The role of context in framing discourses in the transition from piped to sustainable stormwater systems

Le rôle du contexte dans l'élaboration de discours pour la transition du tout-tuyau à des systèmes durables de gestion des eaux pluviales

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ABSTRACT

Stormwater drainage has traditionally comprised piped or culverted systems in developed countries. Awareness of the potential lack of sustainability of these compared with alternative source controls, green infrastructure and surface based systems has grown in recent decades. Yet there is so far limited evidence that one system is necessarily a priori more or less sustainable than the other. Nonetheless stormwater management systems are among the numerous human-global systems which must adapt in order to function within the new context imposed by climate change. The process of adaptation, moving from one (stormwater) system to another, can only come about as part of a transition. Between the 17th and early 20th century it was appropriate to frame urban stormwater design as essentially an engineering process and the discourses contributing to that technocratic process were also confined within the engineering frame. Climate change has brought a change of context which now challenges this technological framing. This paper considers contemporary urban stormwater system design using case studies from Sweden and the UK and argues that the on-going framing and discourses have not shifted to match the change in context; meaning that urban stormwater design is still predominantly viewed as an engineering process. Based on this analysis, a model is presented to enhance the conceptual relationships of context, framing and discourse. Ways in which the context may be incorporated better into the design process to enable stakeholders to influence the framing and discourse to improve the transition to sustainable stormwater solutions is also presented.

KEYWORDS

Climate change, Discourses, Framing, Stormwater
1 INTRODUCTION

Amongst many researchers and some practitioners there is a shared belief that contemporary approaches to the management of urban stormwater are not as sustainable as they could and need to be (e.g. Chocat et al, 2007; Cettner et al, subm.; Brown et al, 2011). Discourse amongst these actors and beyond, usually frame stormwater variously as, for example: an ‘opportunity’ (rather than just a problem, e.g. Digman et al, 2012); part of an integrated water cycle system (known as water sensitive urban design (WSUD) in Australia, Wong, 2006); or as part of a move towards greater sustainability (e.g. Cettner et al, in press). Despite this, there are no definitive scientific studies that show conclusively that the emerging ways of managing stormwater using source controls, on the surface, SuDS, BMPs or WSUD are necessarily more or less sustainable than the traditional use of piped stormwater systems. There are many individual studies illustrating that alternatives to piped stormwater systems provide added benefits, when compared with piped systems, such as simultaneous water quantity and quality management, aesthetic value and can, e.g. contribute to assisting with water supplies. The worldwide movement linking ecosystem services to, inter alia non-piped stormwater management also appears to support the multi-value benefits of such approaches (e.g. Lundy & Wade, 2012; Moore & Hunt, 2012). Yet the scientific case is so far unproven other than in particular instances: when, where and how are non-piped stormwater systems more sustainable than traditional piped systems? This depends entirely on context.

This paper sets out to explore the movement for changing stormwater practice. What changes have occurred to practice and why? Is there a real need to change practice? And if so, how can such a change be brought about? Using examples from Sweden, England and Wales, it is shown that despite a widespread belief that change is needed; the evidence for ‘sustainability’ of alternative practice is still sparse. Nonetheless, a very vocal worldwide movement is gradually changing the norms of practice often against the better judgement of those who actually have to deliver the designs and construction of non-piped stormwater systems (e.g. Wielebski, 2012). The changes are coming about because of a shared discourse that frames non-piped stormwater systems in a vague, but individually shared, and in some cases institutional, view that these systems are somehow ‘better’ or ‘more sustainable’, despite the lack of proven evidence. Thus there are two important contexts here: the context in which the development or stormwater system sits physically; and the context within which the planning, design and discourse around which system is preferable takes place. Both of these contribute to a change in practice, or a transition.

2 TRANSITIONS IN STORMWATER PRACTICE

Societal systems are complex adaptive systems that adapt to the prevailing environment and simultaneously to societal needs. The societal system is composite, built up from a number of societal subsystems. A transition is defined by de Haan & Rotmans (2011): “as a fundamental change in the structures, cultures and practices of a societal system, profoundly altering the way it functions.” There are numerous examples of transitions in history, one of which was the sanitation transition in industrialised countries in the 1800s (Geels, 2006). Stormwater is usually disposed of via drains and sewers and hence centralised wastewater treatment is the dominant paradigm, assumed to best provide for society’s needs. Alternatives, for example rainwater harvesting, may provide a particular societal need that is not usual or normative, certainly in the UK and Sweden, although common in Australia. Recently, however, even the English water companies have started to refer to rainwater harvesting in their forward thinking (e.g. Kelda Group, 2011) as part of integrated water management. Source control urban drainage, known as SuDS in the UK, is a niche-regime in Australia as part of Water Sensitive Urban Design (WSUD) and is rapidly becoming the dominant regime in the USA under the term LID, Low Impact Development. In the UK, recent legislation is promoting such systems, but Government in England has stalled in introducing compulsion forcing the use of non-piped drainage systems mainly due to opposition by property developers (Wielebski, 2012). Whereas in Sweden, non-piped drainage systems have become standard practice in many places (e.g. Malmo, Stahre, 2008). This is not so in England.

Much of the momentum for using alternatives to piped drainage systems in both the UK and Sweden has come about through shared discourse about ‘sustainability’. In both countries there are reports, guidance documents, policies and legal instruments promoting sustainability. There are also definitions. For example, in England the new National Planning Policy Framework defines sustainable development as: “... sustainable development is about positive growth – making economic, environmental and social progress for this and future generations...Pursuing sustainable development
involves seeking positive improvements in the quality of the built, natural and historic environment, as well as in people’s quality of life” (DCLG, 2012). The latter goes on to say: “...so that it is clear that development which is sustainable can be approved without delay”. How it is possible to be clear about development that ‘is sustainable’ is nothing short of miraculous, given that there is no global consensus as to what the term means, nor how to achieve development that is sustainable (e.g. Bell & Morse, 2008; Ashley et al, 2012). Thus it appears that locally defined versions of sustainable development are being used especially in urban planning to justify development. In England, a distorted vision or framing of ‘sustainable’ systems, engendered by the wording of Government policies and documents, has resulted in misplaced ideas as to the rightness or wrongness of using ‘SuDS’ (so called: SuDS, sustainable drainage systems, CIRIA, 2007). Some practitioners for example, hold the view that piped drainage systems are always wrong, whereas others believe that piped systems are the only guarantee of effective performance, especially against flood risks.

Given the lack of consensual understanding or agreement of the terms ‘sustainable’ or ‘sustainable development’, practitioners charged with designing and constructing urban stormwater systems must arrive at a shared vision or frame of the issue (Lems et al, 2011) as to what it sustainability means in the context of managing stormwater. Evidence from Sweden indicates that this shared vision comes about via dialogue, discussion or discourse (Cettner, 2012). The latter illustrates that the primary discourse in Sweden relates to ‘environmental sustainability’ and the technical responses to address this in stormwater management. Social interaction and wider societal considerations, the multi-value benefit potential (Ashley et al, 2012) are scarcely considered. The primary stakeholders are the water engineers who hold a primarily technocratic vision, despite the urban planners being the main players in how urban areas are laid out (Cettner et al, in press). There is a strong desire in Sweden for scientific evidence regarding the superior sustainability of non-piped stormwater drainage systems to better inform the discourse, but this evidence is not available (Faram et al, 2010).

In each case, England and Sweden, the paucity of evidence as to when, where and how so-called sustainable drainage systems are in fact more sustainable than piped systems is inhibiting the uptake of systems that are the most sustainable. In general, environmental professionals frame their views around ‘SuDS’, whereas developers frame piped systems as being traditional effective and ‘we know they work’. In each case, the differences may be attributed to context. Context of functioning of the drainage system – SuDS are not always the most effective option; and context of the way in which the issues around stormwater management are framed by individuals. Engineers for example, are problem solvers and need to relearn to be opportunity takers, exploiting the many potential benefits arising from stormwater management on the surface (e.g. Ashley et al, 2012). Below some ideas are presented to help to understand how these two seemingly incompatible views may be integrated to incorporate the actors’ expertise in a contextually appropriate way to facilitate a transition to sustainable stormwater systems.

2.1 Historical background

Contemporary urban stormwater design practices in Sweden and the UK may be compared with the significant, historical UK case of a ‘completed’ transition within the field of stormwater. This helps to understand why, despite a significant change in context; discourse has been divided in terms of the framing behind the discourse. For example, some discourses have been framed in terms of the requirement for empirical evidence, while other framing is in terms of opportunity, sustainability, and amenity that stormwater systems could deliver.

The historical case study outlined is the circumstances leading to the creation and implementation of the Land Drainage Act (1930) in England, allowing a transition back to National food production. Since the transition process in the historical case may be thought of as ‘completed’ (in terms of solving the initial problem), generalisations regarding the influence context had on the range of contributing discourses and upon the way in which those discourses were framed can be drawn to help understand why contemporary stormwater system design is not properly embedded in today’s context and why the transition to more sustainable systems is taking place so slowly.

2.2 UK Land Drainage Act 1930 case

Increasing agricultural activity up to the 16th century in England created instances of flooding where none had existed before. The introduction of the Sewers Act 1532 guaranteed protection for landowners by introducing a ‘no benefit, no rate’ funding system for flood prevention schemes based on a principle whereby the beneficiary paid. The growth of free trade during the industrial revolution, and more especially the repeal of the Corn Laws in 1846, brought about a fall in prices and a surge of
imports marking the demise of localised agricultural systems. During and between World Wars I and II, importing food became less viable, making food production a high national priority. The 1930 Land Drainage Act provided momentum for the changes that allowed a return to national food production. The 1930 Act abolished the ‘no benefit, no rate’ system of funding flood defences, thus removing the guarantee of protection and replacing it with funding mechanisms capable of supporting the large-scale engineering works required.

Table 1 illustrates this historical case in terms of the context, problem, frame, discourse and influence on transition that occurred in England as a result of these processes:

<table>
<thead>
<tr>
<th>Context</th>
<th>Problem</th>
<th>Problem Frame</th>
<th>Discourse</th>
<th>Influence on transition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influence of World War I, Stationarity, Global ecological stability</td>
<td>Inability to support the nation’s food requirement</td>
<td>One of the UK’s highest priorities at the time</td>
<td>Land Drainage Act 1930: Optimize land use for agriculture</td>
<td>A steady return throughout the early part of the 20th century to national food production</td>
</tr>
</tbody>
</table>

Using the information in table 1, it is apparent that the Problem Frame and the associated Discourse are appropriate for the Problem and the Context; in a relatively stable environment and such a clearly defined Problem, it was entirely appropriate to frame this problem in a linear, structured manner; i.e., there were no reasons as dictated by the context to do otherwise. Furthermore it was also entirely appropriate for the resulting discourse to be formulated similarly i.e., given such a clearly defined problem and without any other factors requiring consideration, it was appropriate for the discourse to be dominantly technocratic. In terms of the resulting transitions, the frame and the discourse were also appropriate to the problem and the context; i.e., the inability to support the nation’s food requirement was reduced. In terms of the relationships and dependencies of these five concepts (Context, Problem, Problem Frame, Discourse and Influence) it is clear that there is a linear sequential relationship (in the order presented).

2.3 Contemporary stormwater design case studies

The earlier reported findings from studies in Sweden and UK considering the transition process in stormwater management (Ashley et al, 2011) have been tabulated in the same format as Table 1 to help understand the relationships between Context, Problem, Problem Frame, Discourse and Influence. While there are differences in the approaches and patterns of change in England, Wales and Scotland the analysis here has focused on the UK as a whole.

As in the 1930 example, it is clear that the Problem is dependent upon the Context. However, the ‘Problem Frame’ does not acknowledge significant aspects of the Problem itself (flooding, pollution, amenity, carbon emissions and infrastructure inaccuracies such as pipe misconnections). For example, flooding problems in the UK may arise from the way in which we construct our dwellings and infrastructure in physical relation to water, and that this process is driven (in part) by desires and aspirations of the public who choose to live/ work there. In addition, the Problem Framing also fails to acknowledge significant aspects of today’s Context. A significant example of this is the non-stationarity of the climate (Milly et al, 2008) which reduces the reliability of empirical data and hence the performance and efficiency of technical solutions that take the line that ‘we have always done it this way’ (Brown et al, 2011).

The Discourses are compatible with the Problem Framing but do not properly acknowledge aspects of the Problem/ Context. The characteristics of the Discourses tend toward reliance on ‘known’ approaches. While there is clearly efficacy in this ‘known’ approach for aspects of the problems (e.g., managing flooding problems may always involve some element of engineering solution) problems (or opportunities) of amenity in this context are relatively new and are unlikely to be solved using a predominantly technocratic approach.

Finally, the influence on the overall transition also appears to be compatible with the Problem Framing and Discourses, but again does not acknowledge the Context (non-stationarity, ecological instability etc.) and the Problem (flooding, pollution, amenity, CO₂ emissions and infrastructure inaccuracies).

Based on this analysis, a significant difference in the contemporary examples is the lack of acknowledgement of the Context/ Problem in the Problem Frame/ Discourse/ Influence. The Problem Framing, Discourses and Influence have a similarly linear sequential relationship as in the 1930 example.
Table 1.2 Illustrating the contemporary cases in terms of Context, Problem, Problem Frame, Discourse and Influence

<table>
<thead>
<tr>
<th>Context</th>
<th>Problem</th>
<th>Problem Frame</th>
<th>Discourse</th>
<th>Influence on transition: impact upon today’s approach to stormwater system design</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Kingdom (UK)</td>
<td>• Non-stationarity</td>
<td>• Piped stormwater is default</td>
<td>• Decision making based only upon scientific data and case studies</td>
<td>• There are very many and disparate actors in water management in England</td>
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<tr>
<td></td>
<td>• Ecological instability</td>
<td>• Non-piped stormwater applied only through legislative leverage</td>
<td>• Difficulty acknowledging ‘dialogue’ on efficacy of multiple uses and benefits of ‘solutions’</td>
<td>• There is a stalled transition resulting from a change in Government in 2010 and a</td>
</tr>
<tr>
<td></td>
<td>• Urbanisation &amp; Densification</td>
<td>• Flooding</td>
<td>• Difficulty acknowledging ‘dialogue’ on efficacy of linking liveability and stormwater/ green</td>
<td>reinterpretation of the legislation alongside a desire to reduce regulation and</td>
</tr>
<tr>
<td></td>
<td>(reduced space for stormwater utility approaches)</td>
<td>• Pollution</td>
<td>infrastructure links</td>
<td>support commercial enterprise (developers). Originally the new legislation was</td>
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<tr>
<td></td>
<td></td>
<td>• Amenity</td>
<td>• Prioritisation of development land and roads</td>
<td>intended to produce an instantaneous transition through regulatory definition</td>
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<tr>
<td></td>
<td></td>
<td>• CO₂ emissions</td>
<td>• Influence of commercial advantage/ disadvantage (growing perception of commercial advantage in</td>
<td>• There is some limited bottom up use of SUN (Stormwater Utility Nice Ashley et al, 2011) systems instead of piped but more pilot applications and evidence is required</td>
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<td></td>
<td></td>
<td>• Infrastructure inaccuracies (e.g. pipe misconnections)</td>
<td>• Interest in stormwater utility among professionals and authorities often reliant on ‘enlightened-ness’ of individual(s)</td>
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<tr>
<td>Sweden</td>
<td>• Regulations in the act of public water services inhibit alternative to</td>
<td>• Piped solutions are the norm, but many municipalities support alternatives in</td>
<td>• Widespread awareness of non-piped solutions exists among stakeholders</td>
<td></td>
</tr>
<tr>
<td></td>
<td>non-piped solutions in practice</td>
<td>regulations</td>
<td>• Many municipal interests must reach consensus in the planning process (Cettner et al, 2012)</td>
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<tr>
<td></td>
<td></td>
<td>• 290 municipalities in Sweden, with varying engagements in promoting</td>
<td>• Many examples of non-piped solutions exist but implementation is dependent on municipality</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>alternatives</td>
<td>characteristics</td>
<td></td>
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<td></td>
<td></td>
<td>• Precipitation (snow/ water) characteristics vary considerably requiring</td>
<td>• Inter-municipality engagement and capacity building problematic due to high number of</td>
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<td>specific approaches</td>
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</tbody>
</table>
3 CONTEXTUAL INFLUENCE

It is clear from table 1 that the only contextual influence on the problem frame was WW1, and since difficulties in feeding the population is conceptually straightforward; one of the UK's highest priorities is an appropriate problem frame. In addition, because the problem could be framed so simply, it was conceptually straightforward to decide upon the necessary discourse to solve the problem, i.e., alteration of the existing funding mechanisms for land drainage infrastructure. Since 1930 there has been a shift in context (indicated in table 2) which has not been acknowledged in the UK (stalled transition) and only partially in Sweden (slow transition) (Ashley et al, 2011); the discourses have remained relatively unchanged from those found in the 1930 context (Newman et al, 2011). In addition, this shift in context has brought into the discourse a new group of actors who see themselves as appropriate within the urban stormwater design dialogue; i.e., those who frame their discourses based on acknowledgment of the shift in context (climate change, ecological instability etc.) and whose discourses are based on delivery of opportunity, sustainability, multi-value and amenity etc. Difficulties incorporating these various actors, both traditional and newly arrived, and their seemingly incompatible discourses helps explain why the transition to 'more sustainable' urban stormwater design is problematic.

Two theories found in the literature offer some perspective on why it is problematic, acknowledging the shift in context within the contemporary problem frame: entrapment (Walker 2000) and philosophical compartmentalisation (Brown et al, 2011). Entrapment is widely referred to in the academic literature and refers to technological lock-in (Ashley and Brown 2009). Technological lock-in results from the agglomeration of expertise, financial and institutional superstructures required to create and maintain the infrastructure on which society now relies (e.g. Walker 2000; Scrase and Sheate 2005; Newman et al, 2011).

The second perspective, which is less prevalent within literature, is the notion of philosophical compartmentalisation. This is a poorly researched area of knowledge referring to the tendency for individuals and organisations to compartmentalise into a single disciplinary area (for example it is rare to find someone who is both engineer and architect). The difficulties arising from philosophical compartmentalisation are reported as difficulties in one group seeing another groups’ interest as being as 'important' (i.e, preferencing or privileging). Using the above example, engineers and architects are often critical of one another based on disagreements about the importance of form compared with function. Philosophical compartmentalisation may also help to explain the difficulties water managers have in dealing with the notion of uncertainty (Pahl-Wostl et al, 2011); often the primary barrier to implementation of non-piped solutions.

The following outlines the significant steps which should be addressed to improve urban stormwater dialogues by acknowledging and integrating the different actors, and helping to harmonise their discourse:

- **Initial problem definition:** In the context of this paper, an initial problem definition is assumed to tend toward a linear, engineering problem for example reduce flood risk in urban areas.
- **Context analysis:** Identification of the 'voices' to be included meaning an intention to identify all aspects of the natural and built environment which may affect or be affected by management of the initial problem. For example these may include fields of knowledge, competences, disciplines and associated professional public stakeholders and institutions.
- **Refine problem definition:** Based upon the context analysis the initial problem definition is re-evaluated with the intention of adjustment toward acknowledging the new 'voices'. For example reduce flood risk in urban areas may become manage flood risk, pollution and reduce long term carbon usage and investigate potential for amenity benefit.
- **Define problem frame:** The resulting problem frame can be thought of as the structure with which the discourses should be guided by. If the context analysis is performed thoroughly then the resultant frame should ‘fall out’ of that analysis. For example the contemporary problem frame is technocratic (table 1.2) whereas a more appropriate problem frame may be socio-technical.
- **Define/ Identify discourses:** The resultant discourse(s) can be thought of as the 'tools' which are used to manage the problem. Based on the various 'voices' identified during the context analysis, these tools include manifestations of the skills and competences of the stakeholders. For example engineering, architecture, planning, social, psychology etc.

What is important for effecting the transition in stormwater practice are: stakeholder analysis and a
practical platform such as learning alliances (e.g. Ashley et al, 2012a) upon which contextual aspects and a shared, or legitimised discourse can be incorporated into the design process. Stakeholder analysis, based on stakeholder theory (e.g. Freeman 1984, Boutilier 2009, Steurer 2006, Donaldson and Preston 1995) can be used to help to balance stakeholder interaction in decision making by accounting for and making adjustments based on stakeholder typology. A practical platform for incorporation of the aspects is a learning alliance, defined in the Switch project as ‘a group of individuals or organisations with a shared interest in innovation and the scaling-up of innovation, in a topic of mutual interest’ (Butterworth et al, 2011). In principle, a LA creates a safe environment for stakeholder learning within a context which helps to dissolve context inappropriate power imbalances between stakeholders and giving respect and legitimacy to all opinions (Chaitin, 2003). The aim therefore of a learning alliance is to arrive at consensus based on good reasoning and rational criticism (Habermas 1987).

4 CONCLUSIONS

This paper has demonstrated that contemporary urban stormwater management is not wholly compatible with today’s challenges, opportunities and hence, context; i.e. it lacks clarity regarding what is the best or more sustainable practice. By better acknowledging the contexts and developing framing and discourses based on the appropriate contexts (physical, locational context and framing and discourse context) there can be a more effective consensual framing of the opportunities arising from new ways of managing stormwater. A theoretical perspective has been introduced here in which this re-framing could be accomplished within the urban stormwater practice dialogue.

From the perspective of the actors in the 1930’s context of flood management in England, it is clear that there was no possibility that they could have predicted the changes in context that have occurred since that time (e.g. climate change, ecological instability). As such it would not have been apparent that the entrapment and philosophical compartmentalisation that arose partly because of the decisions made in 1930 (the implementation of the Land Drainage Act) would contribute to difficulties for the contemporary actors involved in stormwater management in being able to adapt to the new context to incorporate the required changes into the procedures for stormwater management. Similarly, the 1930s actors could not know that the decisions made in then would contribute to the current exclusion (or de-legitimisation) of other important actors with different discourses from contemporary stormwater practice.

The current difficulty facing urban stormwater management practices is that there are varied and often incompatible discourses vying for space within the overall urban stormwater design dialogue. Traditional urban stormwater management actors, i.e. those with the responsibility for delivering urban stormwater designs, are constrained to delivering solutions based on empirical evidence, compounded by political imperatives to deliver reliable solutions at known costs (Brown et al, 2011). ‘New’ actors with their accompanying discourses present problems because on the one hand their discourses are appropriate for the contemporary urban stormwater design dialogue (i.e., based on climate change and ecological instability etc.), but on the other, there is very little evidence to suggest that ‘softer’ approaches (SuDS) based on these discourses are any more sustainable than the existing approaches.

This presents a dilemma: if urban stormwater design dialogue is softened to allow the discourses from ‘new’ actors, then there is a risk, because there is no proof that the outcomes in practice will be any more sustainable. However, if these discourses are excluded from the dialogue then the status quo is maintained which is equally undesirable, as the evidence from recent flooding and pollution events in Europe.

An ‘active learning’ approach (Ashley et al, 2011) in which a ‘try it and see’ philosophy is adopted may provide a middle path on which to address this dilemma. This type of approach encourages implementation of a variety of (often) smaller measures based upon an active learning environment in which actor expertise is integrated using the learning alliance platform. A variety of measures should be developed and tested in a variety of situations; those that ‘work’ will be kept and experience gained will inform subsequent dialogues, those that don’t will be discarded. Over the long term costs will be reduced based on the likelihood of increased probability of ‘successes’, and experienced gained from real attempts at adaptation may help dissolve the current tendency toward maintaining the status quo.

In summary, the transition from one form of stormwater management practice (traditional pipe based) to another (innovative surface based) is a major shift in practice. It has created considerable polarisation in professional opinion and actual changes where alternatives have been constructed are emerging, but the resistance to change in both Sweden and England is strong. Whilst scientific
evidence, via pilot schemes and research is needed, just as pressing is the need to address the resistance expressed in professional discourse. This can be tackled by recognising the differing contexts in which the participants act and form their views and seeking ways to harmonise the discourse into a shared vision for action. Learning alliances offer an opportunity for all of the stakeholders to develop shared learning together and find new ways of innovating for more sustainable stormwater management.

LIST OF REFERENCES


