

Welcome to the autumn issue of the FWR Newsletter



The first meeting of the Scottish Green Infrastructure Forum was held in Glasgow recently and I am very grateful to Dr Brian D'Arcy for our lead article in which he takes us through the main issues considered at the conference. This includes the importance of green infrastructure not only to the environment but also to people's health and well-being – a fact which is being increasingly acknowledged. Amphibians in Inverness and rain gardens in Cheltenham are also part of the story - see pages 3 & 4 for more on these!

In 'Wastewater Matters' we explore sludge treatment and what it may take to do this right; Tim Evans argues that sludge treatment should not be the poor relation of drinking water treatment. Other topics included in this issue are the catchment based approach annual conference, plus an 'issues workshop' held by the Consumer Council for Water.

For information on events and news highlights please go to our website [www.fwr.org](http://www.fwr.org). You can also contact us via email ([office@fwr.org.uk](mailto:office@fwr.org.uk)) or telephone (01628 891589).

Maxine Forshaw - Editor

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# GREEN INFRASTRUCTURE - a growing need



Dr Brian D'Arcy  
Independent environmental consultant

Stormwater pond, Ayrshire

**GREEN INFRASTRUCTURE WAS REVEALED** in its full breadth of applications to a mixed audience of engineers, planners, ecologists, social scientists, consultants and regulators at the first conference of the Scottish Green Infrastructure Forum (SGIF) held in Glasgow from 6–7 October.



Kicked off with enthusiasm by Dr Aileen McLeod MSP, Minister for Environment, Climate Change and Land Reform, the presentations featured keynotes from England as well as Scotland, plus presentations from Norway, Spain and Australia. Dr McLeod highlighted the

multiple benefits that green infrastructure brings to people, not just to their environment but also in terms of their health and well-being, together with a variety of economic benefits. The challenge to any government, however, is how to achieve joined-up thinking in policy and practice in order to maximise those benefits.

Sustainable drainage systems (SuDS) that feature 'soft-engineering' such as grass swales, detention basins, ponds and wetlands, have

long been advocated as a practical area of economic activity for developers and public sector bodies to create functional green infrastructure. The frustration with the awfully slow progress in policy and regulation to drive SuDS into routine business in England was contrasted with the recent awakening to opportunities for fresh policies, and even on-the-ground actions, in Wales. And, of course, in Scotland the focus is not 'can it ever become routine business?' but rather, now that it is, 'how can fit-for-purpose features be more consistently achieved?' Scottish Water have recently made progress, with revised standards for vesting public SuDS, and are gaining more experience of the technology as part of their core business as their list of vested sites grows.

One session at the conference looked at SuDS at various scales as applied in Oslo and Melbourne (which has 10,000 rain gardens!), and the retrofitting of smaller scale units in Oakley, near Cheltenham, England (see article on page 3). Rain gardens on a house-plot scale featured in the field visit to the Taylor-Wimpey Torrance Park development in North Lanarkshire, where a raised bed rain garden unit has been installed at a show house, with a natural rain garden feature draining the back garden of another house, at which all impermeable surface flows pass through a novel flow-control system with attenuation.

Green infrastructure brings together diverse interests and a variety of professionals – delegates were full of praise for the opportunities to hear presentations that related to their own work, but from a completely different perspective. It was heartening to hear a presentation from a Highland Council/Scottish Natural Heritage project that was quantifying the wildlife value of SuDS ponds around Inverness (the fastest growing city in Scotland); initial results confirmed expectations that these features are valuable urban wildlife habitats [see detail on page 4]. The account of terrestrial water voles living in patches of rough grassland some kilometres from a watercourse, in the middle of Glasgow, highlighted both the resilience of nature and the importance of green elements in an urban landscape which may be under-appreciated by human populations with more conventional views on urban aesthetics. Not least impressive was the fact that when environmental health officers were called out to a 'rat infestation' they were able to identify the large furry rodents as water voles, not rats, and instead of exterminating them, notified their biodiversity colleagues.

There are, of course, challenging issues around the delivery of multiple benefits from green infrastructure, not least the fact that putting multiple budgets together to realise potential net savings to the public purse is not easy. Millions of pounds have been allocated (and are in the process of being spent) as part of the Metropolitan Glasgow Strategic Development Plan, where Glasgow City, Scottish Water and SEPA have been working together for a decade or so to find sensible cost-effective solutions to storm water management and, in the process, improve green infrastructure provision where practicable. Various approaches to making

green infrastructure a recognised fundable practice with quantifiable multiple benefits were discussed at the conference – from a Natural Capital Standard for Green Infrastructure to papers which looked at planning perspectives, ecosystem services, and of course BREEAM (Building Research Establishment Environmental Assessment Methodology) and green infrastructure.

Perhaps the most important aspect of green infrastructure benefits is the positive impact on the health and well-being of human populations. This was a key issue for the Minister, Dr McLeod, in her opening presentation, and was championed in detail later by Roger Crofts (Chair of the Royal Scottish Geographical Society) in his keynote talk at the close of the first day, advocating that doctors should be prescribing the 'green pill'. The scientific evidence on which such views are firmly based was set out eloquently by Professor Richard Mitchell (University of Glasgow) who asked 'can green space do what politics can't – reducing health inequalities?'

Arguably the most unexpected presentation for a water engineer or scientist to see at the conference was a refreshing, illustrated talk by Marc Granen, a landscape artist from Spain. To say it was 'off-the-wall' would be incorrect since it was entitled 'Edible green walls in Barcelona'. But it was thought-provoking and a stimulating reminder of how good it is to come out of the confines of the professional silo from time to time.



*Grass swale at edge of road, Kinross, Scotland*

It was good to note that there was enthusiasm at the close of the conference for a follow-up Scottish Green Infrastructure Forum to be held in two years' time.

More information, including the presentations, can be downloaded from the SGIF website [www.sgif.org.uk](http://www.sgif.org.uk)

Dr Brian J D'Arcy is an independent environmental consultant, a Research Fellow at Abertay University, and Chair of the Scottish Green Infrastructure Forum.

*All images in this article are courtesy of B J D'Arcy except that of Aileen McLeod which is courtesy of Central Scotland Green Network Trust.*



*Raised bed rain garden (Taylor Wimpey show house)*

## RAINGARDENS ARE DESIGNED TO CAPTURE RAINWATER

Small units can be designed to take runoff from roofs and driveways (or as street-side features for road runoff, or as modular units across a car park). A small rain garden can be retrofitted and take roof runoff, discharging back into the drain at a slow rate, using integral storage capacity to attenuate peak flow. The soil layer is free draining and plants are not usually typical bog vegetation, but rather are species which can adapt to thrive in periods of wet and dry weather.

A 'natural raingarden' by contrast, has been suggested for gardens in the west of the UK: a wet back garden can be drained to a natural low point away from the building, and a shallow depression dug out. The earth can be disposed of by application around the perimeter, stopping ingress of runoff either into your garden or from it to cause problems with a neighbour. The unit in the ground is sized to provide temporary storage during periods of minimal evapotranspiration; bog plants are suitable.

[www.enviroexperience.co.uk](http://www.enviroexperience.co.uk)

## Priors Farm, Oakley – a SuDS retrofit

Sue Illman, *Illman Young Landscape Design Ltd*

**Priors Farm, Oakley is a housing estate of around 300 homes on the edge of Cheltenham, which has suffered from flooding for a number of years. The flooding arises due to overland flows from the hill above, as well as surcharging of its combined sewers due to the overland flows entering the surface water system, water generated on site, and backing up from the lack of capacity in the network downstream.**

This site was selected due to its ability to address some of its own flooding problems, and contribute towards alleviating problems downstream. This is the first demonstration SuDS retrofit site within Cheltenham Borough, and the Environment Agency sought to engage both the Council and their social housing provider, Cheltenham Borough Homes, as partners in the project.

The project went through a number of consultation stages with the local residents, initially to engage their interest and understanding of the flooding problem and possible solutions, and to select which options they preferred to deal with this issue. An analysis of the site then considered the potential of all areas of public open space within the estate and evaluated every front garden for the potential inclusion of a rain garden. Three separate areas of public open space were considered suitable, along with around 60% of the front gardens.

To facilitate the next stage of engagement, a leaflet explaining what the rain gardens could look like, and offering options for their design, was produced. Each interested resident



Public open space SuDS



was visited and the scheme was explained to them; they were asked to choose the shape of rain garden they would like, and to discuss how it would be sited on their property, and the way in which the water would be conveyed to the rain garden from the disconnected downpipe. Plans of the revised design for the public open spaces, incorporating the SuDS layout, were also shown.

Each resident who wished for a rain garden was then given a leaflet offering optional colour schemes for the plants, allowing them to select the individual plant species for it within a given range of parameters. During construction, residents were also involved in agreeing how existing plants in their garden would be lifted and replanted (if applicable) to make space for the rain garden, any specific details regarding the route of the channel to the rain garden, and how the actual plants would be set out within it.

Two phases of works have now been completed, and the SuDS are working well, but no further extreme events have yet tested them fully. Both the rain gardens and the public open spaces have been designed to accommodate a 1 in 100 storm event for the rainwater diverted into them. Where owners fully engaged with the idea, the SuDS have become well-tended features in their gardens – some adorned with gnomes, bird baths and other statues or sculptures. Others are growing well despite relative neglect. The public open spaces have taken longer to settle, and have been subject to both minor abuse and a lack of quality maintenance by the grounds contractor, but are still functioning well.



All photographs are courtesy of Illman Young

# INVERNESS

## Sustainable Urban Drainage Systems

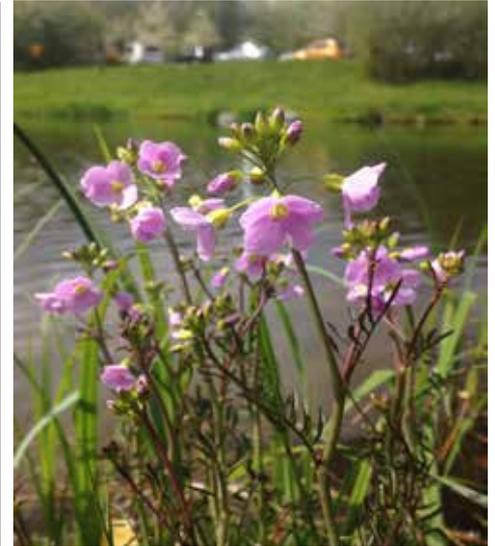
**Marcia Rae**

*Graduate Research Assistant, Highland Council*

**T**he **Inverness SUDS project** is a collaboration between Scottish Natural Heritage, Highland Council and Salford University. It has sought to build on a previous five-year study by David O'Brien (published this year in *Urban Ecosystems*) which determined that amphibians were breeding in Inverness SUDS.

The current project sought to identify all SUDS sites in Inverness that may be supporting amphibians, assess their value for wildlife and their connection with other similar habitats. This information is being gathered so that best practice can be identified and shared with local developers and planners; nowhere else in Scotland has such a thorough survey taken place. It will produce detailed information on the environmental quality and wildlife value of the SUDS ponds. In addition, DNA analysis will indicate how isolated amphibian populations are from adjacent ones.

Initial results from the March–July survey period are looking good in terms of the presence of frogs, toads and palmate newts in



*Cuckoo flower*



*SUDS pond at Inshes Park, Inverness*



the ponds. This proves that SUDS are indeed providing valuable habitat for these species within the urban environment. The results are being presented at the first Sustainable Urban Drainage conference on 27<sup>th</sup> November 2015 at the Highland Council Headquarters in Inverness.

**More information can be found at:**  
<http://www.highlandbiodiversity.com/news/5-oct-2015-sustainable-urban-drainage-systems-conference.asp>

*All images are courtesy of Marcia Rae*

## Catchment Based Approach Annual Conference

June 2015 at Fishmongers' Hall, London  
Maxine Forshaw, FWR

**T**he day began with a look at catchment-based approach (CaBA) achievements during the past year. Richard Cole (Defra) said that by March 2014 over 100 catchment partnerships had been established across all of England's catchments, and that partnerships are now spending less time developing the partnership and more time 'delivering practical environmental work'.

Defra is providing funding this year of £4.7m for catchment projects and the CaBA host role. However, challenges still remain – benefits are often difficult to assess and progress can be slow around enabling more co-ordinated measures and bringing planning systems together. The new government does not alter the localism agenda, but during 2015–16 Defra will explore options for the future.

For the upcoming revised River Basin Management Plans (RBMPs) for the 2nd cycle of the Water Framework Directive, each catchment partnership has been invited to write a synopsis of their catchment in terms of their top three

priority issues and planned contribution to environmental outcomes by 2021. So, in addition to the recent consultation on the draft RBMPs, this is a further example of where we are able to engage with the process.

The CaBA National Support Group covered their role and the tools available to the CaBA community. The CaBA website (<http://www.catchmentbasedapproach.org/>) is the primary location where partnerships can describe their work, network with each other and access tools, best practice, technical support and news. On the CaBA website, partnerships are now able to edit and maintain



Hambleton Mill, River Thames (Courtesy Maxine Forshaw)

their own catchment pages.

Experience of working with local authorities and with water companies were presented by Northumbrian Water Group and Bucks County Council. There were many interesting examples of 'Delivery in the Urban Environment' including many from the London catchment partnerships (14 in total) – River Cray channel improvements; the *Citizen Crane* project, ie the River Crane phosphorus monitoring and river monitoring initiatives; Thames 21's *Thames River Watch* using volunteers addressing issues such as water quality, litter accumulation and invasive species; and the

Hogsmill River connectivity project to aid fish passage.

Levering additional funds is seen as a key aspect of the catchment-based approach. Income generation through employment and training programmes (provides manpower and creates a visible impact), direct business engagement, tapping into communities, heritage initiatives via Heritage Lottery Fund, the landfill tax route, and others such as health initiatives (eg *Get out, Get Active*), environmental mitigation and European funding. All need a substantial input of time and effort, but left the attendees with much food for thought!

CONSUMER COUNCIL FOR



## Issues Workshop

20 October 2015  
Maxine Forshaw

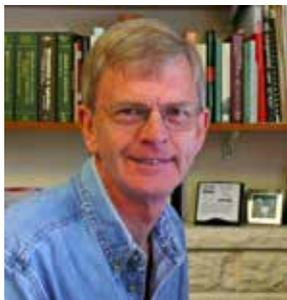
**T**he Consumer Council for Water (CCWater) have been holding a series of workshops around the country to ask 'what does the future hold for water consumers, water companies and CCWater?'

CCWater is the independent statutory organisation representing household and non-household water and sewerage customers in England and Wales. CCWater explain:

*We provide a strong voice for consumers by keeping in close contact with local water companies and with consumers. We make sure that the collective voice of consumers is heard in national water debates...we want consumers to get a good, reliable water and sewerage service from their water company at a price they find acceptable and can afford. We want their issues and concerns to be addressed.*

The organisation has recently held five sessions around England and Wales to find out what their stakeholder organisations think are likely to be important issues (over the next three years and beyond) which matter to water consumers, and the possible impact of these. Examples could include climate change, value for money, reliable water, abstraction reform, and an effective sewerage system. Discussions also centred around what this may mean for CCWater in terms of what they should be doing about such issues on behalf of consumers. A draft Forward Work Programme will be issued in November, followed by the final version in January 2016.

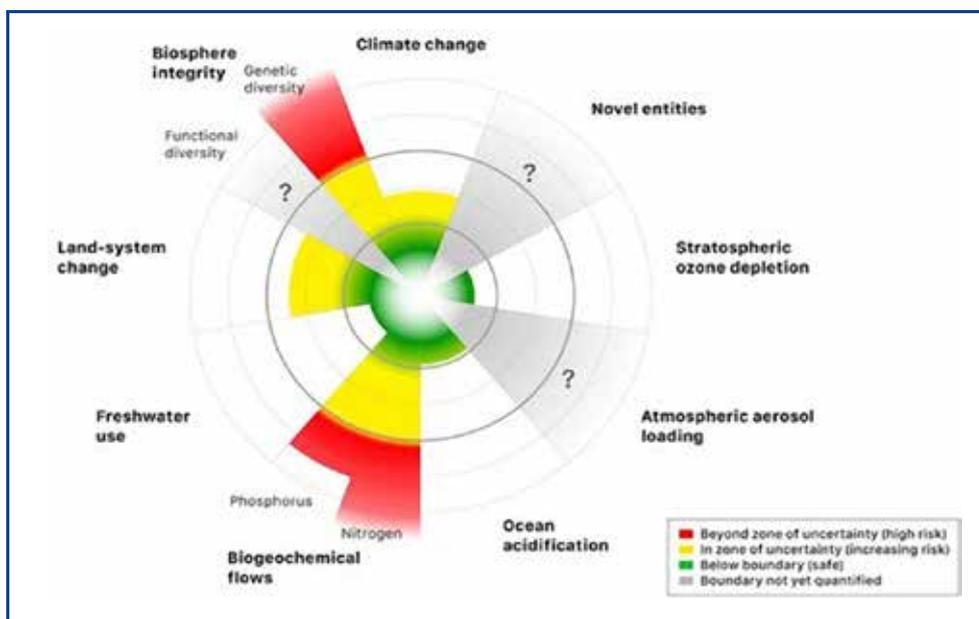
## WASTEWATER MATTERS



### Sludge treatment it should cost what it costs to do it right

**Tim Evans**  
FWR Wastewater Section Co-ordinator

**THE ENVIRONMENTAL FOOTPRINT OF THE UK'S SLUDGE MANAGEMENT** is about the best in the world. Approximately 85% of sewage sludge is treated by anaerobic digestion (AD) in the UK. Of that, 20% or more includes thermal hydrolysis (TH) as a pretreatment, which is the state-of-the-art method. Most sludge is dewatered. The Bucher filter press has achieved a step change in water extraction at Thames Water and will probably be taken up by other companies. Less than 20% of sludge is incinerated, virtually none is landfilled and the rest (more than 80%) is used on land to complete nutrient cycles and help to conserve soil organic matter. That headline story is very good but complacency, and not spending enough, could put it all at risk. Sludge management accounts for almost half of wastewater management operating costs, so it is significant.



Understanding of earth system boundaries (courtesy UCL)

Apparently we are exceeding the earth system boundary for fixed reactive nitrogen and for phosphate by about six and five times respectively. Phosphate is the least abundant of the major plant nutrients. The total phosphate in wastewater is equivalent to about one-third of our phosphate imports, so using treated sewage sludge to replace some of the fertiliser requirement for farming (which accounts for more than 80% of phosphate use) is a very worthwhile contribution. Incineration of raw sludge yields almost no net energy (water does

not burn) but the combined energy yield with TH plus AD and good dewatering is positive. Incineration, however, squanders the phosphate content currently and also the fixed reactive nitrogen.

The earth system boundary situation adds to the case for recovering ammonia and phosphate from sludge dewatering liquor. Osaka and Oslo Wastewater Treatment Works have been recovering ammonia for more than 10 years but this is applicable way beyond those cities whose name begins with 'O'. Osaka uses steam stripping under reduced pressure,

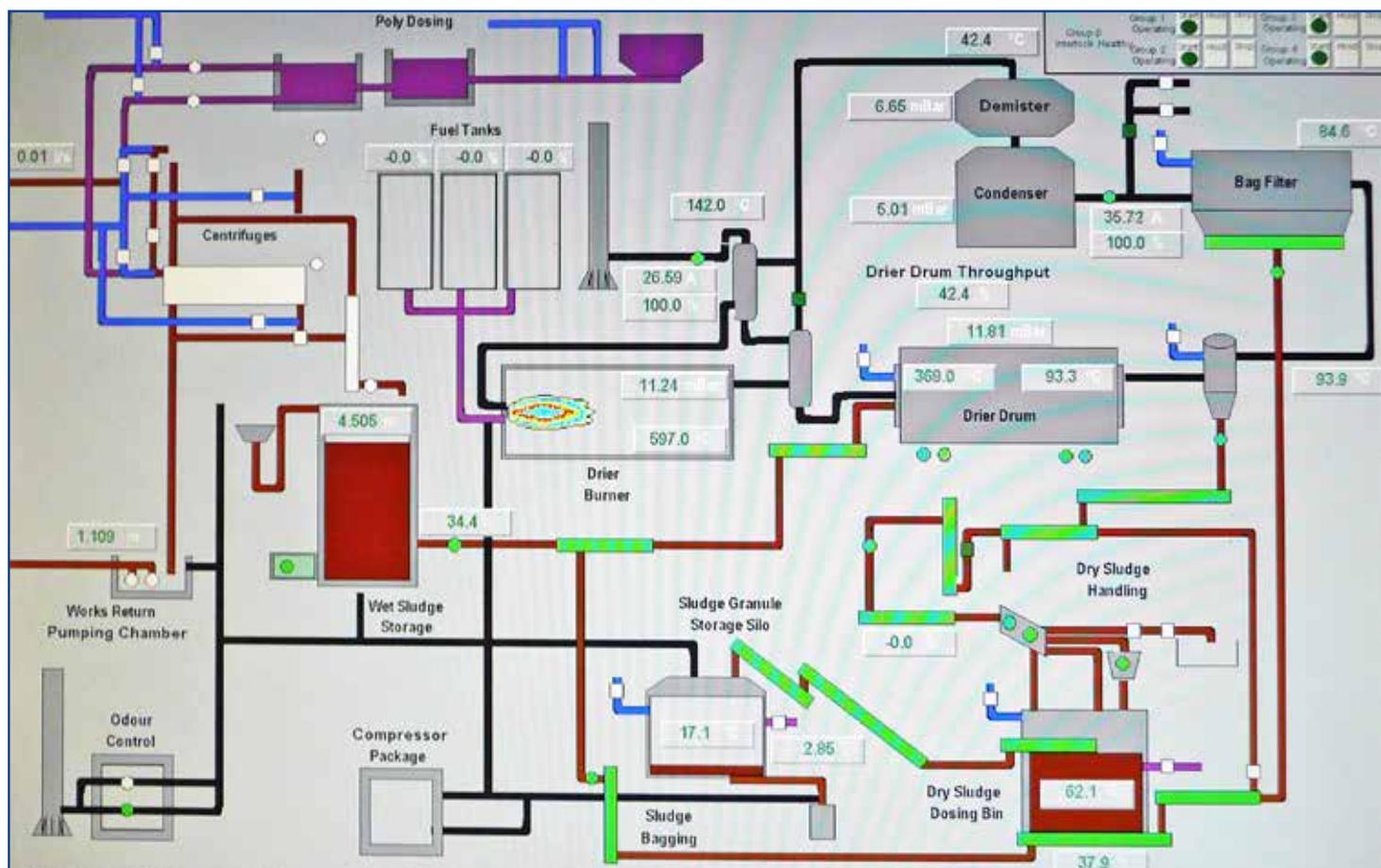
which is the most cost-effective method and produces the highest value product. The first struvite (P recovery) plants in the UK are at Slough in Berkshire and Stoke Bardolph in Nottinghamshire, and there are many more around the world.

So, renewable energy and helping to reduce our exceedance of the earth system boundaries through recycling is a very positive story and a step towards the circular economy, but land application relies on confidence (which can be a house of cards) and some designs and practices of sludge management are jeopardising its integrity.

Discussions with stakeholders (British Retail Consortium, Country Land & Business Association, etc) in the late 1990s introduced the water industry to HACCP (Hazard Analysis and Critical Control Point). The Agreement (and Safe Sludge Matrix) was a world milestone.

HACCP was developed to ensure that food going into the manned space program would not give astronauts food poisoning [not pleasant in a spacesuit]. Applied correctly, HACCP deals with Murphy's Law (*if anything can go wrong, it will*) because it requires you to create a strategy to cope with failures. However, the water industry imposed its own 'HACCP-lite' instead of applying it to the whole process. If you think that's harsh, consider a sludge treatment centre that receives dewatered raw cake from other works and digests it with its own sludge. What could possibly go wrong? Well, there could be hard objects (eg bolts, tools, iron, rocks) in the cake that could damage pumps, accumulate in vessels, etc and result in unplanned shutdowns (and costly repairs) and that is exactly what happens. HACCP would have required designers to plan for, or prevent, such breakdowns – for example, by re-slurrying the cake so that it can be screened, but they didn't because full HACCP was not taken up.

Another example would be an incinerator (or gasifier) burning raw cake. When there is a shutdown (planned or unplanned) you have raw cake – can it be stored on site pending the incinerator returning to operation? One of the largest sludge treatment centres in the UK has barely four days' cake storage on site – it can't even cope with Easter: I don't think that can ever have been subjected to an honest HACCP analysis! Processes such as incineration and drying involve a chain of equipment. Is it built with redundancy (duty/standby) which is maintained operational at all times, or has it been value-engineered so that when a conveyor stops, for example, the whole process



Where is the contingency in this raw sludge drying? If one link in the chain breaks, the whole process stops (courtesy Tim Evans)

stops? Is the integrity of digester domes checked or might they be condemned for leaking? Are digesters dewatered and mixing systems maintained so that the sludge is stabilised properly and has acceptable odour when applied to land?

Reliable sources have told me that when large sludge treatment sites have had shutdowns, the cake has been hauled to third-party sites outside their water companies' areas where quicklime has been mixed with the cake using a loading shovel, and subsequently the mixture has been applied to land. Alkaline stabilisation can produce a very useful alternative to agricultural lime, with acceptable odour and the added benefit of plant nutrients; however, intimate mixing and controlled reaction are key requirements. It is a useful contingency because it can be turned on and off, but to be done properly it must be capitalised adequately. It should cost what it costs to do it properly; anything less produces stinking s\*\*\* that is going to upset people in the vicinity of places where it is spread. The Scottish government launched an enquiry into the use of sewage sludge on farmland. From a transcript of proceedings in

the Scottish parliament it is clear that complaints about odour from people in southern Scotland were the trigger for the enquiry, and also that the offensive sludge did not necessarily originate in Scotland (maybe none of it did?)

Using sludge on farmland to complete nutrient cycles and help conserve soil organic matter is the best practicable environmental option, and it is also the least expensive option. Extensive research over many years has shown that it is safe. Yes, you can find most of the chemicals used in society in sludge, but they are present at such low concentrations and/or in chemical forms that are biologically unavailable that the risk of transmitting a harmful dose to any receptor is below the

threshold that we accept for everyday activities. It is the route for more than 80% of the UK's sludge (100% for some companies). It is business critical. The future of land application depends critically on confidence. If there were widespread public opposition, the food industry could, in effect, deny access to farmland tomorrow. Sludge treatment is the preparatory step for publicly acceptable land application. I think it is essential that designers and operators of sludge treatment buy into the objectives of land application and the farming calendar. It should not be the poor relation of drinking water treatment. It should cost what it costs to do it right.



Land application of biosolids with all the necessary controls (courtesy Tim Evans)

## An update on the activities of the FWR

**Caryll Stephen**

Chief Executive of the Foundation for Water Research



**F**OLLOWING A FAIRLY HECTIC SUMMER, when FWR continued to be represented at a number of water events, we are now looking carefully at our future workload for 2016.

The WFD Information Centre area of our website is being updated in a number of areas, and we continue to be busy with our work on catchment matters. Two new ROCKs (Reviews of Current Knowledge) are due to be published during the winter period, and consideration is being given to writing a Guide on clean water storage and wastewater disposal for pleasure boats

and caravans – this being a topic we are often asked about at shows and exhibitions.

Sadly, on the wastewater side, Tim Evans, who has guided and managed our Wastewater Forum since 2002, has decided to retire, although he says he may still write a few articles in the future...possibly! We thank him for all his hard work and contributions of many fascinating articles for our newsletter over the years and wish him well for the future, especially with the renovation of his recently acquired house in France. We welcome Steve Bungay (Helix ECL) who has agreed to 'step into Tim's shoes'; we will include a full briefing in the February issue of the newsletter.

The festive season is now beginning to take hold and I'd like to thank all who contribute to our newsletters, and, as this is the last issue in 2015, I wish all our friends and readers a Happy Christmas and a good New Year.

## Wychwood Forest Fair and WSW Peterborough

**Neil Tytler, FWR**

Marketing has been quieter through the summer as the holiday period arrived. Going into the autumn, FWR has attended two events. In September the Wychwood Forest Fair was held (near Chipping Norton in Oxfordshire). This fair is attended by large numbers of the public and is an ideal event at which to publicise our work and the information and publications we produce.

In October we ran a stand at the Water, Sewerage and Waste Exhibition at Peterborough. There was a steady stream of visitors to our stand, with a number of questions from water company employees, local authority staff, NHS personnel, surveyors and consultants being answered.

Peterborough Cathedral



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