
Cambridge City Council
The Cambridge Approach to SuDS
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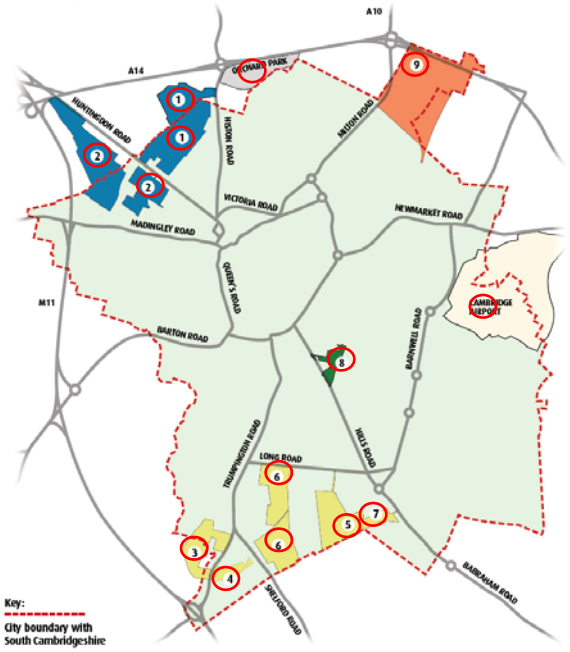
CAMBRIDGE
CITY COUNCIL

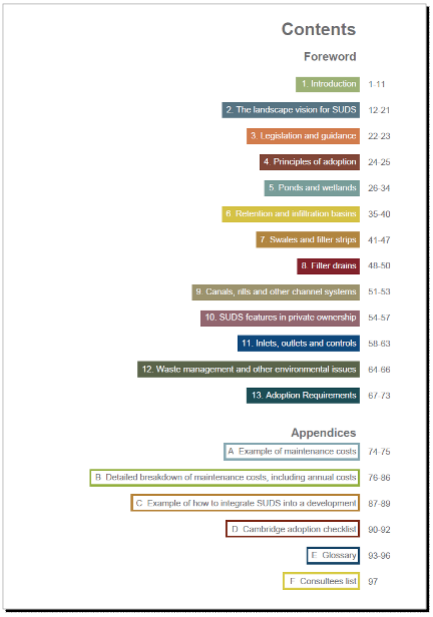

Drivers:
Growth
Existing Infrastructure
Elected Members
Sustainability

1 NIAB – 1593 homes
2 University – 3000 homes + 2000 bed student accommodation
3 Trumpington Meadows – 1200 homes
4 Glebe Farm – 286 homes
5 Addenbrooks 20:20 – medical research campus creating 9000 jobs
6 Clay Farm – 2300 – homes
7 Bell School – 347 homes + 100 bed student accommodation
8 CB1 – 331 homes + 1250 bed student accommodation
9 North East Cambridge East Cambridge?
Orchard Park – 1120



SUSTAINABLE DRAINAGE
Cambridge Design and Adoption Guide

What is in the Guide?



Contents

Key of benefits arising from specific SUDS measures

- Water storage: Providing long and short term storage of water during a storm event
- Silt removal: Removing suspended sediments in water
- Pollutant treatment: Effective treatment of polluted water
- Infiltration: Allowing water to soak into the ground
- Biodiversity: Increasing the variety of plants and wildlife
- Visual amenity: Providing attractive, useable and pleasing features
- Play: Open space available for physical activities
- Education: Learning opportunities with wildlife and water management
- Embodied Energy: Reduction in construction energy
- Adaptability: Easily changed for additional future capacity

Each sustainable drainage component throughout this document has been rated for all of the above benefits that they can provide. By comparison a traditional drainage scheme will only score high on storage.

Landscape and urban design focused

The landscape vision for SUDS

The Cambridge landscape

Cambridge lies at the edge of the East of England fenlands with its open, flat and low-lying landscape dissected by numerous rivers, dykes and drainage ditches. Cambridge itself has a distinct and unique local landscape character where water has always been present and has been woven into the fabric of the city by way of the River Cam, its tributaries, and its water meadows.

The city will experience considerable growth over the next decade as a result of being designated as part of one of the four national growth areas. Ensuring this growth is implemented sensitively, with due regard to the existing character of the City, and championing a high standard of design, will be paramount in protecting and maintaining the distinctiveness of the Cambridge landscape.

The promotion of SUDS is one measure whereby the council's aims for quality, sustainable development, work hand in hand with its aim to ensure that the vital character of the city is maintained and enhanced.

By using the landscape to manage rainfall and harness water in a creative way, SUDS will strengthen local distinctiveness and add value to the local environment. For this reason, it is important that design teams have a strong landscape focus.

It is important to remember that the primary and overriding function of SUDS is to drain surface water effectively, and this function must not be compromised by other design considerations. Effectiveness and quality of design must be considered together.

Hobson's Conduit – Water in the landscape in central Cambridge

Coe Fen – Wetland in central Cambridge

Wetland, The Docks, Cambridge

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The urban canal

Just outside the city centre, Hobson's Conduit is a slow moving canal with a formal character that is appropriate for urban areas. It is particularly suitable for courtyards and as part of a conveyance system between urban development centres. Although the canal may have a formal design, the content of the canal can be designed with high biodiversity value with access points for wildlife along the edge.

Another famous Cambridge characteristic is its water meadows or floodplain adjacent to the River Cam, which are in parts bounded by residential developments. These water meadows are often grazed and are unique in as much as they extend into the city itself, for example Sheep's Green. Again, these are a much loved feature and typify the Cambridge landscape.

Hobson's Conduit in Trumpington Street

Specific constraints in Cambridge

A large part of Cambridge is underlain by clayey soils (Gault Clay to the west of the River Cam and Chalk Marl to the east) which will limit the opportunities to use infiltration methods such as soakaways. However, this is not always the case. In some areas there are sand and gravel deposits over the top of the clay soils that may be suitable for infiltration. In many areas there is shallow groundwater in the sand and gravels and the variation in water levels must be understood and their effect on the operation of infiltration systems allowed for.

Each site should be evaluated on its own merits by undertaking comprehensive soil Standard BS 5930: 1999, Code of practice for site investigations, including infiltration testing and groundwater level monitoring. This will identify any opportunities for infiltration.

Although clay soils may prevent a complete infiltration solution it will still be possible to use other SUDS features such as ponds, wetlands and swales. It is also possible to allow some water to soak into the ground, even if the drainage design calculations do not allow for it (for example out of the bottom of an unlined swale).

Sheep's Green water meadow near Cambridge city centre

Fill leading to an urban wetland - Malmo

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Cambridge specific and multi disciplinary

Swales in Cambridge

One particular character of watercourses in the fen landscape is the shallow gradient of ditches and wetlands where water moves slowly under hydraulic pressure rather than by gravity and a topographical gradient.

This hydraulic pressure results in ditches with a very gentle or negligible slope and shallow, slow moving permanent water in the base. This allows the development a linear wetland with say, common reed (Phragmites communis) the dominant plant. The use of a wet swale retaining water in the bottom for most of the year creates a SUDS feature that reflects the character of the fen landscape and provides enhanced biodiversity. The growth of common reed both in summer and in winter, when the stems remain until spring, provides a visual route marker or informal hedge to develop a subtle space hierarchy.

Therefore, the normal swale profile, which has a fall to drain by gravity, is modified to a local variant that drains by hydraulic pressure to create a linear fenland wetland with a local character. The fenland swale provides a visual link through the landscape with high biodiversity value.

The flat gradients can cause problems for piped drainage because it often results in very deep trenches and large pipe diameters. SUDS can deal with the shallow or even totally flat gradients in the same way that nature has done, by using wide shallow features to manage water flows.

Waterbourne at Clay Farm, in Trumpington with common reed

The landscape vision for SUDS

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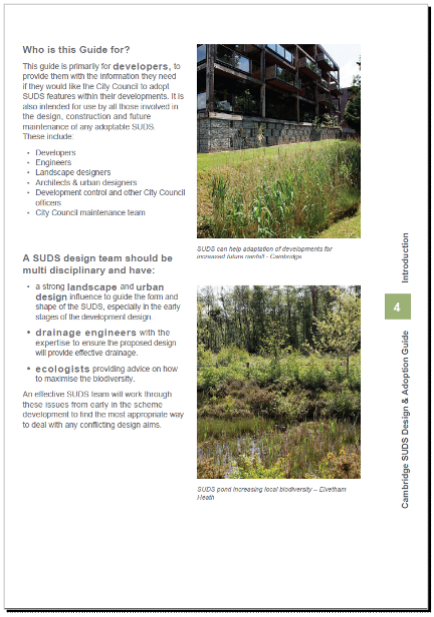

Who is this Guide for?

This guide is primarily for **developers**, to provide them with the information they need if they would like the City Council to adopt SUDS features within their developments. It is also intended for use by all those involved in the design, construction and future maintenance of any adoptable SUDS. These include:

- Developers
- Engineers
- Landscape designers
- Architects & urban designers
- Development control and other City Council officers
- City Council maintenance team

SUDS can help adaptation of developments for increased future rainfall - Cambridge

A SUDS design team should be multi disciplinary and have:

- a strong **landscape** and **urban design** influence to guide the form and shape of the SUDS, especially in the early stages of the development design.
- **drainage engineers** with the expertise to ensure the proposed design will provide effective drainage.
- **ecologists** providing advice on how to maximise the biodiversity.

An effective SUDS team will work through those issues from early in the scheme development to find the most appropriate way to deal with any conflicting design aims.

SUDS pond increasing local biodiversity – Elvetham Heath

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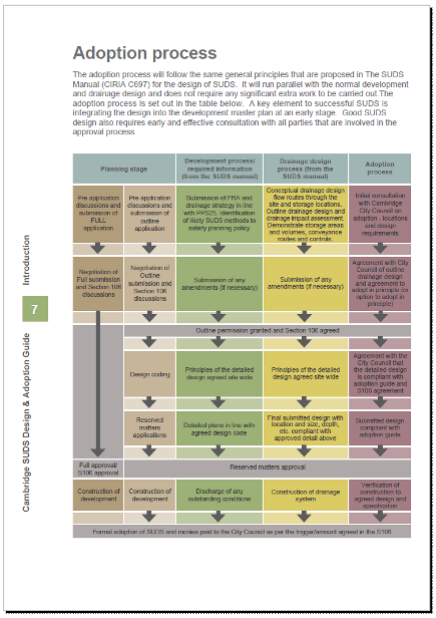
What we will adopt and the process



Adoption process

The adoption process will follow the same general principles that are proposed in The SUDS Manual (CIRIA C697) for the design of SUDS. It will run parallel with the normal development and drainage design and does not require any significant extra work to be carried out.The adoption process is set out in the table below. A key element to successful SUDS is integrating the design into the development master plan at an early stage. Good SUDS design also requires early and effective consultation with all parties that are involved in the approval process.

Planning stage	Development process/ required information (from the SUDS manual)	Drainage design process (from the SUDS manual)	Adoption process
Pre application discussions and submission of FULL application	Pre application discussions and submission of outline application	Submission of FRA and drainage strategy in line with PPS25. Identification of likely SUDS methods to satisfy planning policy	Conceptual drainage design: flow routes through the site and storage locations. Outline drainage design and drainage impact assessment. Demonstrate storage areas and volumes, conveyance routes and controls.	Initial consultation with Cambridge City Council on adoption, locations and design requirements.
Negotiation of Full submission and Section 106 discussions	Negotiation of Outline submission and Section 106 discussions	Submission of any amendments (if necessary)	Submission of any amendments (if necessary)	Agreement with City Council of outline drainage design and agreement to adopt in principle (or option to adopt in principle)
Outline permission granted and Section 106 agreed				
Design coding	Principles of the detailed design agreed site wide	Principles of the detailed design agreed site wide	Agreement with the City Council that the detailed design is compliant with adoption guide and S106 agreement
Reserved matters applications	Detailed plans in line with agreed design code	Final submitted design with location and size, depth, etc. compliant with approved detail above	Submitted design compliant with adoption guide
Full approval S106 approval	Reserved matters approval		
Construction of development	Construction of development	Discharge of any outstanding conditions	Construction of drainage system	Verification of construction to agreed design and specification
Formal adoption of SUDS and monies paid to the City Council as per the trigger/amount agreed in the S106			

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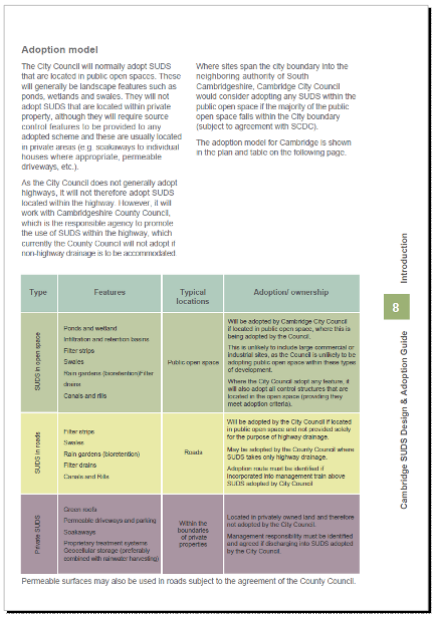

Adoption model

The City Council will normally adopt SUDS that are located in public open spaces. Those will generally be landscape features such as ponds, wetlands and swales. They will not adopt SUDS that are located within private property, although they will require source control features to be provided to any adopted scheme and these are usually located in private areas (e.g. soakaways to individual houses where appropriate, permeable driveways, etc.).

As the City Council does not generally adopt highways, it will not therefore adopt SUDS located within the highway. However, it will work with Cambridgeshire County Council, which is the responsible agency to promote the use of SUDS within the highway, which currently the County Council will not adopt if non-highway drainage is to be accommodated.

Where sites span the city boundary into the neighboring authority of South Cambridgeshire, Cambridge City Council would consider adopting any SUDS within the public open space if the majority of the public open space falls within the City boundary (subject to agreement with SCDC).

The adoption model for Cambridge is shown in the plan and table on the following page.

Type	Features	Typical locations	Adoption/ ownership
SUDS in open space	Ponds and wetland Infiltration and retention basins Filter strips Swales Rain gardens (bioretention)/Filter drains Canals and rills	Public open space	Will be adopted by Cambridge City Council if located in public open space, where this is being accepted by the Council. This is unlikely to include large commercial or industrial sites, as the Council is unlikely to be adopting public open space within these types of development. Where the City Council adopt any feature, it will also adopt all control structures that are located in the open space (providing they meet adoption criteria).
SUDS in roads	Filter strips Swales Rain gardens (bioretention) Filter drains Canals and Rills	Roads	Will be adopted by the City Council if located in public open space and not provided solely for the purpose of highway drainage. May be adopted by the County Council where SUDS takes only highway drainage. Adoption route must be identified if incorporated into management train above SUDS adopted by City Council
Private SUDS	Green roofs Permeable driveways and parking Soakaways Proprietary treatment systems Geocellular storage (preferably combined with rainwater harvesting)	Within the boundaries of private properties	Located in privately owned land and therefore not adopted by the City Council. Management responsibility must be identified and agreed if discharging into SUDS adopted by the City Council.

Permeable surfaces may also be used in roads subject to the agreement of the County Council.

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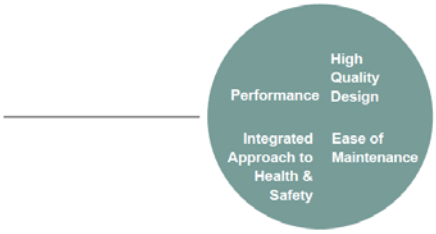
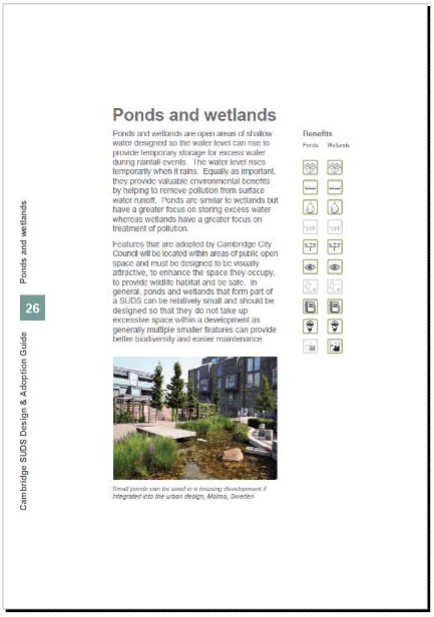
Principles of adoption

Reduce flood risk	Micro managed bespoke design
Improve water quality	Integration with wider landscape setting
Delivering biodiversity benefits	Use of robust, low impact materials
Provide amenity for residents	Designed to be attractive all year round



Easily identifiable features and risk	Simple, surface features
Shallow gradients	Minimise use of grills and other engineered features
Planting and design used to create barriers where necessary	Shallow gradients
	Robust appropriate planting for ease of maintenance but not at the expense of biodiversity (unless erosion prevention is a priority)

Typical section – Ponds and wetlands



Ponds and wetlands

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Ponds and wetlands

Ponds and wetlands are open areas of shallow water designed so the water level can rise to provide temporary storage for excess water during rainfall events. The water level rises temporarily when it rains. Equally as important, they provide valuable environmental benefits by helping to remove pollution from surface water runoff. Ponds are similar to wetlands but have a greater focus on storing excess water whereas wetlands have a greater focus on treatment of pollution.

Features that are adopted by Cambridge City Council will be located within areas of public open space and must be designed to be visually attractive, to enhance the space they occupy, to provide wildlife habitat and be safe. In general, ponds and wetlands that form part of a SUDS can be relatively small and should be designed so that they do not take up excessive space within a development as generally multiple smaller features can provide better biodiversity and easier maintenance.

Benefits

Ponds Wetlands

Small ponds can be used in a housing development if integrated into the urban design, Malmo, Sweden

Ponds and wetlands

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How they work

In a well designed system most of the storage and treatment is performed by the upstream source control elements of the SUDS. Ponds and wetlands will provide a final 'polish' to remove any remaining pollution. This is achieved by ensuring that water flows slowly through the pond over an extended period of time. The time water takes to travel through is known as the residence time. The greater this is the slower the water flow, which helps silt drop to the bottom of the pond and allows the vegetation and other organisms to remove pollution.

An important mechanism is biodegradation of oils by natural organisms in the pond. The organisms need a good supply of oxygen which means the permanent water must be shallow so oxygen can reach the bottom of the pond.

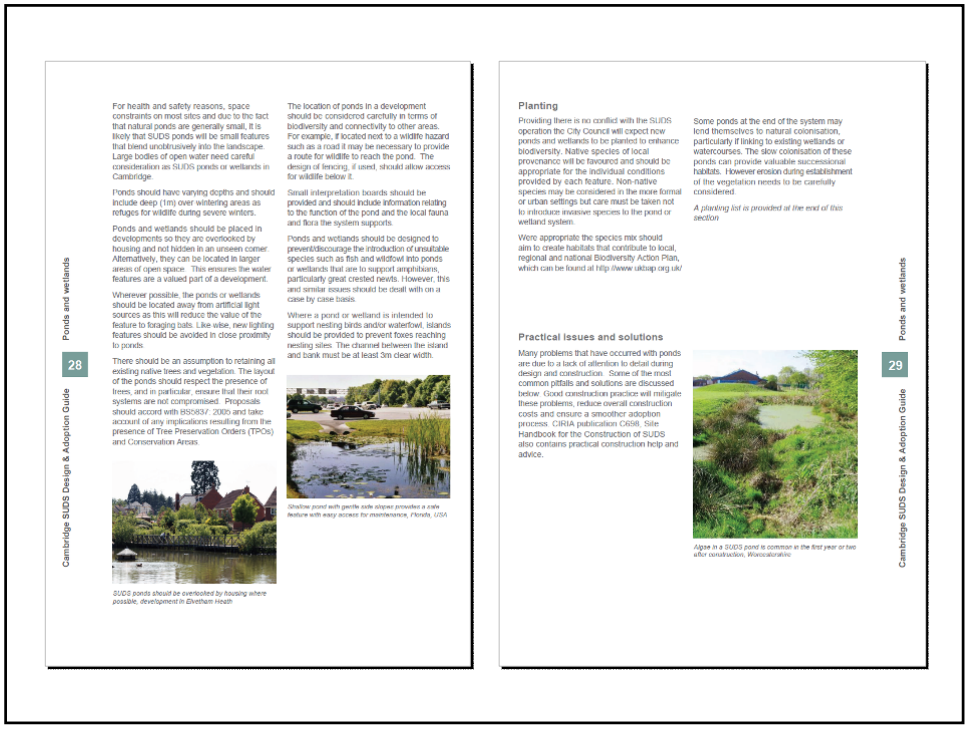
Cambridge specific design considerations

The exact form of the ponds and wetlands will depend on the specific topography and ground/soil conditions present at the site, as well as its orientation, aspect and proximity to other landscape features, buildings, etc. The design should contribute to the amenity of the local communities and be of 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.

The creation of bays suitable for breeding wildfowl should be integrated into the shape of larger ponds where possible. Hard edges and straight lines may be appropriate in some hard urban landscapes.

Small SUDS pool in high density housing – due to the close proximity to buildings hard edges are appropriate in this development, Stroud, Gloucestershire

Small SUDS pond, fully developed, Hopwood Services



Ponds and wetlands

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For health and safety reasons, space constraints on most sites and due to the fact that natural ponds are generally small, it is likely that SUDS ponds will be small features that blend unobtrusively into the landscape. Large bodies of open water need careful consideration as SUDS ponds or wetlands in Cambridge.

Ponds should have varying depths and should include deep (1m) over wintering areas as refuges for wildlife during severe winters.

Ponds and wetlands should be placed in developments so they are overlooked by housing and not hidden in an unseen corner. Alternatively, they can be located in larger areas of open space. This ensures the water features are a valued part of a development.

Wherever possible, the ponds or wetlands should be located away from artificial light sources as this will reduce the value of the feature to foraging bats. Like wise, new lighting features should be avoided in close proximity to ponds.

There should be an assumption to retaining all existing native trees and vegetation. The layout of the ponds 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.

The location of ponds in a development should be considered carefully in terms of biodiversity and connectivity to other areas. For example, if located next to a wildlife hazard such as a road it may be necessary to provide a route for wildlife to reach the pond. The design of fencing, if used, should allow access for wildlife below it.

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

Ponds and wetlands should be designed to prevent/discourage the introduction of unsuitable species such as fish and wildfowl into ponds or wetlands that are to support amphibians, particularly great crested newts. However, this and similar issues should be dealt with on a case by case basis.

Where a pond or wetland is intended to support nesting birds and/or waterfowl, islands should be provided to prevent foxes reaching nesting sites. The channel between the island and bank must be at least 3m clear width.

SUDS ponds should be overlooked by housing where possible, development in Elvetham Heath

Shallow pond with gentle side slopes provides a safe feature with easy access for maintenance, Florida, USA

Ponds and wetlands

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Planting

Providing there is no conflict with the SUDS operation the City Council will expect new ponds and wetlands to be planted to enhance biodiversity. Native species of local provenance will be favoured and should be appropriate for the individual conditions provided by each feature. Non-native species may be considered in the more formal or urban settings but care must be taken not to introduce invasive species to the pond or wetland system.

Were appropriate the species mix should aim to create habitats that contribute to local, regional and national Biodiversity Action Plan, which can be found at http://www.ukbap.org.uk/

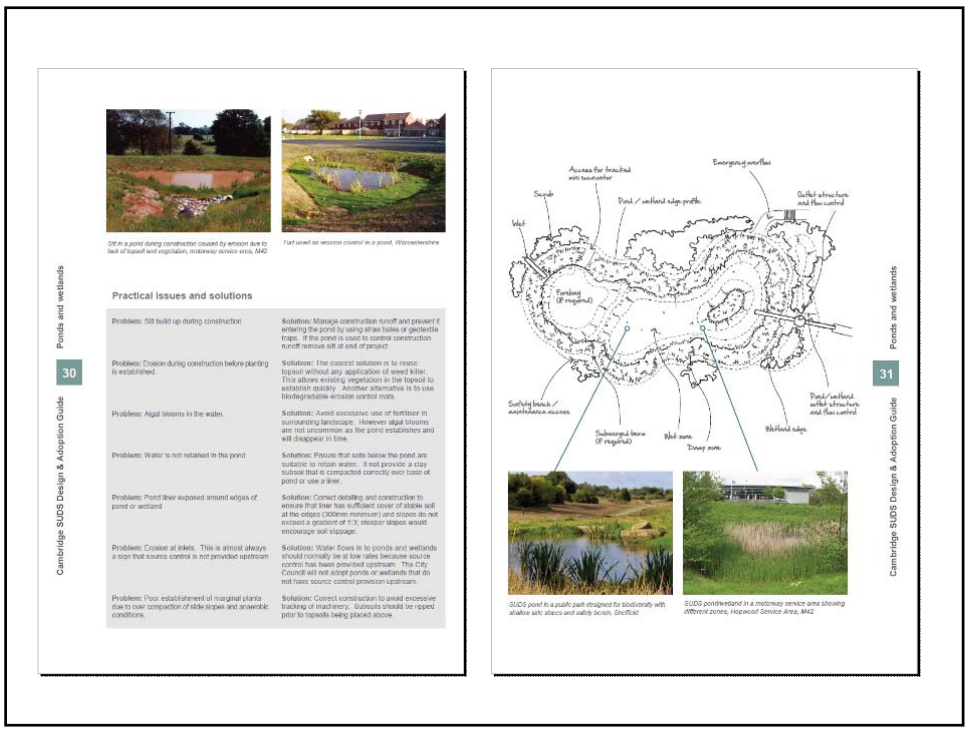
Some ponds at the end of the system may lend themselves to natural colonisation, particularly if leading to existing wetlands or watercourses. The slow colonisation of these ponds can provide valuable successional habitats. However erosion during establishment of the vegetation needs to be carefully considered.

A planting list is provided at the end of this section

Practical issues and solutions

Many problems that have occurred with ponds are due to a lack of attention to detail during design and construction. Some of the most common pitfalls and solutions are discussed below. Good construction practice will mitigate these problems, reduce overall construction costs and ensure a smoother adoption process. CIRIA publication C698, Site Handbook for the Construction of SUDS also contains practical construction help and advice.

Algae in a SUDS pond is common at the first year or two after construction, Worcestershire



Ponds and wetlands

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Silt in a pond during construction caused by erosion due to lack of topsoil and vegetation, motorway service area, M42

Turf used as erosion control in a pond, Worcestershire

Practical issues and solutions

Problem: Silt build up during construction	**Solution:** Manage construction runoff and prevent it entering the pond by using straw bales or geotextile traps. If the pond 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.
Problem: Algal blooms in the water.	**Solution:** Avoid excessive use of fertiliser in surrounding landscape. However algal blooms are not uncommon as the pond establishes and will disappear in time.
Problem: Water is not retained in the pond	**Solution:** Ensure that soils below the pond are suitable to retain water. If not provide a clay subsoil that is compacted correctly over base of pond or use a liner.
Problem: Pond liner exposed around edges of pond or wetland	**Solution:** Correct detailing and construction to ensure that liner has sufficient cover of stable soil at the edges (300mm minimum) and slopes do not exceed a gradient of 1:3. steeper slopes would encourage soil slippage.
Problem: Erosion at inlets. This is almost always a sign that source control is not provided upstream.	**Solution:** Water flows in to ponds and wetlands should normally be at low rates because source control has been provided upstream. The City Council will not adopt ponds or wetlands that do not have source control provision upstream.
Problem: Poor establishment of marginal plants due to over compaction of side slopes and anaerobic conditions.	**Solution:** Correct construction to avoid excessive tracking of machinery. Subsoils should be ripped prior to topsoils being placed above.

Ponds and wetlands

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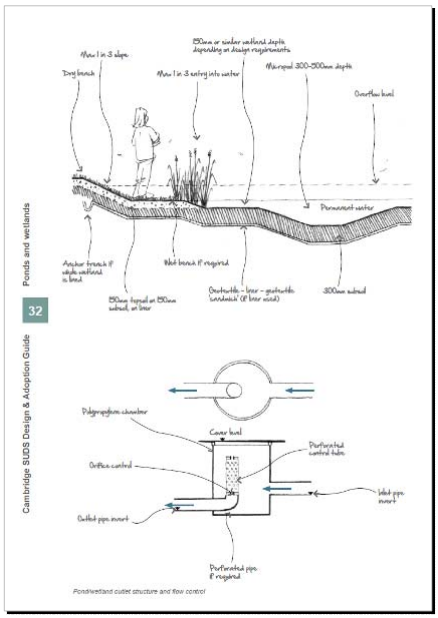
SUDS pond in a public park designed for biodiversity with shallow side slopes and safety bench, Sheffield

SUDS pond/wetland in a motorway service area showing different zones, Hopwood Service Area, M42



Ponds/wetland outlet structure and flow control

Maintenance requirements

Maintenance of ponds is relatively straight forward for landscape contractors and typically there is only a small amount of extra work required for a SUDS pond or wetland.

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 in a pond. The best time to carry out more intensive work is between September and November when the impact on wildlife will be minimised (e.g. no newt breeding or young, ground nesting birds are not breeding, impact on water voles is less, etc.).

Intensive silt and vegetation removal should only be carried out to limited areas at any one time (25% to 30% of the pond area on one occasion each year). Again this is to minimise the impact on biodiversity.

Wherever possible the SUDS ponds and wetlands should be designed so that special machinery is not required to undertake maintenance.

The costs of maintenance can be found within Appendix B.

Managing wetland vegetation with a mini excavator. Larger excavators should not be necessary, motorway service area, M42

Planting list for SUDS ponds/ wetlands

The following species list is considered suitable for planting in Cambridge SUDs. This list should not be considered exhaustive and the exact choice should relate to site specific conditions. Designs that aim to create a range of plant communities and habitats across a scheme are favourable.

Aquatics – submerged and floating, plant with weights. In permanently wet zone, equate to National Vegetation Communities, group A11

Potamogeton pectinatus (fennel pond weed)
Potamogeton natans (broad - leaved pond weed)
Myriophyllum spicatum (spiked water-milfoil)
Sparganium emersum (unbranched bur-reed)
Ranunculus circinatus (fan-leaved water-crowfoot)
Potamogeton lucens (shining pondweed)

Damp zone - inundation-tolerant, plant up to 250mm above anticipated normal water level as plugs in groups of 5-10N/ plants to create stands

Persicaria amphibia (amphibious bistort)
Caltha palustris (marsh marigold)
Phalaris arundinacea (reed canary grass)
Veronica beccabunga (brooklime)
Angelica sylvestris (wild angelica)
Lythrum salicaria (purple loosestrife)
Lotus uliginosus (greater bird's-foot trefoil)
Lycopus europaeus (gypsywort)
Myosotis scorpioides / laxa caespitosa (water forget-me-not)
Apium nodiflorum (fool's-watercress)
Lychnis flos cuculi (ragged robin)
Rumex hydrolapathum (water dock)
Mentha aquatica (water mint)
Cardamine pratensis (cuckoo flower)
Ranunculus flammula (lesser spearwort)
Juncus articulatus (jointed rush)
Carex pseudocyperus (cyp sedge)
Stachys palustris (marsh woundwort)
Scrophularia auriculata (water figwort)

Wet zone – emergents, plant in 0.250mm of water, as plugs in groups of 5-10N/ plants to create stands

Sparganium erectum (branched bur-reed)
Typha angustifolia (lesser bulrush)
Schoenoplectus lacustris (common club-rush)
Iris pseudacorus (yellow flag iris)
Glyceria fluitans (flote-grass)
Carex acutiformis (pond sedge)
Alisma plantago-aquatica (water-plantain)
Glyceria maxima (reed sweet-grass)
Veronica scutellata (marsh speedwell)

Dry zone - plant on upper slopes and berm-top as seed, at the following % cover

Festuca rubra (red fescue)
Anthoxanthum odoratum (sweet vernal grass)
Cynosurus cristatus (crested dogtail)
Briza media (quaking grass)
Deschampsia cespitosa (tufted hair grass)
Prunella vulgaris (selfheal)
Rhinanthus minor (yellow rattle)
Filipendula ulmaria (meadow sweet)
Lathyrus pratensis (meadow vetch)
Lotus corniculatus (common bird's-foot trefoil)
Carex hirta (hairy sedge)
Centaurea nigra (black knapweed)
Plantago lanceolata (ribwort plantain)
Potentilla anserina (silverweed)
Rumex acetosa (common sorrel)

On site verification

Specific canal adoption requirements

The adoption criteria for Cambridge City Council are:

- Canals, rills and other channels should have a maximum water depth of 150mm.

Specific inlet adoption requirements

The adoption criteria for Cambridge City Council are:

- Inlets and outlets in the sloping sides of ponds, basins or swales should be chamfered pipes to suit the angle of the slope.
- Vertical headwalls in open spaces will not generally be acceptable.
- Control features such as orifices and weirs should be on the surface where possible. Where control structures are below ground they should be accessible for maintenance from the surface without the need for entry into chambers.
- There should be an overflow route around a control feature in case it becomes blocked.

Verification of construction

The City Council will require verification that any SUDS they are to adopt have been constructed in accordance with the agreed design and specification. Verification will take the form of developer supplied documentation and City Council inspection during construction.

Work shall not start on site until the planning authority case officer has formally approved the adoption design plans and specification in writing. Once in place, the City Council should be given at least two weeks notice of the start of construction of the development and should be provided with a programme of works. The Council should be notified of any significant changes to the program.

The SUDS construction should be carried out to the satisfaction of the City Council's SUDS Engineer, who shall be provided with free access at all reasonable times to any part of the SUDS works or other works that may affect the operation of the SUDS.

During construction the developer may be required to prove the thickness and type of any material or layer, if it has been covered prior to inspection. Any work that cannot be inspected because the appropriate notice has not been received will result in the work being re opened for inspection and reinstated at no expense to the City Council.

A pre excavation inspection will be required to ensure construction run-off is being adequately dealt with and will not clog constructed SUDS features or pollute downstream features.

The developer's consultant should also inspect the construction and materials used. The consultant should prepare a site inspection plan and verification report. This will be site specific but as a minimum it will be expected to include the following:

- Photographs of excavations, confirmation of soil conditions, confirmation of levels, profiles and general earthworks.
- Photographs and full manufacturer's details (if appropriate) of inlets, outlets and any control structures associated with any feature to be adopted.
- Confirmation of topsoil sources with appropriate certificates.
- Full planting list and confirmation of plant sources, planting method statement and initial maintenance regime.
- Confirmation of subsoil and topsoil depths.
- Confirmation of gravel fill specification and sources, installation method statement of filter drains.
- Conformation of source and test certificates for membrane liners if used. Membranes shall have welded joints and shall be inspected and the joints tested after installation. Records of the tests shall be provided.

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- Photographs of the feature before and after planting.
- Full as constructed drawings and a topographical survey of the 'as constructed' feature.
- Confirmation of initial maintenance regimes.

The City Council will require a maintenance period of one year after completion of the whole development served by a SUDS. During this period the provision for a review of the performance of the SUDS features to allow minor adjustments and refinements based on observed performance should be provided. Any adjustments made will be at the developer's expense. At the end of the maintenance period there will be a final inspection. Any accumulated silt will have to be removed at this time and any areas of erosion or other defects repaired.

The City Council reserves the right to decline the adoption of any system that is not designed in accordance with the essential adoption requirements and where construction is not verified as detailed within this document.

Health and safety

The City Council will generally require SUDS ponds to be small and shallow with gentle side slopes which should also minimise health and safety risks. However, all proposals should accord with the requirements of the Construction, Design and Management Regulations 2007. This requires hazards to be removed by design wherever possible rather than providing mitigation to manage risk. For example, a pond designed to the principles of this guide (shallow, gentle slopes, wet benches) minimises the hazard and is better than a large deep pond, with steep side slopes that requires a fence to make it safe.

Child safety must be considered in pond and wetland design. This is best dealt with by measures mentioned in the guide such as shallow slopes, minimising water bodies of any depth and the use of peripheral planting. Larger fences cause their own safety problems (ease of access for rescue is hindered and they attract older children to climb over them) and are not recommended. However, where very young children up to the age of five years are likely to be present, and could potentially be unsupervised, a low toddler proof fence may be considered, that is sufficiently low to allow adults to get over it quickly.

Written evidence prior to construction will be required to demonstrate that all necessary health and safety risk assessments of the proposals have been undertaken by the developer and their advisors. Such risk assessments should consider all work phases, including construction, long term maintenance work and risks to the public during operation.

Maintenance costs

Item	Frequency	Comments	Cost	
			Minimum cost for small areas of POS (based on fixed cost of a site visit)	£/100m² per visit for larger POS areas
Litter removal	1 per month	Litter quantity and characteristics will be dependant on the site Litter may collect in ponds and wetland features Litter collection may be part of the general landscape maintenance Litter collection should be undertaken at each site visit and the beginning of any maintenance task, particularly grass cutting All litter must be removed from site	1 site visit with 3 men, 1 light van, mower and ancillary equipment. Half day visit comprises 3 hours on site and 1 hour travelling. Half day maximum POS area including SUDS is about 4000 m² (including pond or wetland vegetation). Cost per visit = £249	0.67
Inspect control structures to/from pond or wetland	1 per month	Surface control structures can be slot weirs, V-notch or gabion baskets with control in the stone fill. They can be inspected without removing covers or special keys		£5/ structure
Grass cutting on slopes around pond above temporary water level – amenity grass	1 per month	All grass cuttings managed on site in wildlife or compost piles	Full day visit comprises 7 hours on site and 1 hour travelling. One day maximum POS area including SUDS is about 10000m² (including pond or wetland vegetation) Cost per visit = £498	1.14
Scrub clearance from bankside	1 per year	Overhanging branches and encroaching growth will normally be undertaken as part of landscape maintenance		5.83
Cut 25% to 30% wetland vegetation and remove to site wildlife piles	1 per year			3.38
Remove planting and silt from 25% to 30% of base and place in site piles	1 per 5 years	Silt accumulation is slow if 'source control' features are located upstream in the 'management train' Only required once every 5 years	Assume 1 site visit with 3 men, 1 light van, small excavator and ancillary equipment. Total pond area up to 1200m² Cost per visit = £689 Disposal of silt by truck with mechanical grab (assuming it is not special waste) £51.18/m³	
Extra cost if silt, grass cuttings, etc are removed from site during routine maintenance	To suit other operations	Ideally all cuttings should be used on site to construct and maintain wildlife piles but this may not be the best option in public open space and removal from the site may be needed.	£2.65/100m² cleared. Assumes the waste is not classified as special waste and proportion of silt is minor (which should be the case if source control is in place upstream). Disposal of silt by truck with mechanical grab (assuming it is not hazardous or special waste) £55/m³	

= SUDS Specific Items

Adoption checklist

D. Checklist of adoption requirements

The following checklist can be used to confirm that the City Council's requirements for adoption have been met. This accreditation process follows advice in The SUDS Manual – CIRIA C697, London 2007 and Environment Agency guidance.

Ref No	Item	Date agreed with Cambridge City Council
1.	**Conceptual design**	
	The SUDS Manual requirements	
	• provide a clear explanation of the SUDS proposal following CIRIA C697 (The SUDS Manual) guidance	
	• Flow routes through development	
	• Attenuation storage locations identified	
	• Source control provision and interception storage identified	
	• Long term storage locations identified	
	• Landscape and ecology criteria defined	
	• Treatment levels identified	
	Cambridge specific requirements	
	• Mimic natural drainage patterns and landscape of Cambridge	
	• SUDS as shallow as possible	
2.	**Outline design**	
	The SUDS Manual requirements	

Checklist of adoption requirements

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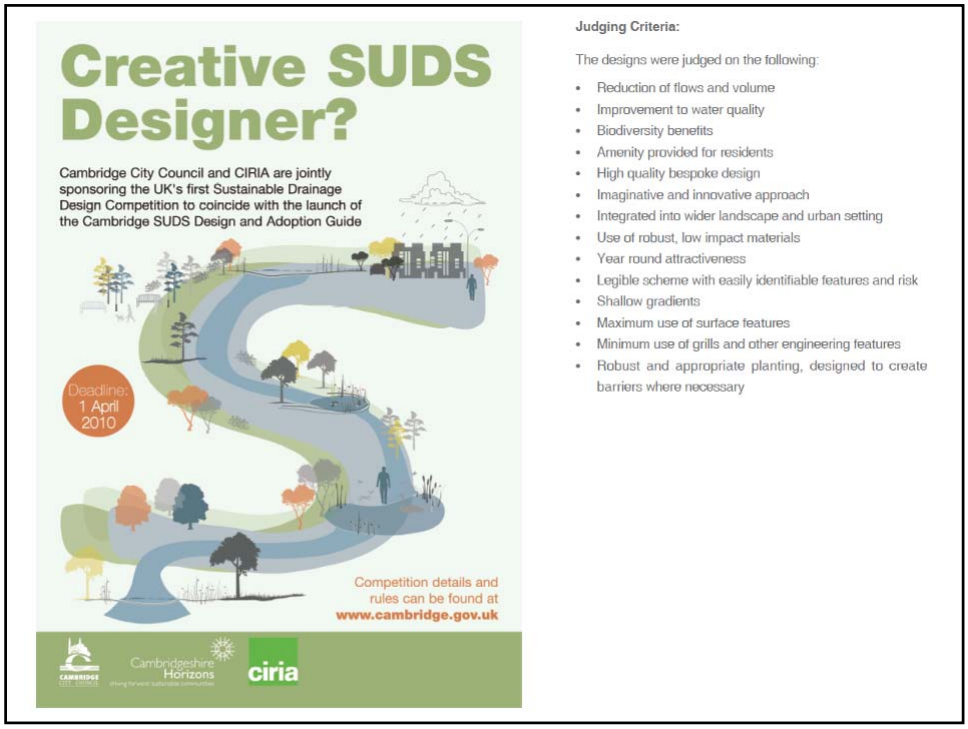
n Guide


Creative SUDS Designer?
Cambridge City Council and CIRIA are jointly sponsoring the UK's first Sustainable Drainage Design Competition to coincide with the launch of the Cambridge SUDS Design and Adoption Guide
Deadline: 1 April 2010
Competition details and rules can be found at www.cambridge.gov.uk
Cambridgeshire Horizons
ciria
Judging Criteria:
The designs were judged on the following:
Reduction of flows and volume
Improvement to water quality
Biodiversity benefits
Amenity provided for residents
High quality bespoke design
Imaginative and innovative approach
Integrated into wider landscape and urban setting
Use of robust, low impact materials
Year round attractiveness
Legible scheme with easily identifiable features and risk
Shallow gradients
Maximum use of surface features
Minimum use of grills and other engineering features
Robust and appropriate planting, designed to create barriers where necessary


The entrants:
ROYAL HASKONING
Giles Hopgood
Mott MacDonald
PWS
Premier Water Solutions Ltd
RAMBOLL
Richard Stevens
ATKINS
GHBullard & Associates
Civil and Traffic Engineering Consultants

And the winner is…..Royal Haskoning - Peterborough


Second place… Giles Hopgood


KEY
1 Primary Swale
2 Secondary Swale
3 Tertiary Swale
4 Rain gardens with sand filters
5 Filter Strips
6 Retention Pond
7 Detention Pond
8 Vegetated outflow Stream
9 Willow Sink
10 Street Trees
11 Fruit Trees
12 Water tolerant Trees
13 Green Roofs on north part of residential buildings
14 Glass fronted residential buildings for maximum solar gain.
15 Private Front Gardens
16 Commerical Building/shops
17 Clubhouse
18 Sports Pitch
19 Playground
20 Community Allotments
21 Homezones
22 Two Way Access Road
23 One Way drivable section of Homezone
24 Boardwalk
N
SCALE 1:500
No access for cars east of this line creating a pedestrian orientated site.
Watercourse

Third place….Mott McDonald - Cambridge