

Delivering sustainable drainage on the ground

LANDFORM Event: E7510

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THE ISSUES

With concerns about climate change, unpredictable weather patterns and flooding in the UK the need for well planned, designed, constructed and maintained SUDS has never been greater. However despite legislative drivers such as PPS25 and the publication of the CIRIA SUDS manual (CIRIA publication C697), the implementation of SUDS in the UK has been problematic.

Problems may arise at the design, construction and operation stages of SUDS systems with the challenges of adoption a particular concern.

The LANDFORM (Local Authority Network on Drainage and Flood Risk Management) network has been established to allow local authority staff involved in flood risk and surface water management to share good practice, policy, research outputs and experiences to identify and subsequently overcome the challenges of implementing good practice .

LEARNING POINTS

1. LANDFORM is a new network primarily for local authorities to share experiences and discuss policy and research outputs regarding drainage and flood risk management. As well as seminars, an online forum and website are provided for members.
2. While the technical aspects of SUDS are well established at the design and modelling stage, these often fail to translate into final construction due to a lack of common understanding between the planner, designer, developer, contractor and operating authority.
3. To successfully implement SUDS on a large scale it is vital that local authority planning departments are aware of the multiple objectives SUDS can meet such as managing flood risk, helping water quality management and potential creation of amenity/green space. Only then can drivers such as PPS25 and the Water Framework Directive make an impact.
4. Developers are wary about committed sums demanded from local authorities to carry out maintenance of SUDS. Oxfordshire County Council has overcome this problem by clearly explaining what the sums will be spent on and signing a Section 106 agreement (of the Town and Country Planning Act) that ensures the sum is ring-fenced for SUDS maintenance on that specific site.
5. Construction problems can only be controlled by ensuring that the contractor is aware of the principals of SUDS and what the specific site is designed to achieve.

6. Post construction problems such as disturbance of porous paving by public utilities can be overcome by ensuring that a standard construction services corridor is provided with clearly marked crossover sections. Communication within local authorities is key to ensuring contractors are aware of the areas where they can and cannot dig.

PAUL SHAFFER, CIRIA

Paul is an Associate at CIRIA where he is involved in initiatives that promote the sustainable use and management of water with a focus on flood risk management and sustainable drainage. His work on sustainable drainage has included the development of guidance, conferences and training designed to help overcome the challenges of implementation.

What is LANDFORM?

There has been good practice guidance available regarding the implementation of SUDS for the last 10 years now. However there are many cases where this guidance has not been put into practice. LANDFORM is a network for local authorities (LA's) to promote good practice in drainage and flood risk management between members. One of the ways of doing this is by improving capacity and confidence in SUDS implementation. Some LA's are higher up the learning curve than others with regards to flood risk management and sustainable drainage. As a result there are a wide range of competencies and confidences between different LA's. This network has been set up to provide an active learning environment, allowing for a two-way communication platform for people to share experiences and learn from each other. It is all about getting the LA drainage engineers, planners, landscape architects and ecologists together to talk and for them to liaise with other key stakeholders such as the EA and sewerage undertakers.

LANDFORM aims to provide tools and support mechanisms to enable LA's to help overcome the problems with implementing flood risk management and sustainable drainage. Seminars are planned for people to meet face to face and discuss relevant issues and there is also a website which signposts users to a number of useful information sources. Additionally there is a portal for members to communicate via an online forum. These tools and mechanisms are designed to make sure that LA's and stakeholders are aware of what is going on in the wider arena of flood risk management and sustainable drainage, keeping them up to date on developments in policy, research and good practice methods.

Why do we need LANDFORM?

Flood risk management is becoming a greater concern, the cost of flooding damage to UK Plc this summer was estimated to be around £3 billion. PPS25 is a considerable driver for LANDFORM, placing an emphasis on planning authorities to request more sustainable drainage developments. LA's provide several key functions that make them vital to successful flood risk management. They are involved with flood risk management infrastructure, liaise with emergency services regarding contingency planning and can ensure sustainable drainage is included at the planning stage of all new developments. Furthermore they may be essential to ensuring the successful adoption and maintenance of sustainable drainage schemes. Following this summer's floods it seems that the UK public will continue to look to LA's when demanding drainage and flood risk management responsibilities.

With this in mind, LANDFORM can help LA's who have not got the adequate resources, experience and expertise to get up to speed with developments and improve competency and capacity. Land use planning is now a major issue, with development on floodplains being increasingly scrutinised. PPS25 offers an excellent opportunity to link sustainable development and flood risk management. SUDS design and flood risk assessment procedures are well established; what is needed is to overcome specific problems with stakeholder communication, local and central politics, planning and funding.

Who is involved in LANDFORM?

The strategic advisory group for the network covers many areas of flood risk management and sustainable drainage. The group includes members and policy officers of the Local Government Association, the Planning Officers Society and County Surveyors Society which represent a number of highway authorities. Also included are regional SUDS groups (conglomerates of LA's, with different views on SUDS but knowledgeable about them and the relevant issues). There is also representation from the maritime councils (via the coastal group chairman) and advisors from Defra covering both flood risk management and water quality aspects. In addition there are representatives from DCLG, EA, The Royal Town Planning Institute, the research community and CIWEM to represent some of the practitioners that provide the technical expertise. To date it has been difficult to successfully engage with planners.

What are the plans for LANDFORM?

The network is primarily funded by the EA but has recently secured additional funding from Mouchel Parkman and is open to dialogue with other potential contributors.

LANDFORM is starting from humble beginnings with enough money to run for two years (ending 2009) but is looking to expand its activities and budget in the future. The website is broken into two main areas. The first is focused on providing information about policy and regulation. It describes the key stakeholders and legislation such as PPS25. The other section is devoted to technical and practical issues, giving examples of good practice being taken forward and the thorny issue of adoption. The website and eForum will only be as good as the information provided by members, it needs two-way communication.

Two events per year are planned in the original budget however with additional sponsorship, such as that received from Interpave and The Concrete Centre, it is possible to run ad-hoc events that are likely to focus on consultation and dissemination. LANDFORM also hope to provide training days for LA's, however it is vital to have input from LA staff in order to tailor these to meet their needs.

The next events are likely to focus on managing flood risk in new developments, ie the impact of PPS25, the usefulness of strategic flood risk assessments and what is meant by a strategic surface water management plan. Another event may look at managing flood risk in existing developments. After the recent floods, flood risk management in existing developments will be important as will the outcomes and reactions to the Pitt review on Lessons Learned.

LANDFORM is likely to look at how LA's can work together to retrofit solutions, not only focusing on the technical aspects but on how people working together can deliver improved solutions. Sustainable drainage has not been easy to implement, there are a number of challenges to overcome, but Oxfordshire County Council have managed to overcome many of these.

What is sustainable drainage?

Sustainable drainage is an approach, aiming to manage rainfall as close to the source as possible, mimicking natural processes. SUDS includes a portfolio of approaches; it is not a 'one-size fits all' solution. You can manage surface water by infiltration, storage and conveyance and various combinations of all three. It's sustainable because it helps maintain surface water quality, reduces flood risk and creates high amenity public open green space that supports biodiversity.

Traditionally storm water has been conveyed away from the built environment as quickly as possible, leading to increased flood risk downstream and a loss of available surface water upstream. In addition, traditional drainage approaches also pick litter and pollution from urban areas and combined sewers that mix foul and storm water can overflow during heavy rainfall, causing pollution.

Climate change is now accepted and the increased likelihood of extreme weather events makes flood risk management an area of major concern. The Stern Report makes reference to storm water management by stating that water should be allowed to infiltrate into the

ground as close to source as possible. The Water Framework Directive is also forcing Defra to think about ways of managing non-agricultural diffuse water pollution and avoiding it mixing with surface water. The new PPS's link planning and flood risk management together with sustainable development. PPS25 emphasises the aim of achieving 'multiple objectives' and how sustainable drainage can meet these. PPS1 is an overriding document about sustainable development and mentions sustainable drainage. PPS25 suggests regional spatial strategies and local development frameworks should take sustainable drainage forward and develop agreements on maintenance and adoption.

The biggest challenge for SUDS maintenance is not 'what to do?' but 'who does it?' There is a need for an overall mechanism for adoption and ownership. Good communication between the myriad of stakeholders that exist in urban drainage and flood risk management is necessary. There is a need to understand where other stakeholders are coming from and what their agendas are. Some stakeholders may operate within very small and restrictive comfort zones.

PPS25 talks about surface water management plans but it is necessary to better understand what these should include how they can be put together and how to deliver those multiple objectives. LANDFORM is about improving confidences and competencies, about how to work together to improve people's ability to implement these solutions.

BARRY WEST, OXFORDSHIRE COUNTY COUNCIL

Barry has been a Highways Adoption Officer with a number of Local Authorities and has been with Oxfordshire County Council for the last 14 years. He played a major role in updating the councils design guide twice and has contributed to the successful adoption of a number of SUDS schemes in Oxfordshire.

DELIVERING SUDS

Oxfordshire County Council's previous Director of Environment and Economy took an enthusiastic approach to SUDS. Disposal of surface water cannot be left until the last minute in the planning process and should be one of the first factors considered.

PPS25 requires planners to investigate flood risk for any development and to make sure there are safe routes for surface water to drain away. Unfortunately during the summer, Oxfordshire experienced extensive overland flooding but this also provided a stern test of the SUDS already implemented in the area. None of the existing SUDS sites flooded.

Water courses cannot cope with a sudden and large influx of water, and traditional storm-water systems have difficulty accommodating heavy storms, increasing flood risk at the point of discharge and downstream. Furthermore, storm-water pipes under roads can cause differential cracking in the road surface.

There are many different types of SUDS available and each must be tailored according to site specific factors. For example, a swale was built five years ago on a peripheral road on the outskirts of a development in Witney, on oxford clay, taking road surface drainage along a reasonably steep slope. After consultation with the local planning authority and the consultants for the developer, check-dams were added to the swales. This reduces the water flow rate, holding water back during peak flows and allowing the capacity of the swale to be utilised for storage and flow attenuation. The check dam also allows evaporation and evapotranspiration to be maximised during this attenuation. The dam was designed to minimise the damage to both cars and dam should a car accidentally run over the dam.

With small developments, SUDS implementation is normally dealt with by liaison officers. With larger developments though, Oxfordshire County Council use design teams, consisting of the planning authority, the highway authority, the developer of the site, their consultant and anybody else who should be involved. Core members of these design teams ensure that experience is retained and a mutual understanding is built between stakeholders. This is

particularly beneficial when dealing with SUDS adoption. Other stakeholders such as the EA, landscapers and ecologists are brought in when required during the development. The CIRIA SUDS manual recommends the use of multidisciplinary design groups, allowing all these different stakeholders to come together and talk at the design stage, to arrive at a solution that meets most of their needs. It is especially important that district councils, who are responsible for land drainage and public open spaces and the highways authorities that are responsible for highway drainage agree about the SUDS design and what areas to adopt.

S38 agreements (1980 Highways Act) are the most common agreements used during road construction. Here the developer has to design and construct the road according to the highway authority specification and the highway authority must be satisfied upon completion before agreeing to adopt the road. The 1980 Highways Act does not specify technical details however; these are decided by the highways authority and are subject to review and updating.

Section 38(6) of the Highways Act provides provisions for the highway authority to cover the future maintenance of the road. The highway authority in Oxfordshire has taken a fairly relaxed attitude to future maintenance costs, only requesting commuted sums for extraordinary items, i.e. only for items outside of normal yearly maintenance. The interpretation of section 38(6) so far has been up to the local council but this may one day be challenged by a developer in court who disagrees with the proposed commuted sums. In Oxfordshire commuted sums are charged for maintaining porous paving and swales however most developers have accepted this in the Oxfordshire area.

An example of how SUDS design will happen in the future in Oxfordshire is illustrated with the currently proposed 1600 house development with Countryside Properties and their consultants WSP. The design code is principally driven by Oxfordshire County Council and aims for a drainage system consisting entirely of SUDS features including porous pavements, ditches, swales, balancing ponds and wetland areas. The EA members on the design team insist that ecology and surface water quality issues are addressed in the combined SUDS design code. For successful adoption, it is essential for the local authority to have a strong input to the design codes of new developments with sustainable drainage.

GORDON HUNT, OXFORDSHIRE COUNTY COUNCIL

Gordon has been a drainage officer with Oxfordshire County Council for a number of years, working with Barry to help deliver SUDS in the Oxfordshire area.

DELIVERING SUDS

The attitude to SUDS varies between the different stakeholders in a development. Consultants and landscape architects are keen to implement SUDS due to their environmentally friendly and aesthetically pleasing features. The attitude of engineers depends on their appreciation of the concepts of SUDS. Developers tend to initially be enthusiastic about SUDS when they become aware of the capital cost savings over traditional drainage systems. Although when they hear about the land take required with swales for example and the commuted costs, they are not so keen. Despite savings due to the lack of need for kerbs, gullies, manholes and pipe runs, developers are unhappy at the need for a slightly wider road and the prospect of paying commuted sums.

Oxfordshire County Council has not experienced any problems with the adoption of SUDS. They adopt from the highway authority and work with the district councils and parish councils, who can subsequently adopt the public space and look after the swales, using the appropriate commuted sums towards maintenance.

Swales tend to be 3-5m wide and shallow, with gentle side slopes. The initial swales in Oxfordshire were too deep; they never filled up and were difficult to mow. By halving the depth to 250-300mm the grass is easier to mow and less of a potential hazard to cars and children. Soakaways have been adopted by Oxfordshire County Council for a long time yet

maintenance can be problematic. Often inlet covers can get buried and the exact location of a soakaway is lost, and when they start to silt up it can be difficult to clean. Kerblin drainage linked to swales can be an effective solution for sites where there is nearly a constant flow of water. Boreholes are also common in Oxfordshire despite the fact that the EA consider them to be a pollution threat to aquifers. Boreholes can be notoriously difficult to maintain when they block up. Typically, blowing in compressed air, air saturated water or water jets is attempted to dislodge the silt particles but no single approach is guaranteed to work. A solution to 2 boreholes that were constantly flooding was found by linking them to a 3-stage pond with a rip-rap to aerate the inflowing water. These ponds were constructed on a private paddock and when the owner expressed a desire to have a nature reserve, the ponds were planted with reeds which the owner was happy to take maintenance responsibility for. There are at least 12 sites with porous paving in Oxfordshire and all work to specification. The main problem arises when the contractor is not familiar with fitting porous paving and fails to bed them in properly. A good contractor will however bed them in such that they are solid and don't move.

Regarding the maintenance costs of SUDS, cutting the grass in swales 3-4 times a year is considerably cheaper than sucking out gullies, cleaning manholes and replacing broken kerbs. Soakaways, however, are rarely cleaned adequately by maintenance teams. Typically a pipe is stuck in the central area of the soakaway and the silt and water sucked out. Proper cleaning requires digging out around the soakaway for 0.5m and replacing the stone. There is a lot of information about how to clean ponds and reedbeds, however to date none have required cleaning in Oxfordshire. With kerblin drainage, the system requires jetting once every few years. By connecting private drainage (roof water) to the highways drain, it may be possible to flush kerblines during storms, reducing the need for maintenance jetting. Some systems that are 4 years old have not required jetting at all so far. Porous paving requires suction sweeping and is recommended twice a year in the manuals. Performed tests have concluded that while small sweepers are acceptable with porous paving, with larger models, you need to tilt the suction otherwise you start to move the blocks and pull up the stone in between the blocks. For weed control it is recommended that weedkiller is applied once every two years in springtime.

Commuted sums are index linked and collected from developers at adoption before being placed in an interest bearing account. Oxfordshire County Council ring fence commuted sums and the interest gained so it is not used to make up budget deficits elsewhere. The commuted sums have to cover maintenance for 25 years from adoption but annual sums must be spent in a given year. When calculating the commuted sum for porous paving for example, the cost of hiring a sweeper must be considered. They can only be hired on either a daily or half daily basis as a minimum, which puts smaller sites remote from other porous pavements, at a cost disadvantage. For example a commuted sum for a ½ day hire in Oxfordshire is £7-8000.

With soakaways, some LA's charge a flat fee of £5000 for soakaway maintenance. However in Oxfordshire, the size of the soakaway, and how many times it is likely to need to replace the stone in the soakaway is used that to calculate costs. To determine the likely replacement rate of the stone it is necessary to see how quickly the water soaks away and assess the quality of the water entering the soakaway. We do not use the BRE 365 soakage test but our own test which requires a 2mx2mx2m hole. Being present at the soakage test allows for a better appreciation of the soakaway performance and enables the adopter to estimate the commuted sum more accurately by inspection of the excavated material. If the soakaway test fails to retain any water, it is possible that no commuted sum is applicable.

With porous paving, the contractor often uses a 2m deep test hole, but it actually only needs to be 0.5m deep at the most. The test has to be at the depth where the water is soaking into the ground. Sometimes at 0.5m depth the soil drains very poorly, however if it can be shown that deeper down the soil profile much better drainage occurs, then it can be justified to build trenches that convey the water down to these free flowing areas. Designs should include a high level overflow where required as a guaranteed drainage path. Several different design approaches are used by manufacturers with porous paving. For example some have two layers of geotextile, (i.e. the block, the sand, the upper geotextile layer, the stone and another lower geotextile underneath). Others have only one lower geotextile at the bottom. Previous

experience has shown that the upper geotextile is necessary to stop silt and sand entering into the stone layers and prevents sand being lost from the system. It is also easier to replace the surface blocks if there is an upper geotextile layer. Should a running layer be used during construction it is preferably removed and replaced with stone. Alternatively the layer should be 100mm cored across at 750mm centres and the holes filled with stone. Smaller core diameters can cause problems with silting.

Where porous pavements meet buildings or impermeable roads, there is the need for an impermeable barrier to prevent water flowing in either direction. Flows towards the permeable paving may overload the paving and flow towards buildings and impermeable areas may cause flooding or soaking of foundations. Depending on the slope of a porous pavement, it may be necessary to incorporate check dams under the paving in order to slow down the flow rate. On steep sites 300mm check dams between sections of porous paving act as a storage device in the higher sections of road. These dammed sections fill up during storms and overflow down into the next section and so on. Without this, there would be a much higher tendency to sheet flow on steep sites.

When considering the use of underground storage and modular flow attenuation boxes, the key to maintenance, and thus commuted sums, is how easy it is to remove the silt that inevitably becomes trapped in the system. An important consideration in porous roads is the whole life cost, porous paving has the potential to last much longer than traditional blocks due to the ability to simply lift out the blocks and replace whatever part of the structure is faulty, be it the surface blocks, the geotextiles or the sand or stone layers.

GORDON HUNT & BARRY WEST, OXFORDSHIRE COUNTY COUNCIL

DEVELOPMENTS IN OXFORDSHIRE WITH SUDS

The SUDS schemes in Oxfordshire were thoroughly tested in July and it was found that there were no problems with any of them. Even in areas with high levels of clay, porous paving has worked so long as the soakage tests and design were properly conducted.

The keys to successfully collecting commuted sums are;

- a) To explain precisely what the commuted sums are for and how they are calculated
- b) To explain to the developer how SUDS can save money
- c) To ensure the developer understands the principles behind SUDS

To help assure the developer that the sums are ring fenced it is recommended to sign clear agreements (Section106 agreements), to ensure that if the site is sold on, the commuted sums continue to apply. To ensure that construction is adequate, it is essential that the workforce on the ground is made aware of the principles of SUDS. Also explain to the developer that the EA are especially keen on swales and wetlands due to their ecological and amenity value.

Problems with sustainable drainage are possible but can be reduced or avoided altogether by working from first principles. Design teams are beneficial as there is a multitude of different perspectives and expertise that may be able to identify problems at the design stage which individual members of the team may not have noticed. The monitoring staff responsible for ensuring that the construction is being carried out according to the system design must be up to date with the latest developments in SUDS.

Problems with public utilities incorrectly installing services and interfering with the SUDS process can only be avoided by sensible planning and clear communication. Problems are most likely with porous pavements, which should only be disturbed in line with block manufacturer's recommendations. It is vital during the planning process for a porous pavement and road to ensure that there is a service corridor going along the side of the road. Even with a service corridor at the side of the road if there is insufficient communication

between public utilities, the planning department and the highway engineer the problems can arise as illustrated in Figure 1 below.

Figure 1 – example of incorrectly installed public utilities on a porous paved road



In Figure 1 the service corridor is highlighted at the side of the road by a row of white blocks, yet the public utility staff installed the access points in the middle of the road.

With Oxfordshire County Council, the service corridor has to be of standard construction, and when adopting a porous paved road, it is classified as a road of special engineering construction. Maintenance teams will therefore take extra care when dealing with maintenance and pay attention to the drawings. When adopting the road, 'as constructed' drawings and a health and safety file are produced which can be easily accessed by the maintenance teams. Service corridors must also be provided that traverse the road. These corridors should also be of standard construction and be demarcated clearly. Service drawings should always be available. By having a service corridor crossing the road, the road may not need to be closed, avoiding public grievances. The service corridors crossing the road also act as check dams in porous pavements. Impermeable barriers are required between porous paved roads and traditional roads and also foul sewers to ensure that storm water is conveyed to the correct place.

Design codes are the way of the future and developments will not get planning permission until the design code is approved. Design codes ensure that when the site is sold aspects of the original design, (i.e. SUDS) must remain in place and not be altered without express permission. Design teams containing all key stakeholders can ensure solutions that meet the requirements of most if not all stakeholders and will smooth the planning application process.

DISCUSSION

Q1 How did you arrive at an agreement with the developers for a figure for commuted sums for SUDS adoption? Did you take into consideration the liabilities being adopted as well when calculating at a commuted sum?

A1 We have a cabinet style interaction with local authorities where we would give a figure to the engineer and ask him to go to his committee for them to decide if they are happy with it.

Q2 Do you ever take on additional drainage into SUDS which would not normally be considered as highway runoff? And if so, does this affect the commuted sums?

A2 Yes, we often take additional flow from the building roofs and the local authorities are happy to adopt these systems so long as the commuted sum covers the maintenance of the system for a 25 year period.

Q3 So what happens after the 25 years run out and the system is still there, requiring maintenance?

A3 Each year the commuted sum is index linked and so rises with inflation each year to ensure that the real costs are covered for the next 25 years. Sums are placed in an interest bearing account and so far our commuted sums have left us with a net surplus of funds. With highways, the highway authority ultimately takes responsibility for maintenance. However with other schemes, after 25 years there will be a problem with funding maintenance which may require an increase in commuted sums. LANDFORM is the ideal vehicle to address issues such as this though.

Q4 Our council are very enthusiastic about commuted sums and insist that they be calculated on a site specific basis and that no sums can be transferred from one site to another. Is this how your council operate?

A4 Yes, that is why we sign a Section 106, so the developer knows it can only be spent on their site for the specific purpose of SUDS maintenance.

Q5 Are the majority of your systems highway drainage systems and do they take private drainage as well or do you keep these separated?

A5 A lot of the time the site is very tight and there is nowhere else for the water to go so it makes sense to run private drainage into the highway drainage system. There are examples where we take the front half of terraced house roofs into highway drains and the back half goes into soakaways.

Q6 Do these private drains connected to highway drains need to be licensed?

A6 Any connection to the highway drain must be licensed and for houses, will be stated on the deeds of the house. In one case we have taken the whole housing development into one linked SUDS scheme and the system drained well. Except for one instance where the farmer on neighbouring agricultural land ploughed his field the wrong way and the site flooded, which can have a very strong impact on site drainage.

Q7 If you grant a licence to connect private drainage to the highway system do you charge a fee? This may be one way of softening the blow when the commuted sums run out after 25 years.

A7 We can charge a fee when connecting to the highway drain but we don't charge fees on an annual basis.

Q8 Have you examined the retrofitting of SUDS where, prior to development you may agree with the county councils that they will be the standard bearers of the SUDS?

A8 In some sites this is possible but in others there are more difficulties due to the listed nature of the developments in place.

Q9 What about with a county road in the middle of nowhere?

A9 Yes sites like these are much simpler to retrofit, however there are problems when dealing with highway engineers who are not familiar with the principles and benefits of SUDS. They may view the retrofitting as an additional and unnecessary burden to their workload. One way of retrofitting the highways that easily appeals to the highway engineer is to do away with the gullies and kerbs and fit in a filter drain and/or swale.

With traditional road gullies, the concrete block they are set in can sometimes pop up as the road is pounded by the traffic and cause ponding to occur to the depth that the gully has been raised. However with porous pavements, if they deform, they will still drain the water away.

Q10 It would be interesting to know how you interact with the other key stakeholders. For example, who drives who? Do you drive the planners or vice versa?

A10 This comes down to establishing a rapport with the planners where they come to an understanding about SUDS. Also it has been of help that they have already seen the visible benefits of existing SUDS schemes which makes it easier to implement new systems.

Q11 Do you work to a supplementary planning document or within a specific framework?

A11 Yes, at least on larger developments we work to a design code which the councillors are involved with.

Q12 And is this design code a generic document about sustainable urban development in general or specifically about sustainable drainage and flood risk?

A12 Not yet specific but that has to be built in now that we have PPS25 we must do this.

Q13 What about SUDS planning and implementation in contaminated land sites? The particular site in mind is the gasworks in Southall, where they ruled out SUDS because the land was too contaminated.

A13 This is an important question because more and more contaminated land is being built on. The LAs rely on the EA to assess the contamination potential and risk of transferring pollutants to the nearby watercourse. Some SUDS, such as porous paving, have been shown to facilitate removal of organic contaminants due to the bacterial breakdown of organics by colonies established in the bedding material of the pavement. More research has to be done on using SUDS with contaminated land.

In Scotland there has been guidance produced on using SUDS in contaminated areas by SEPA and also that SUDS can avoid the need for digging deep trenches for drain piping which reduces the disturbance of the soil and thus the mobilisation of contaminants.

Q14 How many of your SUDS schemes are on greenfield sites and how many on brownfield ones? Is it much easier to implement SUDS in greenfield sites.

A14 Nearly a third of the sites listed in our presentation were on brownfield land. No reason why we can't retrofit SUDS on brownfield sites with high level overflows to existing drain systems.

Q15 Do you ever have problems with individual householders who may for example be concreting their garden and have 2 tonnes of sharp sand dumped on a porous pavement?

A15 Yes it is a problem that unfortunately has to be picked up by the maintenance people. The highways inspectors are responsible for preventing this but it is an extremely difficult task as there are not well defined clauses in the highways act to prevent and punish such behaviour.

Q16 A question about swales, you mention that they are easy to mow but what about the accumulation of silt that eventually has to be removed?

A16 We haven't experienced any problems with silt on our sites. You do get typical litter such as plastic wrappers, drink cans etc that have to be removed but no great areas of silt.

Q17 Does the grass absorb this silt?

A17 Well it is a natural process as the grass grows up it knits the silt material into the topsoil. Biggest hassle is to keep the grass level 25mm below the road level.

Q18 With kerbline drainage, does this discharge into swales?

A18 No this goes straight into sewers and down to the river.

Q19 Developers often don't like SUDS because they consider them too expensive. Do CIRIA have any cost figures comparing the cost of a traditional drainage system to SUDS?

A19 There was lots of research done a while ago but unfortunately this information is not highly accessible or really affordable at the moment. There is guidance coming out from Lamb Drove, Cambridge that details construction cost savings with SUDS. There is also work done by Scott Wilson on behalf of Interpave covering initial and whole life costs which is free to download from the Interpave website. It concluded that in most cases permeable paving was cheaper than traditional pavements and drainage.

Q20 How do you make it clear to public utilities that this where you have placed the crossover for a service corridor?

A20 Is the responsibility of the asset management team although most of our crossover details are the same we don't employ a single standard design although they are always detailed on 'as constructed' drawings. Where contractors have failed to use the crossovers correctly, our highways inspectors will chase them up in due course.

Q21 How do you deal with problems from contractors not constructing SUDS properly?

A22 It is a problem and it is all about education and training. There is a wide variation between different contractors, you shouldn't always go for the lowest tender.

CONCLUDING REMARKS FROM BOB SARGENT, CHAIRMAN

The speakers are to be congratulated on a really inspiring presentation, which had clearly been of great interest to the audience, demonstrated by the level and volume of the questions. SUDS have been promoted in the UK for over 10 years, and the need for their widespread adoption continues to grow as increased development puts more strain on our drainage systems and climate change leads to more intense rainfall. The use of SUDS has been very slow to develop, however, and the problems of adoption and maintenance are often cited the main reasons for this.

As the work in Oxfordshire clearly shows, these so-called barriers are more in the mind than in reality and can be overcome with an imaginative approach to drainage and by the various parties working together. This must be a blueprint for the future and the shows that the current arrangements for urban drainage can be made to work – an important message for the current reviews of drainage management in the wake of recent flooding.

Clearly there is more to do to spread the good practice demonstrated in Oxfordshire by the speakers and reassure other authorities and developers that SUDS can work very well in practice. The LANDFORM initiative is therefore very well targeted and should go a long way to provide that reassurance. This meeting has been an excellent start to the LANDFORM programme. It is very encouraging to see the enthusiasm demonstrated today and I look forward to the much wider adoption of SUDS in the future.