from the presence of Tree Preservation Orders (TPOs) and Conservation Areas designations.

Small interpretation boards should be provided and should include information relating to the function of the swale and the local fauna and flora the system supports.

Children paying in a shallow swale designed to provide amenity, School, Worcestershire

Planting

The City Council will expect swales and filter strips to be planted to enhance biodiversity and contribute to local, national and regional aims, for example Biodiversity Action Plans (BAP). Considerations will include:

- Linking to existing wildlife corridors
- Providing a diverse range of plants that are suited to the specific conditions of a SUDS swale (tolerant of varying water levels, slight pollution, etc.).

Planting in the swale or filter strip is essential to stabilise slopes, reduce erosion and slow water flows to aid sedimentation, as well as to provide some nutrient take up.

Planting should be designed to establish quickly and water should not be allowed to flow in swales until the vegetation is established (or erosion protection is provided).

Hard swale to suit surrounding urban landscape, Portland, USA

Shallow swale alongside a distributor road – check dams maximise storage and slow water, Witney, Oxfordshire

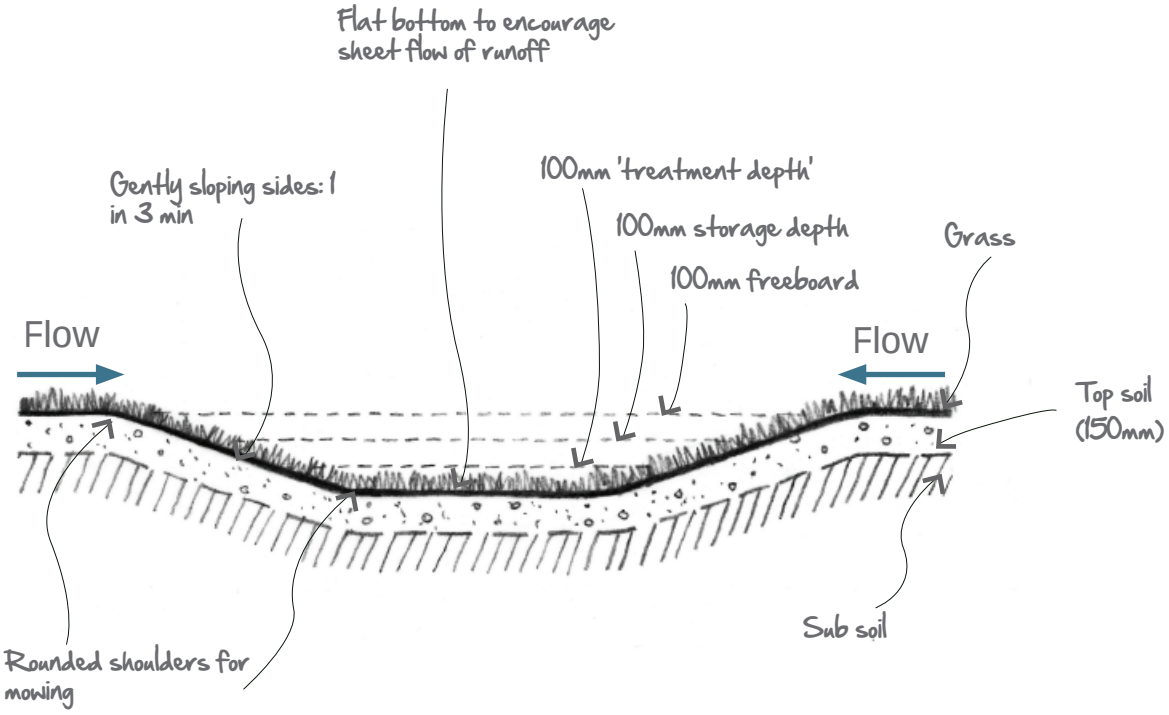
Practical issues and solutions

Many problems that have occurred with swales are due to a lack of attention during design and construction. Some of the most common pitfalls and solutions are discussed below. CIRIA publication C698: Site Handbook for the Construction of SUDS also contains practical construction help and advice.

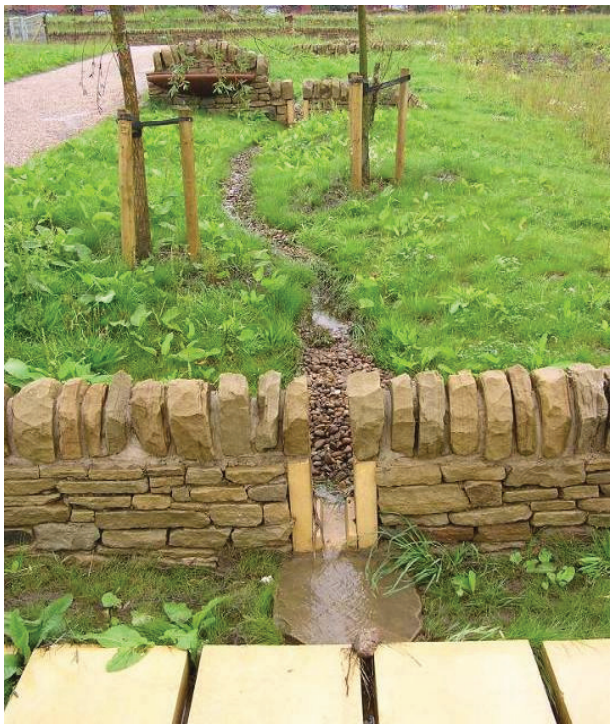
Problem: Wet or boggy patches develop in base where not designed for.	**Solution:** This often occurs because the base has not been constructed to the correct levels and there may be a low point in the swale. Construct to correct levels and possibly use a rootzone material to cover the base, and/or an underdrain.
Problem: Silt build up during construction	**Solution:** Manage construction runoff and prevent it entering the swale by using straw bales or geotextile traps. If the swale is used to control construction runoff remove silt at end of project.
Problem: Erosion during construction before planting is established.	**Solution:** The easiest solution is to reuse topsoil without any application of weed killer. This allows existing vegetation in the topsoil to establish quickly. Another alternative is to use biodegradable erosion control mats or turf.
Problem: Erosion after planting is established. Occurs if the water is forming channels due to incorrect levels, or the filter strip vegetation is higher than the edge of the paved area it is draining.	**Solution:** Correct detailing and tolerances during construction. Drop from edge of hard area to filter strip or swale should be 20mm to 25mm and the tolerance on construction of a filter strip should be 10mm level difference in 3m at right angles to the water flow.
Problem: Water does not flow over edge into swale along whole length (where designed to do so) and enters via preferential route and concentrates flows and silt in one area.	**Solution:** Ensure that where over-the-edge drainage is required the grass is 20mm to 25mm below the edge of the hard surface to be drained.

Water flows along edge of grass before entering swale

High grass at edge of road prevents water entering swale

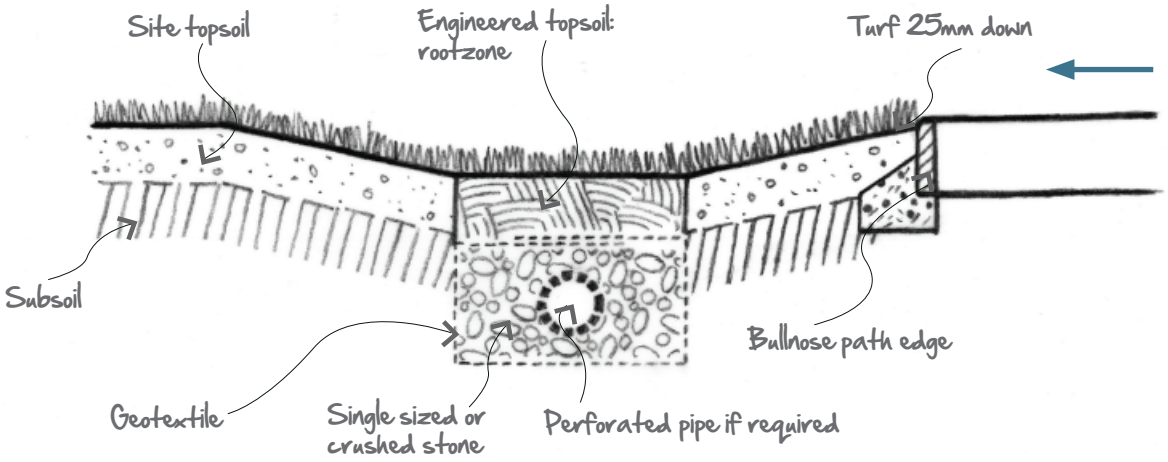


Cross section through a swale

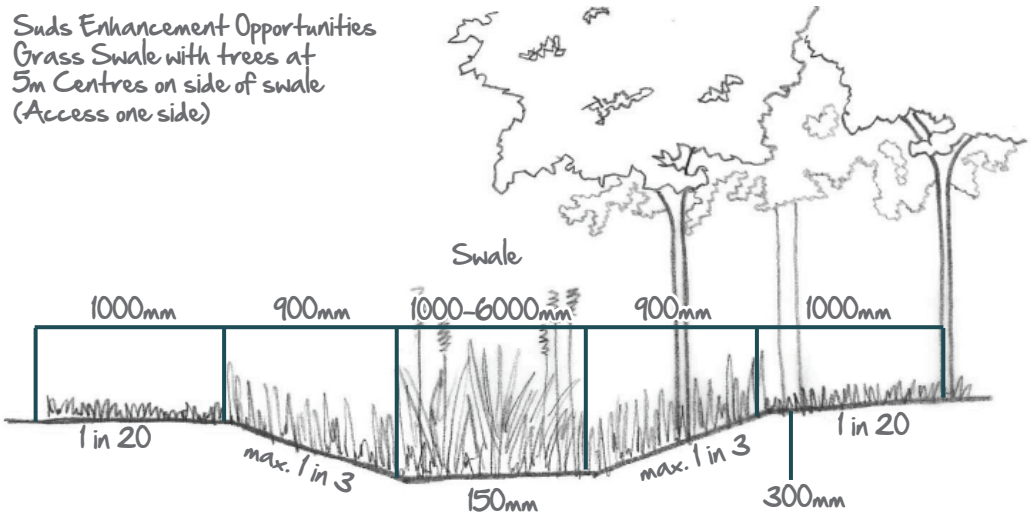


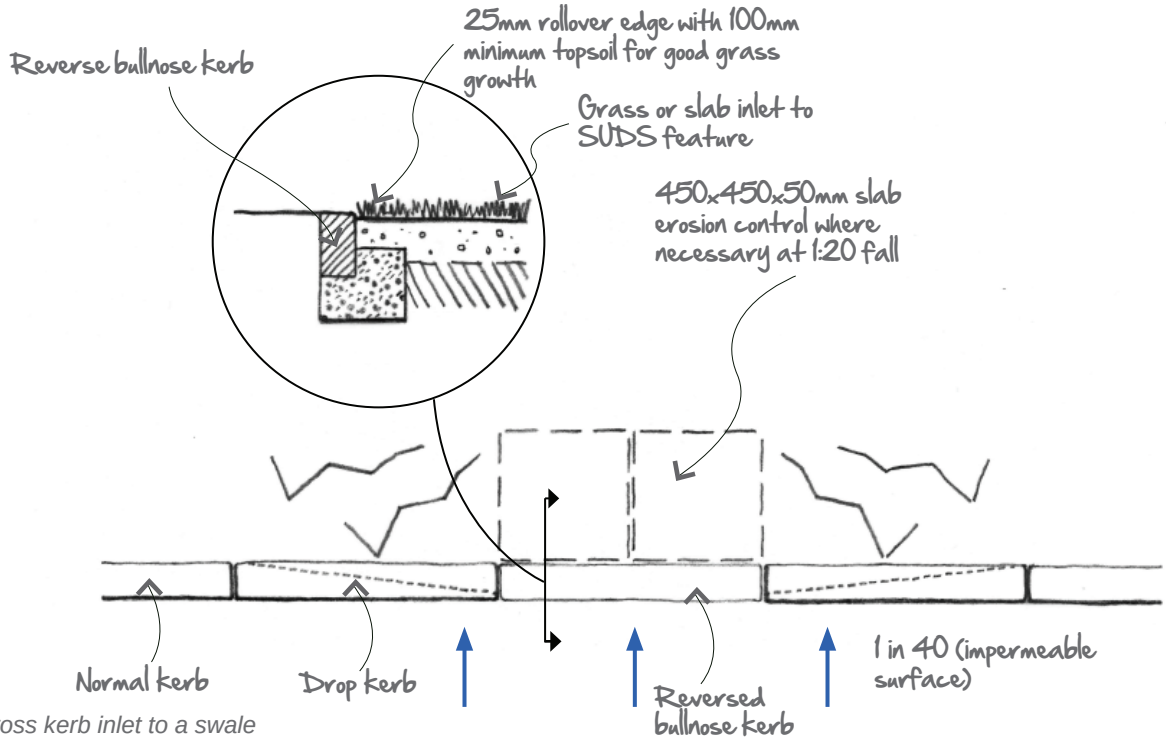
Swale detail where it passes through a wall in a park, Sheffield

Swale integrated onto surrounding ground in a park, Sheffield



Cross section through enhanced or dry swale with under drain





Cross kerb inlet to a swale

Maintenance requirements

Maintenance of swales and filter strips is relatively straight forward for landscape contractors and typically there is only a small amount of extra work required over and above that required for any open space.

More intensive maintenance work such as silt and/or vegetation removal is only required intermittently but it should be planned to be sympathetic to the requirements of wildlife.

The swales and filter strips should be designed so that special machinery is not required to undertake maintenance. Grass cutting should not be carried out when the swale or filter strip is wet.

The costs of maintenance can be found at Appendix B.

Shallow swale in a housing development with wetland planting, Elvetham Heath

Do not cut grass when swale is wet