Delivering more effective stormwater management in the UK and Europe – lessons from the Clean Water Act in America

Pour une gestion plus efficace des eaux pluviales au Royaume Uni et en Europe : Enseignements du "clean water act" en Amérique.

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RESUME

Le CWA - Clean Water Act (programme Eau Pure Américain) mis en place aux Etats-Unis dans les années 70 peut apporter des enseignements très utiles pour l'Europe. Le CWA fût l'élément moteur pour l'amélioration des cours d'eau et autres milieux aquatiques. Il a dû faire face aux même types de difficultés et opportunités que celles rencontrées aujourd'hui en Europe lorsque l'on travaille sur les systèmes de gestion des eaux pluviales. Par l'analyse des 30 années d'histoire du CWA, l'Europe devrait être capable d'éviter une bonne partie des problèmes rencontrés aux Etats-Unis pour maîtriser les rejets d'eaux pluviales afin d'améliorer la qualité de l'eau.

ABSTRACT

What is known as the Clean Water Act (CWA) in the USA, implemented in the early 1970s, can provide some useful lessons for Europe. The CWA has been the key driver in cleaning up watercourses and other water bodies, has encountered a similar range of difficulties and opportunities that are being found across Europe when dealing with stormwater systems. By drawing on the 30 years of historical lessons from the CWA, the EU should be able to avoid many of the problems encountered in the USA for controlling stormwater discharges to deliver improvements in water quality.

KEYWORDS

BMP, Clean Water Act, Floods Directive, Institutional factors, Legislation, LID, Priority Hazardous Substances, Stormwater, SUDS, Water Framework Directive.

INTRODUCTION

Europe is required to implement the "good status" requirements of the Water Framework Directive (WFD) by 2015 (Commission of the European Communities, 2000). This provides the European Community (EC) framework for the protection of waters. The aim is to promote the sustainable use of water, while progressively reducing or eliminating pollutants for the long-term protection and enhancement of the aquatic environment. A new proposal for a Directive on the Assessment and Management of Floods (Floods Directive) (Commission of the EC, 2006) sets out to reduce and manage flood risk. The Floods Directive and measures taken to implement it are to be closely linked to the implementation of the WFD. The EC proposes to fully align the organisational and institutional aspects and timing between the Directives, based on river basin districts defined in the WFD.

Particular challenges for stormwater management are two WFD 'daughter' Directives in preparation. One concerns groundwater and the definition of good chemical quality, and the other, the way in which the most polluting substances are handled, the 'priority substances' (PS) and the 'priority hazardous substances' (PHS); some of which, such as nickel, are ubiquitous in stormwater. Notwithstanding the daughter Directives, stormwater sewers and drains are known to convey significant pollutants and need to be better controlled under the WFD; albeit such pollution being better managed at source than in drains.

There are various forms of ownership and operation of the networks of combined or separate drains and sewers across the EU that convey stormwater runoff (e.g. Middlesex University, 2003; Mohajeri et al, 2003; Juuti & Katko, 2005). These may be owned publicly or privately or be part of the network that is operated by sewerage undertakers or municipalities. Similar extents of combined and separate sewers also exist in the USA. Best Management Practices (BMPs) for the management of storm water, are common in many countries worldwide, despite a lack of consistent information on their performance even in the USA (Field et al, 2006). There is a general belief that these systems are 'more natural' or 'more sustainable' than conventional piped drainage and sewerage systems. At the very least BMPs usually provide the means to simultaneously deliver water quality, quantity and amenity benefits and are a major component in the delivery of clean-up of stormwater discharges required under the Clean Water Act (CWA) in the USA.

There are clear parallels between the WFD and the CWA. The latter was implemented in the early 1970s and has resulted in significant efforts to improve the quality of America's 'impaired' water bodies, much of which has included improvements to stormwater management. US experience has demonstrated that the use of BMPs and Low Impact Developments (LIDs) can be a much more cost-effective way of ensuring protection to receiving waters than the traditional approach of stormwater control using drains and sewers. In addition to separate storm drainage, BMPs can also help to better manage the stormwater that is discharged into combined sewers, by slowing down the rate of runoff, or even by removing these inputs altogether.

There are similarities between the member States of the EC and the individual States in the USA, although the Federal legislation and the main regulator the US Environmental Protection Agency (USEPA) have a more direct role in the implementation of the CWA in the USA. There is no equivalent in the EU as each member state is responsible for the implementation and policing of the WFD requirements. This paper reports on an investigation of US practice in relation to European practices and has concluded that there are a number of important lessons and opportunities of relevance from US practice to better manage stormwater in Europe.

THE MAIN IMPLICATIONS OF THE WFD FOR STORMWATER MANAGEMENT

The WFD is an opportunity to ensure a consistent and integrated approach to the way in which we currently manage water within defined river basin districts. The establishment of the European 'priority list' of substances posing a threat to or via the aquatic environment is significant. There are currently 33 priority substances on this priority list (Official Journal of the EC, 2001; Commission of the EC, 2006a). Estimates of the costs of compliance for the UK suggest some €9bn would be needed to deal with these substances for the discharges from point sources alone. Even with this level of investment, only some 70% of the PHS would actually be removed (Ross et al, 2004). However, the 33 so far identified could be added to significantly in the future and this may add additional treatment and financial burdens and possibly require the development and installation of new technologies. Inevitably the Directive will mean that some stormwater and other discharges to water bodies will be required to cease or at the least have substantial treatment systems installed.

The precise standards to be attained to comply with the WFD are being set within and by each member state. Ecosystems do not recognise state boundaries and hence there has to be harmonisation especially across shared borders. Even in the UK the approach to the implementation and adoption of proposals is likely to vary for each constituent country, depending on present and proposed legislation and on policy differences. It will also depend on the need for Ireland and the UK, as separate Member States, to harmonise standards, where appropriate, within shared River Basin Districts (UKTAG, 2006).

In addition to the WFD, the proposed Floods Directive seeks to provide maps and flood risk management plans through a broad participatory process. The main purpose of the draft Floods Directive is to set out a framework for the reduction of risk to human health, the environment and economic activity associated with flooding.

THE CLEAN WATER ACT

Governance in the USA is exercised at a National or Federal level and also at a State level, with Counties and Townships, and in some areas, Indigenous peoples (tribes) having responsibilities and a degree of autonomy not typically seen in Europe. Much of the clean up of water bodies in the USA has resulted from litigation by activists and NGOs. This led to the enactment of the Federal Water Pollution Control Act Amendments of 1972. This law became commonly known as the CWA. This gave the Federal Agency and the EPA the authority to implement pollution control programmes and continued requirements to set water quality standards for all contaminants in surface waters, requiring a permit to discharge any pollutant from a point source into navigable waters.

The National Pollutant Discharge Elimination System (NPDES) ‘MS4’: Municipal Separate Storm Sewer Systems was developed to protect receiving waters from contaminated stormwater discharges (Maestre et al, 2004). Initially the EPA believed that the traditional end-of-pipe controls used for process discharges and treatment works could not be used to control stormwater pollution. Stormwater regulations (Phase I) were initially developed for large municipalities (>100,000 population) and for certain industrial categories. Now Phase II of the stormwater permit programme extends to all urban areas. The CWA provided the capability to implement stormwater management plans at the regional level and was welcomed by planners; however, in the late 1970s problems arose due to inadequate data and lack of technological development. As a consequence, between 1978 and 1983, the USEPA conducted the Nationwide Urban Runoff Programme (NURP) to determine water quality from separate storm sewers for different land uses.

Starting in the late 1980s, efforts to address polluted runoff have increased significantly. For 'non-point' runoff, voluntary programmes, including cost-sharing with local landowners, are the key tool. For 'wet weather point sources' like urban storm sewer systems and construction sites, a regulatory approach is now being employed. Engagement of stakeholder groups in the development and implementation of strategies for achieving and maintaining State water quality and other environmental goals is another hallmark. Evolution of CWA programmes over the last decade has included a shift to more holistic watershed-based strategies with equal emphasis on protecting healthy waters and restoring those that are 'impaired'.

States can be authorized to administer the NPDES program by EPA. An NPDES programme has various components, including; Base Programme for municipal and industrial trial facilities, Federal Facilities, General Permitting, Pretreatment Programme and Biosolids. A State may receive EPA authorisation for one or more of the NPDES Programme components.

The control of stormwater depends ultimately on the appropriateness of the local municipality within the regulatory system. Whilst the granting of Permits is delegated from EPA to State level this is often further delegated. In general, this usually reflects the population of the area. Where populations are less dense, this authority would be administered at County Level, and in sparsely populated areas would probably be retained at State level.

Whilst it would appear that the regulations are disjointed, with some States still not having yet achieved even Phase I of the CWA, let alone working towards Phase II, which has a delivery date of 2008, this is inevitable given the flexibility in the implementation process. The requirements of the CWA are implemented at site level via the definition of Total Maximum Daily Loads (TMDLs) for impaired water bodies. A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still meet pre-defined water quality standards, and an allocation of that amount to the source of pollutants causing the impairment. The most common reported impairments are: metals (19%); pathogens (13%); nutrients (9%); sediment (8%) (TMDL website: www.epa.gov/owow/tmdl/).

The CWA establishes the water quality standards and TMDL programmes, this requires that the jurisdictions establish priority rankings for waters on the lists and develop TMDLs for these. Specific guidance is also provided on the mandatory public outreach programme for which local towns would be responsible. This should focus on educating the public about negative water quality impacts. In summary, it is apparent that the regulatory practices from State to State are variable, but these are appropriate to the locale which they serve. Usually provided the construction of the stormwater systems receives the appropriate permits these will then be taken over (adopted) by the municipality, county or state.

LESSONS FROM USA CONTROL OF STORMWATER PRACTICES FOR EUROPE

Although the CWA has been the baseline for cleaning up the waters of the USA since 1972, progress has been slow, often achieved only through litigation and court orders. The devolution of responsibilities for NPDES to State and local level, with some retained by the EPA, has resulted in a complex and fragmented approach being taken, albeit one in which local knowledge and priorities have established the main goals for improving impaired waters and for which local community involvement has been strong. Stormwater facilities are delivered and managed by a wide variety of organisations, from municipalities to private contractors and the use of stormwater utility companies is common.

A range of measures for the management and treatment of stormwater in the USA are evident. These range from structural controls to 'natural' and equivalent 'green' systems. Early on in the development of the measures arising from the CWA and in setting TMDLs, it was realised that the performance of BMPs in terms of water quality could not be readily defined due to a lack of knowledge about their long term performance (Field et al, 2006). Associated with this has been the accreditation of a number of proprietary devices for the removal of specific pollutants. Unfortunately the desire for a 'universal' treatment system for stormwater pollution control has also resulted in the promotion of such systems and their utilisation, despite their inability to provide 'complete treatment'.

The CWA has a number of similarities to the WFD. However, the CWA has been around for 30 years with a target for Phase II implementation of 2008. The WFD echoes a lot of similar sentiments to the CWA but implementation is expected over a much shorter and possibly unrealistic time frame. Many of the water quality standards that are enforced in the EU have centered on the quality issues relating to foul/combined sewer pollution. Surface water has heretofore not been subject to the same degree of quality control (Middlesex University, 2003). Apart from the imposition of petrol/oil interceptors when high levels of pollution are expected there is little to be found for guidance on the form of treatment for stormwater. Some of the requirements to remove pollutants from stormwater can be overly onerous under both the CWA and WFD. Caution is required when it is expected that the removal of 'all' of a certain 'specified pollutant' such as Cadmium or Nickel is possible or even desirable economically, as some of these elements are naturally occurring and total removal is not realistic other than through changes at source.

In the USA as well as the EU there is a move to new 'more natural' stormwater management approaches, BMPs, LIDs, SUDS (sustainable drainage systems) and 'source controls'. In some parts of the USA 'natural' stormwater systems, originally defined as BMPs, have been in use for at least 50 years as an alternative to traditional piped drains and sewers. There is therefore a long history of experience in regulating, implementation and use. Inherent in these is the need for greater engagement of all the actors involved. In the USA citizen involvement in the planning of stormwater management via formal boards, informal citizen groups and other activities is notably strong since it is a requirement under the CWA. Whilst this does occur in the EU, such involvement is generally much weaker and gaining public confidence and commitment to the better management of stormwater is therefore often ineffective (e.g. for UK, see House of Lords, 2006).There are major impediments to the use of these systems in many EU countries due to urban density, regulatory inadequacies and institutional constraints. Elsewhere in the world, such as in the USA, many of these barriers do not exist as institutional arrangements are more flexible, although there are other challenges to be overcome. New ideas and versatile systems are needed that will assist with particular applications in Europe, such as high density housing, retrofitting to resolve existing problems and to meet the requirements of the WFD.

US experience has shown that the incremental and localised small-scale management of stormwater, such as: evapotranspiration techniques; green roofs; water gardens and/or disconnecting existing inputs to major drainage systems can collectively provide significant benefits to managing local and downstream water quality and quantity. These approaches can also provide other benefits such as local irrigation or opportunities for reuse.

It is apparent from US practice that there are considerable benefits from providing greater incentives for the use of innovative stormwater management techniques. These are most effective where the stormwater costs are clearly identifiable within

charging schemes. Incentives include charges (and discounts) based on directly connected impervious areas. Clearly identifiable costs and discount or rebate opportunities can aid in engaging each of the stakeholders. In many areas of the USA separate stormwater utilities (municipal or private) deliver a service associated with a defined income stream as above. These utilities also raise awareness of stormwater, help identify better opportunities for innovative management and more effectively engage all stakeholder groups.

Whole life performance and costing of stormwater systems is needed to include construction, maintenance and the selection of the most appropriate sustainable drainage systems (this may include piped systems). Ensuring effective design and construction is challenging even in the USA and the lodging of developer payments with the regulatory authorities before construction can ensure that good designs and construction are actually delivered.

In the USA the CWA makes clear recommendations about education and community participation. There is a need to build capacity (knowledge and competence) within the stakeholder communities and also to help stakeholders understand/accept innovatory approaches and technologies which may include the need to assume a more responsible role. There are a wide variety of approaches to the adoption and maintenance of BMPs in the USA, from municipal responsibility to individual householders. Within a particular regulatory area there is a tendency to utilise one single approach. It is apparent that stormwater systems should be adopted and managed by a single appropriate agency within a local context. This may be a separate stormwater utility (see above). In the EU adoption and maintenance is a major challenge for local on-site systems and is linked to how these systems are funded, which is not uniform across the community.

Notwithstanding recent efforts in the EU, there is a need to invest more in developing and evaluating the long term performance of BMPs via clearly defined and scientifically robust long-term monitoring. Protocols for monitoring defined from US studies will help to define investigation programmes (e.g. Roesner et al, 2006). This will require significant investment across the community and in member states and should be recognised by regulators and others as essential for the development of long-term and sustainable stormwater management systems. There is a need to better understand the effectiveness of dispersed solutions to the management of stormwater in a European wide context. Costs, risks and institutional barriers need to be considered within a whole system performance context. Cross-regulatory and institutional barriers arising due to the mixed management responsibility for stormwater in many countries in the EU need to be exposed and eliminated where stormwater disconnection is identified as the best option.

A separate and identifiable separate surface/storm water charge should be apparent to bill payers as is done in many parts of the USA, in the same way that sewage and water charges are usually identified. Alternatives available for stormwater system users to e.g. disconnect, reuse, fit green roofs, should be made clear in information available from regulators and sewerage service providers and others such as public groups. This should be accompanied by clear indications of the financial support and benefits (rebates) available for alternatives, along with educational programmes aimed at building the capacity of householders, facilities managers and others to take a more active role in local stormwater management. As the latter will not be in the interests of any private sewerage undertakers, because it will lead to a reduction in income, regulators will need to review the incentives to the undertakers to promote these changes to current practice. The limited experience of BMPs and equivalent systems worldwide means that there needs to be better arrangements in place to

ensure good design and construction. This requires the education and training of all stakeholders, especially planners and building control officers.

CONCLUSION

The capacity to understand and deal effectively with stormwater within virtually all stakeholder communities in Europe is limited. This is also true even in the USA, although the CWA recognises and formalises the need for stakeholder education. With the changing drivers (and even current ones such as the WFD) this is no longer going to be acceptable. A more concerted and encompassing approach to the engagement and education of all stakeholders is essential in order to build the capacity to deal with the future challenges. There is a clear need for a cross-institution stakeholder engagement and capacity building initiative; however, this is may currently be difficult to achieve due to the inflexibility and intractability of the existing regulatory and institutional arrangements that are restraining the opportunities for innovative stormwater management in many European countries.

Currently the place of stormwater (and water) within formal planning processes in many EU countries is not considered to be very important. In view of the future uncertainties from climate change and impacts from current legislation (WFD in particular), the place of stormwater management will need to take a more central role in all aspects of urban planning. In addition, regulatory systems will need to become more flexible and adaptable to new knowledge.

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Start studying CLEAN WATER ACT. Learn vocabulary, terms and more with flashcards, games and other study tools.Ä Congress exempted some water pollution sources from the point source definition in the 1972 CWA and was unclear on the status of some other sources. Such sources were therefore considered to be nonpoint sources that were not subject to the permit program. Agricultural stormwater discharges and irrigation return flows were specifically exempted from permit requirements. Nonpoint sources arent covered since they are difficult to regulate and trace - nonpoint source discharges are not always easily observed, and monitoring nonpoint pollution can be costly. Le CWA - Clean Water Act (programme Eau Pure AmÃ©ricain) mis en place aux Etats-Unis dans les annÃ©es 70 peut apporter des enseignements trÃ¨s utiles pour l'Europe. Le CWA fÃ»t l'Ã©lÃ©ment moteur pour l'amÃ©lioration des cours d'eau et autres milieux aquatiques.Â A range of measures for the management and treatment of stormwater in the USA are evident. These range from structural controls to â€˜naturalâ€™ and equivalent â€˜greenâ€™ systems. Early on in the development of the measures arising from the CWA and in setting TMDLs, it was realised that the performance of BMPs in terms of water quality could not be readily defined due to a lack of knowledge about their long term performance (Field et al, 2006). The Clean Water Act has made great strides in reducing point source water pollution, but this effect is overshadowed by the fact that nonpoint source pollution, which is not subject to regulation under the Act, has correspondingly increased.[40] One of the solutions to address this imbalance is point/nonpoint source trading of pollutants. In January 2003, the EPA Water Quality Trading Policy was issued. At this time, many waters in the United States did not support their designated uses. Specifically, 40 percent of rivers, 45 percent of streams, and 50 percent of lakes that had been surveyed were unfit.