
Managing water risks in Birmingham, the city with the tastiest tap water in Britain¹

Bertha Darteh², Alistair Sutherland³, Jennifer Chlebek⁴, Geoff Denham⁵, Rae Mackay⁶

1. INTRODUCTION

1.1 Urban Water Management (UWM) issues in Birmingham

Birmingham is reputed to have the tastiest tap-water in Britain and it certainly has plenty of it. Why was a city with excellent drinking water selected to participate in an international project addressing problems in urban water management?

In fact, Birmingham has too much water. Since 1904, its main water supply has been imported through a 118 km pipeline from the Elan Valley in South Wales. After use by households and industry, this water is treated and then discharged into the city's water courses. Leakage of the imported water from the supply and wastewater systems has contributed to the city's rising groundwater table and has increasingly posed risks to property.

Until the decline in British manufacturing industry, Birmingham was the UK's centre for engineering, and many factories extracted groundwater for heavy industrial use. Current groundwater exploitation is much reduced from its historical peak, adding to the problem of high groundwater levels. Large areas of the city have impervious surfaces, including roofs, that don't soak up water, so when it rains these increase the risk of local flooding. Climate change carries a higher likelihood of intense rainfall which contributes to an increased local flooding risk.

¹ Darteh, B. et al. 2010. *Managing water risks in Birmingham, the city with the tastiest tap water in Britain*. [Online]. Available at: <http://www.irc.nl/page/58311> [Accessed 11 February 2011].

² Faculty of Engineering, Kwame Nkrumah University of Science and Technology, Ghana (berthadarteh@yahoo.co.uk)

³ Natural Resources Institute, University of Greenwich, UK (a.j.sutherland@gre.ac.uk)

⁴ Arup, Solihull, UK (jennifer.chlebek@arup.com)

⁵ Arup, Solihull, UK (Geoff.denham@arup.com)

⁶ School of Geography, Earth and Environmental Sciences, University of Birmingham, UK (r.mackay@bham.ac.uk)

Rising ground water and flooding carries the risk of contaminating boreholes and rivers that could be used for water supply. These contamination risks are not well understood.

An additional risk arises from the fragmentation of institutional responsibilities for managing different aspects of water in Birmingham. This makes it difficult to coordinate planning activities relating to water and other services, including plans to further modernise the city's aging infrastructure.

1.2 Birmingham in context

Birmingham is fairly typical of many large post-industrial cities in Northern Europe, relying on a centrally managed water supply and wastewater/sewage collection service, with an effective water supply system and a network of sewerage and drainage infrastructure. Water and wastewater infrastructure and services are provided in the UK by private companies. In the Midlands area, of which Birmingham is part, water is supplied by Severn Trent Water Ltd (water resource zones shown in Figure 1) and South Staffordshire Water Plc. Wastewater services are provided by Severn Trent Water alone. Severn Trent has an operational area much wider than the City of Birmingham as shown in Figure 1.

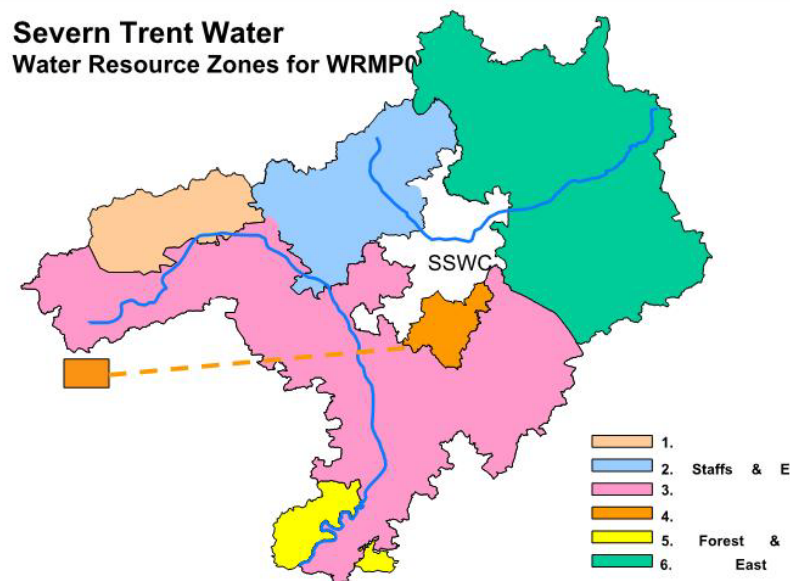


Figure 1 The water resource zones from Severn Trent Water Ltd
(Birmingham shown in Orange)

Source: Severn Trent Water Ltd (2010).

Although much of Birmingham's infrastructure dates back to industrial development during the 19th century, this remains largely functional for managing waste water and rain water run-off. The significant water management issues currently recognised relate mainly to future risks, including climate change. The issues are also linked to increased policy and statutory attention to environment management, water quality and flood and water that followed extensive flooding

in the UK, including Birmingham, in 2007. The Flood Risk Regulations 2009, and the Flood and Water Management Act 2010 place specific duties on local authorities with regards to the management of flood risks, particularly to take the lead in the management of local flood risks and also to encourage the uptake of sustainable urban drainage systems (SUDS) (Defra, 2010).

Birmingham is currently undergoing extensive regeneration, with the current focus being on the Eastside area of the city centre, a multi-million pound scheme over 170 acres designed to increase learning and employment opportunities, to create the city's first new park in 100 years, and to be an example of best practice in sustainability. The SWITCH project has linked with this revitalisation and many of the activities of the SWITCH Birmingham Learning Alliance have been focused here.

1.3 SWITCH, an action-research project on integrated urban water management

The Sustainable Water Management Improves Tomorrow's Cities' Health (SWITCH) project is a major research partnership funded by the EC, undertaking innovation in the area of integrated urban water management (IUWM). Rather than solely focusing on new research, SWITCH encourages the development of city learning alliances as multi-stakeholder bodies to set the research agenda and put research into use in cities. A learning alliance is a group of individuals and organisations with a shared interest in innovation and scaling up innovation on a topic of mutual interest. Learning alliances are designed to break down barriers to both horizontal and vertical information sharing in order to speed up the process of identification, adaptation and uptake of new innovation.

A further objective of SWITCH is to share research results and lessons learnt with stakeholders in the pilot cities and more widely, so that innovations can be scaled up.

Before reviewing early outcomes from SWITCH, the city learning alliances and the aim of interdisciplinary "demand-driven" action-research, it is important to briefly describe key features of the project design and the early history that shaped its implementation:

- The EU project format required the structuring of the project into discrete "work packages". Each work package contained a sub-group of specialisms and this fostered a multidisciplinary approach (different disciplines working separately) rather than an interdisciplinarily approach (specialists from different disciplines working co-operatively).
- While SWITCH headlined the concept of demand-led research driven by the city learning alliances, in reality the main areas of research were decided in

advance as part of the project design. As in the majority of SWITCH cities, stakeholders who joined the learning alliance had limited influence on the main research agenda after the project began.

- Although city learning alliances were central to project implementation, the resources for developing these were largely overlooked during project preparation. The project management team faced the difficult task of re-allocating resources from research activities to learning alliance activities.
- EU rules require funding for research to be matched from other sources and this limited the capacity of project partners to respond to demands from cities for specialist inputs (apart from training). In effect, this rule implied that such demands had to be identified at project design stage so that partners could make inputs where they already had similar ongoing research activities.
- In the earlier stages of the project, the different actors within SWITCH had different understanding of what learning alliances might look like and their main purpose. One view (mainly coming from the smaller number of social scientists) is that learning alliances are a multi-stakeholder platform for identifying research priorities and bringing new knowledge to bear on problems relating to IUWM. Another view (mainly coming from professionals with strong commitment to a holistic, sustainable and futuristic water management paradigm) is that learning alliances are a vehicle for promoting awareness and understanding of IUWM, and for galvanising commitment to it by key stakeholders. A third perspective (mainly of researchers promoting particular water related technologies or models) is that learning alliances are a potential vehicle for promoting and up-scaling promising technologies, knowledge and planning models. A fourth perspective (mainly from city service operators, regulators and planners) is that learning alliances provide an opportunity for cities to interact with local and international researchers and provide a neutral forum for them to meet with other stakeholders within the city and safely air views and explore a longer term vision of what IUWM in the city of the future might look like.

As in other cities, the above features of the project have influenced the types of outcome emerging from SWITCH in Birmingham.

1.4 This review

In October, 2008, a mid-project SWITCH Learning Alliances City Assessment was conducted in eight cities, including Birmingham. The Birmingham assessment (Darteh et al, 2008) looked in some detail at how SWITCH researchers operating in the city were engaging with other city stakeholders in the city, and vice-versa, and the role of the city learning alliance in promoting IUWM.

The Birmingham assessment was based on an emerging understanding of how this future city might improve its water management and address future challenges through the learning alliance. The latest review seeks to consolidate lessons learnt.

The main focus of the current review is on:

- Outcomes from research and demonstration projects in the city, and
- Outcomes from learning alliance related activities

A key aim is to make recommendations from the Birmingham experience that can help inform the final stages of implementing SWITCH in the city, and offer insights to other SWITCH cities and similar initiatives that aim to put 'research into use' in the water sector. Thus, the specific objectives of the review are to:

- Identify lessons learnt on the effectiveness of the intervention logic –has the approach provided the expected results? What worked and what didn't work?
- Make recommendations for actions within the last months of the project – activities that can still be undertaken to achieve the goals of the project
- Identify mechanisms for scaling up and sustaining impact

The review remains a working paper for discussion and aims to support learning in Birmingham through further discussion of its contents. This report is made up of three parts (following this introduction):

- Part 2 outlines the SWITCH project methodology in Birmingham, including the intervention logic, the research and demonstration activities and the approach used to develop the learning alliance
- Part 3 examines the findings and achievements to date, including from research and demonstration activities and from the learning alliance approach
- Part 4 draws key lessons and makes recommendations to help SWITCH in Birmingham be more effective and for the gains made by SWITCH to continue after the project is over.

The review is based upon three sources of evidence:

- the authors' own experience within SWITCH and other action-research projects,
- interviews with members of the Birmingham learning alliance, and
- a review of project documents.

The authors' involvement with SWITCH – two of them as learning alliance facilitator, one as learning alliance coordinator and one as city research coordinator – makes this account partial. However, following the best practice

principles of process documentation (Schouten, 2007) the review aims to be self-critical and reflective.

2. OVERVIEW OF THE PROJECT METHODOLOGY

This section looks at the city of Birmingham in the context of the SWITCH project methodology and describes the specific activities being undertaken under each theme. For further understanding of SWITCH research and work packages, readers are encouraged to explore the information contained in the 2008 City Assessment Report (Darteh et al, 2008).

The SWITCH project methodology comprises:

- research and demonstration activities
- learning alliances
- training
- strategic planning.

During project implementation, the issues and opportunities forming the main drivers for the planned research and pilot demonstration activities were identified for Birmingham as:

- **Rising groundwater table:** with the decline of industry the major abstractions for industrial use have ceased and the resulting rising groundwater tables are now a threat to the subsurface infrastructure of the city. Groundwater quality near the surface is poor and groundwater effluents to the River Tame and its tributaries that pass through the city contain significant organic materials and metals.
- **Flash flood risks:** Changing land use within the city and in its surrounding region has resulted in more flash flooding of urban areas, and this appears to be exacerbated by climate change.
- **Limited coordination between key institutions:** The manner in which responsibility for urban water management has been split between the Water Company, Environment Agency, City Corporation and a number of other organisations including private owners has led to difficulties in adopting strong policies, best practice and an integrated approach to UWM.

These opportunities have been addressed within the context of a highly centralised and regulated UK water sector in which private water companies are the main providers. The importance of understanding the barriers and incentives that the various stakeholders have for engaging with a more progressive urban water management agenda has been part of the research undertaken by SWITCH

in Birmingham, including a comprehensive institutional mapping exercise undertaken by Middlesex University.

Birmingham became involved with the SWITCH project through researchers at the University of Birmingham, who were part of the team that put the project proposal together, and have been involved in research projects in the city ever since. Rae Mackay, Professor of Hydrology at the University of Birmingham became the city coordinator for SWITCH.

The SWITCH Birmingham Learning Alliance was established in Birmingham as the main mechanism for facilitating stakeholder engagement. The learning alliance provided a platform for linking project researchers with the main water sector stakeholders. The learning alliance started to take shape in 2006, through work done by the research team and the learning alliance coordinator, Phil Sharp, an associate director of Arup consultants which steers and facilitates the learning alliance and matches the SWITCH budget. Phil Sharp also acted as learning alliance facilitator up to December 2007, when Jennifer Chlebek (a water engineer at Arup) took over this role. In 2009, Geoff Denham (also at Arup) took over from Phil Sharp as the learning alliance coordinator. Since its inception, there have been 2-3 SWITCH Birmingham Learning Alliance meetings a year, each attracting 10-15 participants, with a number of ad-hoc meetings between researchers, the facilitation team and industry.

The early outcomes from the research, demonstrations and city learning alliance process are presented in Section 3.

2.1. Intervention logic

The intervention logic was developed to influence:

- Research
- Short and long term planning
- Stakeholders' attitudes and behaviour
- National policy

The research and demonstration activities meet the needs of the intervention logic agreed for Birmingham:

Intervention Logic	How it is being met
Improved understanding of the groundwater biophysical and hydrological processes at critical interfaces will contribute to measures which reduce risks from pollution of surface streams by groundwater and assist the	Data from long-term experiments being carried out on the River Tame and at the University of Birmingham campus can provide critical information that will underpin the knowledge required to design appropriate risk mitigation measures for aquifer and river exploitation and will

Intervention Logic	How it is being met
<p>identification of opportunities for safe future use of groundwater resources.</p>	<p>enable extrapolation of the use of these measures from the experimental sites to comparable geo-morphological conditions in other parts of the city and other areas.</p>
<p>Alternative urban drainage technologies and wastewater systems will prove to be more sustainable and reduce risks arising from flash flooding, and better models can be developed for assessing sustainability and risk.</p>	<p>Modified roofing systems, green and brown roofs, in order to reduce run-off during heavy rainfall events and also enhance biodiversity. The data from the green/brown roof research and demonstration sites will enable interested users to make informed decisions about the direct benefits to the supporting building and also provide useful evidence on the broader environmental benefits of green/brown roofs.</p> <p>An improved integrated model (City Water Balance) has been developed for assessing the sustainability of the urban water system, with the potential to contribute to the planning and decision-making at various levels by the main stakeholders in Birmingham (notably the City Council) and comparable towns and cities.</p> <p>With regard to managing risks from flash flooding, emphasis in combining GIS analysis with extensive stakeholder consultation has the potential to influence and inform future planning frameworks and processes, by-law formulation and implementation, technology and product development relating to surface water drainage, and collaborative frameworks for managing aspects of the urban water cycle.</p>
<p>Engaging with an ongoing re-generation programme provides an irresistible opportunity to apply the principles of integrated water management and available research to demonstrate the potential of an integrated approach.</p>	<p>The Eastside Regeneration project is the largest redevelopment of the city central area for many years. SWITCH has actively engaged with this. Many of the learning alliance members and other stakeholders are actively involved in the Eastside Project and it is seen as an excellent opportunity for SWITCH to provide stimulus in what may</p>

Intervention Logic	How it is being met
	otherwise have been a “business as usual” approach. It provides a forum to meet with developers and designers and to keep them informed/appraised about developing sustainable water management practices.
Involving city stakeholders in discussions of the research, demonstrations and visions of IUWM for the future will lead to more effective research implementation and results that are more widely used within management agencies and provide a foundation for more integrated planning and management around urban water into the future.	The city learning alliance is creating the conditions for a productive stakeholder dialogue on goals, problems and solutions, where stakeholders jointly plan activities, share results more widely and quickly than normal and use as much local and outside expertise as possible in putting research into use. While the manner by which the SWITCH project was initiated has meant that the primary research topics were quite well defined before the learning alliance was fully established, the research and development team can be somewhat flexible in responding to the needs expressed by stakeholders in the learning alliance, to support the follow up of opportunities for application of research and best practice. Visioning exercises aimed to bring stakeholders around the table and encourage longer-term planning around sustainable water management.
Public awareness activities and networking will lead a wider sense of the need for a shared vision for integrated and sustainable water management by key city stakeholders.	To widen the learning alliance beyond representatives of key operators, authorities, and consumer groups, the SWITCH team in Birmingham has engaged in strategic networking, with presentations at key meetings and forums. A website provides a central source of information on the project in Birmingham (http://switchBirmingham.wordpress.com/).

Table 1 Intervention logic in Birmingham

2.2 Research and demonstration activities

SWITCH in Birmingham has explored, through research, some key technical challenges and has demonstrated some promising measures under the heading of integrated urban water management. Research and demonstration measures were designed to work together as a package over the longer term to address

rising and polluted ground water, reduce run-off and associated local flooding risks, improve the sustainability of the city's drainage and waste water systems, improve the quality and sustainability of the urban environment, and to enable stakeholders to agree a clear long-term vision for more integrated and sustainable water resource management in Birmingham. The University of Birmingham has taken the lead in coordinating SWITCH research in the city, and project research activities fall under the following more specific headings.

2.2.1 Rising polluted groundwater – risks and future uses

The groundwater research has been split into two packages each of which tackles a key issue. Both packages involve local offices of the Environment Agency (EA) for England and Wales, the body responsible for protection of the environment, including the quality of water in surface and groundwater.

- **Groundwater-surface interactions:** This research has taken place on the River Tame, a heavily modified watercourse which flows through north Birmingham and crosses the major aquifer beneath the city. The research has provided further understanding of the natural remediation of pollutants taking place at the river-aquifer interface when groundwater contaminated by pollutants enters the stream, and the conditions under which this happens.
- **Reuse of groundwater:** Research has examined the occurrence and mobility of viruses in groundwater and their potential risks to health (Tellam et al., 2007). The aim was to assess the risk to drinking water supplies if treated wastewater is injected into the aquifer. It is important to qualify and quantify such risks before exploitation of underground reservoirs can be carried out. The work on safe water reuse, including viral transmissions in groundwater has included, among other activities, monitoring of virus concentrations at multi-level piezometers and pumping wells.

The outputs of these research packages have applications both within and outside of Birmingham. The results on reuse of wastewater have applications in countries with a decreasing groundwater supply or where demand cannot be met by current water supplies.

2.2.2 Sustainable urban drainage systems (SUDS)

Birmingham is heavily developed and as a result of densification and urbanisation the city has very little scope for large open spaces, as can be seen from the aerial photograph in Figure 2. However, this does offer an opportunity to introduce 'green and brown roof' initiatives into the city.

The green roof research and demonstration, led by the University of Birmingham, in conjunction with a number of other interested organisations, is assessing the ecology and hydrology of various types of green and brown roofs. An experimental

array for exploration of different brown roof materials and their impact on biodiversity and urban hydrology has been erected on the University campus.

The potential benefits of green roofs include:

- Reduced run-off during heavy rainfall
- Enhanced biodiversity as a general environmental benefit

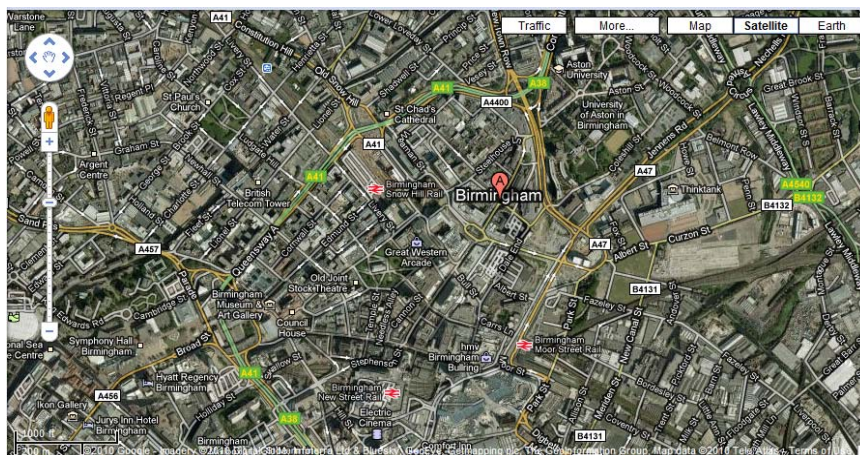


Figure 2 Satellite image of Birmingham

Source: Google Maps (2010).

In addition to the trays at the University of Birmingham, there are two other brown roof demonstration projects:

- Birmingham Volunteer Service Council (BVSC) brown roof in Birmingham city centre
- International Convention Centre (ICC) brown roof

Monitoring of biodiversity at all the sites is part of the research and demonstration effort.

Box 1 What are green and brown roofs?

A green roof is covered with a growth substrate with plants growing on it. Important environmental benefits include thermal insulation of buildings, roof longevity, urban cooling, improved aesthetics, reduced water run-off, and habitat creation.

Intensive green roofs are roof-top parks and gardens, characterised by deep growth substrates, high maintenance and high costs. **Extensive green roofs** are characterised by thin growth substrates, low maintenance and lower costs. The term **brown roof** is used to describe a particular type of green roof – an extensive green roof that is designed to mimic brownfield sites at an early stage of succession. The type of green roof design will influence the environmental benefits.

More information can be found at: <http://switchbirmingham.wordpress.com/2008/04/17/green-roof-research-and-demonstration-projects/>.



Brown roof trays at the University of Birmingham



Brown roof ecology at the ICC



Brown roof ecology at the ICC

Figures 3 a, b and c

Photographs of brown roof installations

Source: Adam Bates

Flash flood risk research undertaken by the University of Middlesex Flood Hazard Research Centre aims to develop a range of best management practices for stormwater management. Middlesex University has developed a GIS based SUDS selection tool (SUDS-LOC) model that identifies areas where green infrastructure can be included. A coupled 1D/2D hydraulic model has assessed the impact on the hydraulic regime.

This technology is being encouraged by Birmingham City Council for use in the Eastside regeneration area. SWITCH is assisting in defining the risks and uncertainties and helping to create a “Vision for Surface Water Management for 2030” in Eastside. This project will help the City Planning Department and the Drainage Department, British Waterways, the Environment Agency and Severn Trent Water Ltd in planning, reviewing and implementing this vision as developments are brought forward through the planning process.

Work on SUDS has involved:

- Collection and analysis of ecological and hydrological experimental data from the extensive green roofs
- Evaluation of options for stormwater storage and use below ground (known as aquifer storage recovery, ASR)
- Updating the Birmingham Groundwater Model to permit testing of the impacts of modified recharge patterns on groundwater levels
- Construction of the initial stormwater GIS mapping and analysis
- Application for assessing alternative stormwater management strategies

Learning alliance members, particularly the City Council, actively engaged with this research and provided co-funding for brown roof demonstrations.

2.2.3 Planning models and processes for sustainability

Birmingham, like many post-industrial cities is undergoing significant renovation and regeneration. One such area is the Eastside region of the city centre. This provided a further opportunity for SWITCH to engage with UWM management issues through engagement with planning processes and through the application of modelling.

Box 2 Eastside Development, beyond a “business as usual” approach to planning for sustainable development

Eastside is a significant area of Birmingham city centre in need of re-generation, following earlier successes in other parts of the city centre. Growing awareness of the importance of truly sustainable development came together with concerns and opportunities relating to the economy,

the environment and society, and led to the aspiration that Eastside would “become an exemplar of sustainable development”. This included the effective and responsible use of energy, water and waste reduction, and engagement with community and social issues.

In 2002 a visioning study identified a range of regeneration opportunities, including the redevelopment of large plots and the creation of a high quality public realm, centred on a new, green, sustainable park.

During dialogue between SWITCH learning alliance members, it was recognised that it will be difficult to achieve the desired exemplar status for Eastside without a master plan or a local development policy. The plan needed to detail the approach and qualitative and quantitative standards necessary to support delivery of development that significantly exceeds (in terms of sustainability) that required by regulation and a ‘business as usual’ approach.

Members of the learning alliance joined forces to undertake a study of issues constraining delivery of sustainable developments that are largely outside the control of individual developers, including transportation and the co-ordination of the planning and management of services and utilities infrastructure. They produced a report making recommendations about the possible next steps and priority actions in seizing opportunities currently available for intervening in the ‘business as usual approach’ to utilities infrastructure for Eastside in order to facilitate a more sustainable solution. The report can be found at <http://switchbirmingham.wordpress.com/reports/>

To inform future regeneration within Birmingham and other cities, SWITCH has produced a scoping model, City Water Balance (CWB), capable of assessing the interaction between water supply, wastewater, stormwater and the ‘natural’ water systems. Currently, these systems are frequently viewed as distinct areas in conventional urban water management, yet integration of UWM across all components of the urban water cycle is increasingly seen to be important for sustainable development. The CWB model supports the holistic assessment of options for reducing waste, minimising costs and decreasing energy demand, and is dependent on a quantified overview of the whole urban water cycle. Although it is benchmarked against data from Birmingham, it is general enough to be applied to other towns and cities with input from the developers of the software.

Box 3 City Water Balance

City Water Balance (CWB) is designed as an efficient scoping model that allows users to explore a broad range of strategies for future city-level change scenarios and to output indicator information on water demand, quality, energy consumption, and life-cycle cost.

CWB is a daily time-step conceptual water, energy and quality balance model operating over annual to ten year periods that uses simplified representations of the flows and storages within representative land use areas mapped across a city.

Data requirements allow a model for a city to be established relatively quickly from extant spatial mapping. Default descriptions and datasets for individual land uses and water management

technologies further facilitate modelling.

Application of the model to Birmingham using historical data for verification and validation has been undertaken. The results provide a valuable illustration of the model's effectiveness.⁷

Source: Last & McKay (2007).

As part of the development of the scoping model, at the invitation of the City Council, a scoping study was conducted for the Eastside area of Birmingham. This study provided recommendations on opportunities to increase the environmental and economic sustainability of the development through co-ordinated planning for services infrastructure, including water related services. The development in Eastside and the engagement of City Planners and other Authorities and stakeholders provided SWITCH with an opportunity for action-research into models and processes for planning more sustainable urban water and energy management systems.

This allowed Birmingham to undertake a truly demand led research project in the context of the SWITCH project. The report on this project is available from <http://switchbirmingham.wordpress.com/reports/>.

2.3 Learning alliance activities

The SWITCH Birmingham Learning Alliance is one of the SWITCH initiatives to address the institutional challenges of water governance. Initial activities towards its formation started in 2006, and the learning alliance was formally launched in early 2007 to provide a platform at which the main stakeholders could meet to share information and views on issues relating to water management in the city, including research priorities and results and the development of a vision for IUWM in Birmingham 30-50 years from now.

The start-up work for the learning alliance was undertaken by the first city coordinator for Birmingham and the research team from the University of Birmingham. Arup, an international engineering consulting firm coordinates, steers and facilitates the Birmingham Learning Alliance.

Prior to the establishment of the learning alliance, the University of Birmingham and Arup had been involved in other projects that required the coordination of various stakeholders. These initial contacts with the different stakeholders provided a basis for inviting a gradually-widening, but still relatively small, group of stakeholders to join the learning alliance. Some of the key stakeholders in the Birmingham City learning alliance are presented below:

⁷ A summarised abstract can be accessed at http://switchurbanwater.lboro.ac.uk/outputs/pdfs/WP1-0_CBIR_PUB_City_water_balance_Abstract.pdf

Box 4 Key stakeholders in urban water management involved in the SWITCH Birmingham Learning Alliance (not including project research partners)

Birmingham City Council (BCC) is the municipal development agency responsible for planning and the management of various municipal functions including housing, education, social services, biodiversity and governance for the city. The BCC members' role in the Birmingham alliance has been strongly linked to work on planning and implementation of urban regeneration as well as the demonstration of green roofs.

The Environment Agency (EA) for England and Wales is responsible for the control of air, land and water pollution; include checking of surface water (quality and quantity), abstraction and discharge, flood management, maintenance of groundwater quality etc. They are involved in the research on stream-aquifer interactions and also on viral transmission in aquifers.

Severn Trent Water Ltd is the world's fourth largest privately-owned water company serving over 8 million customers across the heart of the UK. It has responsibility for the provision of water and drainage services for the Severn and Trent Catchments – from Bristol to the Humber (including Birmingham) and from mid-Wales to the East Midlands.

The Consumer Council for Water (CCW) is the industry “watchdog”, set up to represent customers of water and sewerage companies in England and Wales.

Advantage West Midlands (AWM) is the Regional Development Agency (RDA) for the West Midlands; a governmental organisation that receives funding to support projects in the West Midlands.

British Waterways (BW) is a governmental statutory body responsible for the management of inland navigations, the collection of former private waterways and canals that now form part of a national network.

Chartered Institute of Water Engineers and Environmental Management (CIWEM) is a professional body that aims to advance the science and practice of water and environmental management. It promotes education, study, training and research to establish standards of competence and conduct.

West Midlands Centre for Constructing Excellence (WMCCE) provides specialist business improvement assistance to help local businesses in the construction and building technologies sectors.

The Office of the Water Regulator (OFWAT) is the water industries regulator for England and Wales established by government to regulate the performance of water companies.

Birmingham Environmental Partnership (BEP) was established in 2008 to mainstream environmental issues, particularly those related to climate-change, into the city planning processes. In 2009 a formal link was established with the SWITCH learning alliance.

There have been 2-3 main SWITCH Birmingham Learning Alliance meetings a year, with a number of ad-hoc, one-to-one meetings between researchers, the learning alliance facilitation team and industry. The main meetings attract 10-15 participants on average. Since its inception the learning alliance has undertaken a number of activities following the SWITCH learning alliance methodology. These include:

- Visioning and scenario planning
- Training activities
- Process documentation and monitoring
- Dissemination activities.

The following gives a summary of some of the key learning alliance activities, with detailed documents available from <http://switchbirmingham.worldpress.com>:

Activity	Major outcomes and achievements
Visioning exercise	A number of visioning workshops and consultations have been held to look at the future Birmingham, primarily in 2050. The first workshop reviewed 3 general future scenarios, ('old world', 'new world' and 'sustainable world') to establish what was currently working well and how water management could be improved in the future. The second workshop concentrated more on the visions which were already available within Birmingham and England as a whole. It was agreed that in order for the vision to be successful it had to incorporate existing visions of the key stakeholders within the city. This was followed up by a questionnaire where the learning alliance members were asked to rank key areas of water management in the future. Workshops reviewed responses and looked at other visioning documents for various organisations.
<p>A vision for Birmingham in 2050</p> <p>Birmingham is a green, clean and vibrant, multi-cultural city. We are among the world leaders in terms of water resources, sustainability, environment, economy and development and are seen as an exemplar of sustainable integrated urban water management.</p> <p>Overall, Birmingham is an economically prosperous city with a strong environmental stance. Birmingham is trailblazing the water resources within their peer group and is seen as a model for other cities in the UK and abroad.</p>	
Stakeholder Analysis	One of the SWITCH learning alliance requirements is a stakeholder analysis. The objective is to develop a good understanding of the stakeholders involved in the learning alliance process: their interests and roles and constraints. In Birmingham, the stakeholder analysis not only looked at stakeholders within the city, but at linkages to other stakeholders and the contribution they make, to understand the influence each had within the City and with national stakeholders.
Eastside Utility	A study was conducted to look at utility services and infrastructure capacity (particularly the energy requirements) of the Eastside

Study	<p>development. This was at the request of learning alliance members (Birmingham City Corporation, Eastside Development Group and Advantage West Midlands). The study had major inputs from researchers at the University of Birmingham. The result is a Scoping Report for critical infrastructure for the Eastside Regeneration. Although wider than the “urban water” remit of SWITCH, it showed that water management is intrinsically linked to energy issues. This was well received by learning alliance members.</p>
Training in SUDS	<p>A training workshop was organised in October 2008 on best management practice options for sustainable urban drainage. This workshop was attended by 15 participants from the learning alliance including the city coordinator and facilitator. The resource persons for the workshop included researchers from Hamburg Essen, University of Birmingham and Middlesex University and gave opportunity for learning alliance members to engage with activities in another SWITCH city. One significant thing about the training is that people paid to attend.</p> <p>Members of the Birmingham learning alliance also enrolled for the SWITCH Stormwater Online Course, organised and run by the University of Abertay Dundee.</p>
Scenario Planning Workshop	<p>The learning alliance is finalising work on scenario planning as a follow on from the visioning work. Learning alliance members suggested a number of discussion points which were analysed in depth during a workshop. This was followed by a questionnaire, resulting in three potential scenarios. Two are more pessimistic in terms of climate/energy/population with the third being a more optimistic scenario where by Birmingham is flourishing and has embraced innovative water and energy management solutions. The scenarios have been modelled with the City Water Balance Decision Support System to understand the net impact on the water and energy cycle.</p>
City Water workshops.	<p>City Water comprises the full suite of decision support tools that have been developed during SWITCH, including City Water Balance.</p> <p>City Water workshops were held in February 2009, May 2009 and November 2010. The second was described as a “breakthrough” workshop it led to an opportunity for researchers to obtain important data from Severn Trent for the various models (City Water Balance, City Water Economics and City Water Drain). The modules within the City Water model are at various stages, but as stated above, City Water Balance has already been used to assess the impact of water and energy management options on future scenarios.</p>

Table 2 Summary of key learning activities

Box 5 Examples of outcomes relating to raising awareness, changing attitudes and supportive behaviour since 2008

“People in local authorities tend to be complacent in what they do – the benefit of SWITCH is to thrust new ideas in their face.”

“We are finding that we have become disconnected from local authority planning. The situation is now changing with the water cycle studies. There are more liaisons. They may not have a SWITCH label but there is a movement towards more cooperation and a more integrated approach to deliver sustainable development... there is some legislation that is pulling us back into statutory planning committees.”

Water company representative

“One of the things we have noticed is that the Environment Agency has been asking local authorities to do water cycle studies to look at some of the issues that SWITCH is interested in – when planning new developments, how will water supply and drainage be made to work?”

“I put the facilitation team in touch with people from wastewater side of the company.”

Water company representative

“There is thrust towards working togetherSevern Trent was involved in helping with the design of City Water, on the Waste Water Strategy side, providing information on the planning, water and waste water information from the models we use.”

Water company representative

2.3.1 Institutional mapping

A preliminary stakeholder analysis, followed by a detailed institutional mapping exercise was undertaken by the University of Middlesex early in the process to ensure that SWITCH identified and engaged with stakeholders in planning, monitoring and communicating the research and demonstration activities. This study was undertaken against the backdrop of fragmented responsibility for urban water management in the UK, which has been linked to difficulties in adopting strong policies, best practice and an integrated approach. This study involved a detailed analysis of the complex set of laws, policies, rules and behaviour relating to various aspects of the urban water management sub-systems. The aim was to identify potential barriers to change and innovation, as well as opportunities for change and drivers of change.

2.3.2 Dissemination and monitoring

Dissemination: The Birmingham learning alliance has been working particularly hard to increase dissemination of the SWITCH project to a wider audience. A number of presentations were given during Chartered Institution of Water and Environmental Management (CIWEM) evening meetings and recently a number of papers were accepted into international conferences. The Birmingham learning alliance organised a SWITCH session at the European Congress of the International Association of Hydro-Environmental Engineering and Research. This resulted in

four key papers presenting an overview of SWITCH and three key scientific papers on 1) a decision support matrix for stormwater management, 2) the scoping model City Water Balance and 3) transitioning. These were supplemented by a paper at the International Water Association (IWA) congress in Montreal in September 2010 on the work of the Birmingham learning alliance. A further paper was published on City Water Balance as part of the SWITCH monitor series in Reviews in Environmental Science and Biotechnology (Mackay and Last, 2010).

The Birmingham learning alliance website (<http://switchbirmingham.wordpress.com>) is an effective way to introduce the project and as a result contact has been made by external organisations interested in the SWITCH project or in key elements of it.

Monitoring the learning alliance: Learning alliances emphasise changing stakeholder perceptions, behaviours, and increased collaboration for scaling up. Along with learning alliances in other cities, the SWITCH Birmingham Learning Alliance has tracked and evaluated whether its approach is effective. Two innovative assessment methods have been used in Birmingham to capture these types of changes: scoring ladders mainly to assess qualitative change (Sijbesma and Postma, 2008) and process documentation (Schouten et al., 2007). A training course in July 2007 made the approach available to the SWITCH coordinator in Birmingham. Subsequently the facilitator has been reporting on progress in the city learning alliance through quarterly reports. This review is an example of process documentation.

2.4 Reflection on the intervention logic

The intervention logic of the SWITCH project in Birmingham is implied in the project methodology described above. The hypotheses outlined in this section form a theory of how SWITCH aimed to make a difference in Birmingham, and beyond. Based on the review, there have been limited changes in the intervention logic, especially on the research side. There has been some change of emphasis in the application of research and other expertise to bring about the desired direction of change within the city. Most notably, there has been added emphasis on engagement with planning processes and on formalising the concept of transitioning within the city. This has been enabled by the development of the scoping model (City Water Balance) that is now ready for testing, by identifying a SWITCH researcher to work on transitioning as an integrating theme for SWITCH (ie. a methodology for planning how to prioritise changes to the water system), and by UK national policy developments which have improved the incentives for planning water management at city level.

3. FINDINGS AND ACHIEVEMENTS TO DATE

At project inception Birmingham did not appear to face any major or immediate water management challenges; it is, after all, reputed to have the best tap water in the country! Implementing research that was clearly “demand-driven” was based on the concerns of a few well informed and experienced specialists, rather than on a clear call for change from the learning alliance.

Through the learning alliance, project leaders in the city effectively raised stakeholder awareness of the research being undertaken. They effectively used the opportunity provided by the floods of 2007 to further highlight the relevance of the research. Subsequent national legislation and policy development reacting to concerns raised by the floods provided further leverage for SWITCH to influence planning processes in the city and provided a stronger policy framework for multi-stakeholder longer term planning around water related issues. This development also established a stronger basis for linking research with practice in the city - not only promoting relevant research results from SWITCH research, but also generating consensus on new researchable issues.

3.1 Research and demonstration activities

The focus of the research activities in Birmingham was agreed during project formulation, so researchers faced the challenge of engaging with other city stakeholders while their research progressed. The extent and manner of this engagement, and the potential outcomes were shaped by how each bit of research or demonstration needed help from particular stakeholders for implementation.

“It will take time for the outcome of the research to transfer into our practice – generally there is a challenge of getting research into use.”

Water company representative

The city’s learning alliance provided researchers with a forum for open and early dissemination of their results, and provided room for practitioners’ perspectives to be fed back to the research team at each stage of research development. The exchange of knowledge at this level can directly influence the formation of a wide spectrum of policy and practice. Interaction can lead to iterative cycles of knowledge transfer and influence among the stakeholder/researcher partnership.

This is a new paradigm for research. Historically, the primary goal for the research community has been to provide new high quality knowledge and to publish this new knowledge in a form that is accessible to practitioners, but to leave the practitioners to decide the most effective application of the results and to draw conclusions from the results based on their own needs and perspectives.

Moreover, steerage of research is usually influenced by one or a few stakeholders, each with their particular “hobby-horse”. SWITCH in Birmingham has provided an opportunity to assess the early outcomes from earlier stakeholder involvement in the research process. In the 2008 City Assessment, a SWITCH researcher in Birmingham noted:

“The difference between SWITCH and other research projects is that we are being more proactive in providing outcomes and information to users in a totally different way than we are used to”

The SWITCH research in Birmingham has produced:

- Data on groundwater-river water interaction
- Data on distance and potency of viruses in aquifers
- Construction of 2 brown roofs
- Data on ecology of brown roofs
- Provided two decision support tools; City Water Balance and SUDS-LOC
- Risk assessment matrix

3.1.1 Research on rising polluted groundwater

The research work on rising polluted groundwater and virus mobility in aquifers was detailed in 2.2.1. The expectation was that improved understanding of the groundwater biophysical and hydrological processes at critical interfaces will contribute to measures that reduce risks from pollution of surface streams by groundwater and assist the identification of opportunities for safe future use of groundwater resources.

Reflecting further progress, researchers noted that current work on river restoration doesn’t take account of groundwater ecologically, both in terms of water quantity and quality. The researchers wanted to understand what people should do in addition to what they typically do. While the research was initially slow in coming out with results the findings emerging provide significant new insights into the dynamics of the river bed and river bank systems. The initial research set out to look at mixing (turbulent diffusion) at the stream aquifer interface but in addition it made interesting discoveries about the impact of bacteria on gas in the river bed. Significant gas volumes were observed in the river bed. Compression of this gas when the river levels rise allows greater volumes of river water than expected to enter the river bed. Similarly the storage of groundwater in the river bank (commonly called bank storage) as the river levels rise also assists the penetration of river water into the river bed. The result is a mixing of river and groundwater that enhances the chemical processes that occur in the river bed and improves the removal of many pollutants. The researcher explained:

“The research is showing that bank storage should be part of river restoration design as much as river geometry. If we can gain acceptance of this; it is a great step forward”.

While researchers are upbeat about the relevance and potential applications of this research, its immediate impact on city stakeholders was not apparent. Stakeholder discussions underline the view that specific interest in and uptake of research is mainly governed by institutional agendas and policies. The individual interests of employees may also play a role, along with engagement in research and informed debates based on the results of emerging research, such as research relating to climate change and environmental processes.

At the outset of this research, the main customer/user was regarded as the Environment Agency, which has responsibility for environmental monitoring. The Environment Agency has taken an active role in SWITCH, but due to the size and remit of the organisation there are several Environment Agency learning alliance members, each with their own field of interest and it is difficult for all the representatives to attend all research meetings. While this results in some communication issues, whereby only those directly involved in a meeting are aware of the results, it is not necessarily a disadvantage. Attendance is usually targeted such that the teams who will be taking this forward within the Environment Agency are suitably informed of progress.

Severn Trent Water funds its own research programme linked to its own immediate problems. One representative pointed out that the uptake of research is often a fragmented process, linked to planning cycles and the company has a five year planning cycle. The representative noted that the SWITCH research on virus transmission would eventually be useful in the next five years as “we are looking at viruses so the work that has been done on viruses can be picked up and used, but that is still in the future.”

Why has this problem-oriented research attracted less interest than the other research activities? Possibly because it is addressing longer term water management issues that are less immediate compared to managing stormwater run-off and negotiations with city developers.

A further reason may be that the researchers undertaking this research have been less actively engaged with other city stakeholders through the learning alliance process. When interviewed at the City Summit in October 2009 a Birmingham researcher observed that “research proactiveness has also been an issue,” (in relation to the learning alliance) adding that, “this is more down to the personality differences between the researchers”. The learning alliance facilitator also commented, “Researchers don’t engage with the learning alliance as much as they could do. City Water and green roof researchers have, but the other two components have not been forthcoming with material.” However, it is acknowledged that this research is highly specific and not of wider interest in the learning alliance.

These observations points to the importance of incentives, and perhaps conditionalities to encourage researchers to make additional efforts to share emerging results with key stakeholders. The city learning alliance has offered a platform for researchers, but there is no guarantee that all researchers will take advantage of it. The reasons why some researchers are more proactive than others may need to be further explored.

3.1.2 Sustainable urban drainage systems

Sustainable urban drainage systems (SUDS) has provided an organising focus for a significant part of SWITCH research and demonstration effort in Birmingham. This focus has drawn on research and consulting expertise from the University of Birmingham, Arup, and other EU project partners including Middlesex University Flood Hazards Research Centre, the University of Abertay Dundee and Swiss Federal Institute of Technology.

The SUDS work has focused largely on the Eastside regeneration area. This area has been used to test the ecology of the brown roofs, has been used to demonstrate the SUDS-LOC tool (see section 2.2.2) and has also been the focus of an energy study (as discussed in the following section) which fed into City Water Balance.

As mentioned, Birmingham is physically constrained and has a number of barriers to change. A researcher within the Birmingham Learning Alliance has first-hand experience of the technological lock-in from previous work on integrated urban water management in Glasgow. He noted that many Birmingham stakeholders have a much clearer understanding of the barriers and constraints that their organisation face, and also realise that together they can make a difference and overcome some of the barriers.

A stakeholder also pointed to the value of such a demonstration noting:

“If it was not for SWITCH we would carry on development as usual. You need demo projects to push things in the right direction. They enable you to evaluate the benefits. Demo scaling up is important. You need demos to make people see that they work in practice and not only in theory.”

The Birmingham Environmental Partnership, established after SWITCH and focusing on embedding climate change issues into the city’s planning processes, has taken up the idea of green roofs and included photographs in its 2008/09 annual report. A stakeholder who attended the September 2009 SWITCH meeting on Scenario Planning noted:

“Green infrastructure is one of the strongest ways of adapting to climate change in terms of cost-effectiveness. Green roofs is one of the ways of dealing with heat stresses, there is a win-win situation if you can deal with it”.

A learning alliance member used green roofs as an example to emphasise the need for good data from research that might support the development of a policy, and good information to underpin negotiation processes:

“I think green roofs are interesting and don’t know when the reports will be available but hopefully they will give me an idea of whether you need a green roof policy – for example if we can say (i.e. to a developer) you are planning 14 floors, so we will give you 15 floors if you are planning to have a green roof – then everyone wins. We will also need have better data to answer the questions about green roofs, like ‘Does it prevent flooding?’ ‘How much water does it hold up?’ ‘Does it really clean up water?’”

The green roof team at the University of Birmingham has been proactive in wider dissemination of its work. This has involved tours of the installations and management of part of the learning alliance website. The University of Birmingham recently hosted a green roof (brown roof) demonstration project of its own (see Figure 3a in section 2.2.2) and also integrated green roofs as a teaching resource for the third year geography degree course.

A researcher attended three of the city’s learning alliance meetings, where he made contact with city stakeholders. This led into setting up a steering group for SUDS, which had approximately seven further meetings involving city planners, the Highways Agency, Environment Agency, Severn Trent, and Hyder Consulting Group, with data gathering and processing undertaken by Arup. Although this work was carried out externally from the city learning alliance, the steering group guided the development of the SUDS tools, including SUDS-LOC, the GIS based SUDS selection and hydraulic modelling package. This work was recently presented to the wider learning alliance, which resulted in much interest particularly from the Environment Agency which has been testing the software in its own offices. SUDS-LOC has the potential to become a key tool nationwide given the recent changes in water management in the UK, including the establishment of SUDS Approval Boards (SABS).

3.1.3 Eastside Utilities Scoping Study

A SWITCH initiative to mainstream water management issues into the regeneration process was the Eastside Utility Scoping Study undertaken in 2008. The study was wider than the “urban water” remit of SWITCH, and the report that emerged⁸ highlighted the link between water management and energy issues. This package of work was carried out as an “add on” to the work undertaken on City Water Balance and contributed to the underlying data within this model.

An immediate benefit from the Eastside Utilities Report was the direct intervention of Advantage West Midlands, the Regional Development Agency, in taking on a coordination role, initially for power supplies. This enabled the key

⁸ The Birmingham Eastside Utilities Report is available at <http://switchbirmingham.files.wordpress.com/2008/08/eastside-utilities-report-final-april-2008-switch-format.pdf>

developers to combine their efforts in terms of supply applications. Significant cost savings have been achieved and an approach developed that will enable the use of combined heat and power to be incorporated in the utilities' plans, and potential for renewable energy sources (converting biomass and waste to energy). AWM went on to look at a combined, co-ordinated approach for the provision of water, drainage and other utility services and for the planning of services diversions and the incorporation of sustainable drainage systems into planned developments including green and brown roofs. A series of Eastside Developer Forums have now been established in an effort to deliver this SWITCH-led intervention.

"There are interacting concerns such as the availability of supply, the extent to which you can reduce leakage or develop new resources, the environmental side, infiltration with sewerage and how it links to flooding, and how to apply SUDS ...we talked about this in relation to Eastside when I was part of the Eastside learning alliance meetings."

Learning alliance member

3.1.4 Planning models and processes for sustainability

An important development since the 2008 city assessment has been the further development of a suite of models for use by city planners and other stakeholders under the umbrella name of "City Water". The University of Birmingham has been working on the City Water Balance module of this software which assesses water, energy and quality balance within the city as a whole. This software is fully operational and will shortly (as of January 2010) be available for download. The future management of this software will be taken over by Ipogee (www.ipogee.ch).

The development and application of models requires available sources of reliable data. For the main researcher involved in developing part of CWB, a breakthrough came in 2009 when, after waiting a long delay, Severn Trent provided the necessary data. The researcher noted that at the start Severn Trent did not have tangible incentives to collaborate.

"They have nothing to gain – they are not getting paid to give it (i.e. data), if you are paying you could get it much quicker."

He observed that further interaction with Severn Trent after he had developed the model paid off

"They were more interested once I demonstrated it, at the beginning you have nothing to demonstrate so you have nothing to show, the guys from Severn Trent were quite impressed with the wastewater side when I presented it to them."

Other stakeholders also noted the interest in and potential impact of the City Water model, included Severn Trent, the Environment Agency and the learning alliance coordinator at Arup.

A stakeholder explained that one of the main things Severn Trent committed to was to make the information available for the model. However, SWITCH operates at a different scale from Severn Trent. “We plan for Birmingham,” said a city stakeholder, “but it is planned as part of a bigger unit. The water model from SWITCH does not match what happens in the UK; here the city is not responsible for its own water.”

A member of the learning alliance facilitation team observed that, “Severn Trent, at the City Water workshop, when they could see there would be a positive outcome and useful tools coming out of research, were committed to providing data to help with that.” When asked what SWITCH will have achieved in the city by the end of this year, this person replied, “City Water will be the key thing if it will be available as a planning tool to help advise the city, to inform their future planning.”

Another stakeholder noted the value of the model. “Potentially City Water is a great high-level planning tool for the City Authorities. It gives them a chance to play around bearing in mind what might happen in future. For example if we can get useful data we can sit down with planners and see what effect green fields will give. They can see the outputs on whatever decisions are made and there is a basis on which to make every decision.”

The process of developing the City Water model has useful lessons regarding the SWITCH idea of joint research and planning. The city learning alliance provided a mechanism for involving planners and other agencies with data after researchers had struggled for some time to get access to the data they needed. A confidentiality agreement was required as part of gaining access, underlining the need to have clear safeguards as well as incentives in place to support collaborative research. The incentive in this case was that the owners of the data came to see the potential value of the model and this underlines the need for researchers to be proactive in promoting their products to other stakeholders. However, understanding incentives and the institutional context for uptake is not something that is usually explained or taught to researchers.

It is noted that city planners are still not well engaged with City Water model. The policy and legal framework in the UK, especially prior to the recent legislation, was not very conducive for engaging city planners in testing and using models like City Water. One of the researchers emphasised getting the “right people” involved, but it is also important that those developing such models are equipped to understand why “the right people” might not be very interested, and the conditions which might make them more interested and over what time-frame. If the city planners are mostly engaged in shorter-term planning, and also acting as brokers,

facilitating pragmatic negotiation as part of the planning process, how does a model like City Water help them in this role?

A further factor in this story is continuity of involvement of key people who “opened the door” to the needed data. This links back to the need for “champions” within the organisations represented in a multi-stakeholder initiative. Such people are not necessarily charismatic individuals leading a particular cause, but they are respected individuals who are able to commit to a cause beyond the immediate interests of their organisation, and can identify and influence others within their organisation to also support such a cause.

3.2 Learning alliance related activities

In the SWITCH design, city learning alliances function as the main platform for bringing stakeholders around the table to discuss how they can work towards a more integrated approach to water management. Potentially, the discussion includes the identification of existing water related problems and how these problems or opportunities can be addressed. Mechanisms for addressing water management problems include the type of problem-oriented research described above, bringing in new knowledge and expertise from elsewhere to address a situation (like the Eastside Scoping), and developing a vision for how water can be better managed for the “city of the future”. More specifically, learning alliances provide a platform for linking SWITCH researchers with other city stakeholders. SWITCH researchers may come into a learning alliance with an expectation that city stakeholders will be interested to engage with and apply their ideas, while city stakeholders may come with an eye on what new ideas or products researchers have to offer them.

The Learning Alliance:

- Informed the research direction
- Produced a vision for Birmingham

On reflection, the idea of bringing stakeholders around the table to identify researchable issues at city level at the start of a five year project appears simplistic. It did not take account of the existing largely centralised institutional arrangements, powers and duties relating to water management in the UK. Using Birmingham as a case study, institutional mapping was done in 2007 under one of the SWITCH work packages. However, the results were not presented or discussed in the learning alliance, and hence it is not clear if this would have made a difference to subsequent activities from 2008 onwards. However, it is likely that the results from this institutional mapping did inform the subsequent formulation of new national legislation and policy relating to flood management which has recently had a positive influence on stakeholder attitudes towards joint planning activities (see Section 1.2).

An important conclusion of the institutional mapping exercise is that technology, broadly defined, provides a workable focus for identifying which stakeholders need to work more closely together in order to address sustainable water management issues. This provides a potential basis for a more focused process, over the longer term, whereby researchers can engage with other stakeholders to bring existing and new knowledge to bear on the problems identified. As the design of SWITCH implied, interdisciplinary and action-oriented research processes would be needed to address the types of challenges and opportunities identified in the institutional mapping exercises. Such a model for future research might be more useful than simplistic ideas about “demand-driven” research.

This also implies re-thinking how research projects like SWITCH are designed and managed. This includes having mechanisms for rewarding, and indeed accounting for, multi-stakeholder processes which are supported by the managers of the participating stakeholders. A learning alliance member pointed out, “You are relying very much on good will and people saying ‘I can fit this into my day’. It depends on the individuals’ roles. I have to account for every hour. It is difficult if they don’t have something that they can book their time against.” For this reason, it is often easier for more senior people in organisations to become involved because they “have a broader scope and don’t have to book their time specifically to one project.” This stakeholder added, “You may get someone who comes to a meeting and then goes back to their office and makes up for the time spent by doing their day job later.” A researcher observed, “Some people were enthusiastic at meetings and the day after it was forgotten – they went back to their day job. The agenda is not part of their job.” Hence in any future initiative like SWITCH interdisciplinary research with stakeholders would require that this becomes part of the “day job” of key employees.

A researcher also reflected on the current project design. He suggested that if the project had a different type of financing mechanism, then a more demand-driven and responsive approach might have been possible. He noted that in the current design there is a conflict between the EU approach and the learning alliance approach. “It would have been good to say we will do this research for the first 18 months, and then the last months will be different from prior discussions and we will come up with ideas from the learning alliance. 60% of the money could be held in a high interest account to support later developments suggested by the learning alliance. How well it would work, I don’t know. We have a broad selection of people with different ideas – most of it is not research, most of it is application (of research).”

This section explores what, so far, has come out of the interaction between SWITCH researchers and the Birmingham learning alliance. The following outcomes are explored:

- The city learning alliance influence on the agenda for SWITCH research and demonstrations,

- The city learning alliance influence on shorter term planning processes,
- The city learning alliance influence on longer term planning
- General influence on stakeholder attitudes and behaviour,
- Influence on national policy

3.2.1 The city learning alliance influence on the agenda for SWITCH research and demonstrations

The main agenda for SWITCH research and demonstration in Birmingham was set as part of project design. There was influence from the Environment Agency and the Sustainable Eastside project, which subsequently became members of the city learning alliance.

Climate related events during the project have also played their part. The floods of 2007 affected homes in the city and Severn Trent's wider operational area, including the flooding of a sewerage works and loss of water supply to many households. The floods across the UK resulted in a government enquiry; the Pitt Report (Pitt, 2008) recommended a 25-year plan to address the issue of flooding, a dedicated Government Cabinet committee, better mapping of waterways and an overhaul of building regulations for flood-prone areas.

In response, research expertise from other SWITCH partners was activated and researchers began to engage with city stakeholders on issues of flood management in the city. More recently, the exceptionally cold winter of 2009-10 (repeated in 2010-11), highlighted other water-related issues linked to climate change, including damage from frozen pipes. Heat stress has also been identified as a climate related issue of concern.

The engagement of the city learning alliance with Birmingham Environmental Partnership has resulted in a working partnership which is beginning to influence research. The SWITCH research agenda has been internalised within the city and relevant "demand driven" new research has been initiated in a sustainable way using local resources. For example, at the time of this assessment the learning alliance coordinator was approached for support for an MSc student studying the link between climate change and water supply.

The broad framework for interactions provided by SWITCH has provided a unique opportunity for younger researchers to link with the stakeholder community and communicate the applicability of their research. The outcomes from this have varied. For two strands of the research (green roofs and water balance modelling), early interactions with stakeholders involved with Eastside regeneration provided a more direct source of demand for the research outputs. The requirement for data for the model further "forced" engagement with Severn Trent, a key stakeholder in the city water management equation. By contrast, once researchers had gained permissions required to set up their technical experiments for research on viral transmissions and natural systems, they were able to revert to a "business as usual" model of undertaking and communicating their research. This suggests

that city learning alliances may be a necessary, but not sufficient, condition as a platform for stakeholder engagement for improving the research-user interface for urban water management issues. More compelling factors would seem to be the researchers' dependence on other stakeholders to provide information or support for their research, an obvious and explicit uptake pathway or mechanism for demonstrating the value of the research (e.g. green roof demonstrations) and emerging policies and planning processes that create demand for certain types of information or technical solutions.

3.2.2 Influence on planning

The project design expected stakeholders to agree together on the main urban water management problems and opportunities, and then agree how they could work together in order to address these. However, there were a number of challenges both in influencing the short-term planning agenda and the longer-term agenda.

- **Shorter-term planning processes**

Interviews with city stakeholders highlighted the challenges faced in achieving a coordinated multi-stakeholder water management planning process focused on the city, and particularly in getting the city planning authorities involved.

A learning alliance member noted that the way the UK water business is arranged, with different responsibilities and overall control not being in the municipalities, it is difficult to get ownership. The SWITCH city coordinator observed, "If you think back to the time when water (for the city) was first being planned, water was important. That driver is not there anymore because now we have water abundantly – the statutory obligations of Severn Trent and other companies mean planners don't have to bother." He added, "The fact that water providers are not planners is a challenge."

An Environment Agency learning alliance representative asked rhetorically who was going to bring the different parties concerned with the coordination of planning for water together, and answered his own question. "The Environment Agency is going to do that, but the best people to do that are the local authorities and councils," adding, "Planners are more interested in business, jobs, the economy and they think we are just interested in the environment".

Another stakeholder acknowledged the "importance of integrated planning" especially over things such as "availability of supply, the extent to which you can reduce leakage or develop new resources, the environmental side, infiltration with sewerage and how it links with flooding, how to apply SUDS and what you can retrofit sensibly". He stressed the need to be realistic, and to achieve some continuity. "We need to get all the interested parties and talk about the issues, but not to be too ambitious. There may need to be some constant members, [but it] may not need to be me."

These and other comments highlight the institutional challenges in getting key stakeholders around the table to plan together. At the same time, the comments illustrate that the city learning alliance has successfully raised awareness among many of the key city stakeholders of the importance of a more integrated planning approach to urban water management.

Despite these difficulties, there are at least two examples where SWITCH has directly influenced shorter term planning in Birmingham. The first is the promotion of green roofs as part of the urban regeneration programme in Eastside, and the second is the Eastside Utilities Scoping Study and follow up activities which have provided input into ongoing planning and development processes in the city. One researcher said that the work done on Eastside was “changing how developers think”.

- **Longer-term planning processes**

The SWITCH city learning alliance design included a visioning process, which subsequently was linked to strategic planning in one of the work packages. Strategic planning has received increased emphasis and resources from SWITCH project management, and the Birmingham learning alliance has played a key role in bringing together stakeholders to develop a shared vision of water management for the city. The learning alliance has formed working links with existing longer-term planning initiatives to improve synergy and reduce risks of duplication.

Formulation of a vision for the city encouraged the participation of all learning alliance members, and one member thinks that the visioning meetings helped to keep the interest of stakeholders. The tone of subsequent meetings, and interviews with learning alliance members further echoes this sense that SWITCH research and demonstrations and its learning alliance is very much about taking a long-term view on water management, with sustainability having a central place.

After an initial push in 2008 to develop a future vision for water management in Birmingham as part of the project’s research on sustainability indicators, things went quiet, until 30 September 2009, when a scenario planning workshop was convened followed by a questionnaire sent out for participants to comment on the scenarios it generated. This effort coincided with establishing a formal link with Birmingham Environmental Partnership (BEP), which strengthened the longer term planning focus, and provided a useful uptake pathway for SWITCH ideas to enter into the city planning process.

One learning alliance representative noted, “We get ideas into the council’s framework by doing risk assessments. Each department does that. We talk to them and help them to look at how climate change impacts on them and how they prepare for it. In the same way we can look at water shortage. Making an impact on decision making is about being able to embed (research) results, evidence-based planning, and we write strategies for the city.” This member of the alliance believes that SWITCH researchers need to be flexible to be more effective in

linking with city planning processes, and should make greater efforts to understand the different perspectives. “SWITCH is looking at the future and councils are looking at a shorter time scale...We can embed into their framework and present opportunities that are available for use and adaptation such as green roofs...To deal with city council and planners you will have to suppose that they are speaking a foreign language to you, and you have to be able to speak their language.”

The learning alliance representative of Severn Trent was cautious about how easy this would be. He pointed to the differences in planning time horizons between his company (the main water provider), SWITCH and other initiatives, and how change is often a gradual process. “Making an oil tanker change direction is a slow process. The Water Framework Directive is an example. The time scales are ambitious in practice, even though they look OK on paper....The difficulty of implementation is the time-lag. We have a 15 year plan, the first five years gets done, and we review then change and have another 15 year plan. This does not encourage a longer-term view. OFWAT asked us to do a 25/30 year look forward. This is where the time scale on the things that SWITCH is looking into come into scale – such as the separation of waste and stormwater.”

Others were more bullish. A learning alliance member identified the scenario planning workshop in September 2009 as the most significant SWITCH event in the city. “People recognised that looking forward into the future 50 years is important rather than their constrained planning cycles – for water companies the asset management cycles are a sort of 5 year planning process – recognising that the longer-term wins are important, not just the short-term processes.”

A stakeholder from the Environment Agency who has been a faithful attendee of the city learning alliance meetings also commented on scenario planning, hoping it will lead to action. “I put forward a scenario. I’m expecting someone to come along and say we need an enormous amount of data. A colleague and I should be able to dig out an amount of information for them.”

A researcher put the increased interest in longer term planning into a wider context. “In the first three years (of SWITCH), future proofing was not part of the agenda (of water issues in the UK). Now a lot of things are happening in the UK towards the future and water. There has been a general groundswell. It is difficult to say SWITCH was instrumental. SWITCH was sitting on a wave that would have come to shore anyway.”

3.2.3 SWITCH learning alliance influence on stakeholder attitudes and behaviour

A leading assumption was that SWITCH was addressing a “wicked” or complex problem, and developing a shared vision with multiple stakeholders of how to tackle this. Given the nature of the institutional context for urban water management in the UK implementing this strategy was definitely going to be a

challenge in Birmingham. After a slow but steady start, SWITCH has been relatively successful in bringing the key stakeholders around the table to discuss the future of water management in Birmingham. Two factors are important for this success.

Firstly, the leadership provided by the City Coordinator and the Learning Alliance Coordinator and Facilitator has been crucial. They were both very experienced practitioners, respected for their knowledge and experience. They used their organisational abilities, communication skills and existing social networks to bring a diverse and initially fragmented group together and over time generate interest in and commitment to the idea of a longer term approach to water management. A researcher recalled, “We put up a flag and said, ‘this is where we are going, will you go with us?’ – some people said ‘it is a good idea, we will come along’.”

In 2008, during the mid-term review, it was noted, “A big difference that the learning alliance has made is in bringing stakeholders together in a way they don’t usually get to meet. Stakeholders don’t usually get an opportunity like this to meet together; to talk of the future of things in a more diverse group. Getting them together in a learning alliance type format is useful, because they develop contacts where they can pick up the phone, call and discuss future issues in a more personal manner.

“Another important outcome that SWITCH in Birmingham made was the impact from the Scoping Study document for Eastside. It was an opportunity for intervention even though it is quite late in the planning process for getting more sustainable development in the Eastside region and encouraging collaboration among the parties – government and the private sector.

“SWITCH would be a good reference for a point in time where people start to change. The project came at a time when it and other projects were giving major consideration to issues of climate change, urbanisation, population, energy etc. These issues are on the agenda and there is the need for a distinct change in our approach to these matters.”

It was further noted that there was a challenge in moving from changing awareness among professionals to achieving more widespread change in attitudes. “How do you introduce change? That’s why we are keen in Birmingham on having a teacher’s training pack. We believe that change will come from the new generation, the children of today, even though the learning alliance is trying to influence the old members of our society. It is the children that will inherit the benefit of a more integrated, sustainable way of managing water in our Cities of the Future”.

This report looked forward to the period after the end of SWITCH, expressing the hope that the learning alliance process will result in:

1. Something of SWITCH (learning alliance) that carries on after the programme itself has finished. "SWITCH will still have a lot of learning to offer the City Stakeholders".
2. The possibility of being adopted by a "son of SWITCH" programme, which would further refine research, and add on to what has been done, developing theories of active learning for example.
3. A SWITCH legacy that will be seen to have been at the very least the start of the paradigm shift. "The point in time we made a change of course, towards the paradigm shift."

Since 2008, the influence of SWITCH, mainly through the city learning alliance, has been apparent in the outcomes already noted above. Further examples of outcomes relating to raising awareness, changing attitudes, and supportive behaviour include:

A researcher had noted that the learning alliance was not truly mature, in so much as people were still acting as individuals as representatives from their respective organisations, but she also noted that stakeholders were becoming more aware of the position their companies play.

"On a personal level, I was interested in the wide range of stakeholder views; for Severn Trent it is an eye-opener...I went to SWITCH meetings and it made me think of myself as being more traditional. You tend to be defensive...what is wrong with how we do this? It is good to have a source of challenge"

"There is thrust towards working togetherSevern Trent was involved in helping with the design of City Water, on the Waste Water Strategy side, providing information on the planning, water and waste water information from the models we use"

Water company representative

Research work on transitioning has highlighted the difficulties that Birmingham faces in being locked in technologically, a belief shared by others in the learning alliance. One member said, "People in local authorities tend to be complacent in what they do – the benefit of SWITCH is to thrust new ideas in their face."

3.2.4 Influence on national policy

SWITCH researchers have been active in lobbying and advisory work to shape the development of policy and legislation which is more supportive of an integrated approach to water management; particularly the promotion of sustainable urban drainage systems.

Box 6 National transition to IUWM

"I think that the datasets resulting from the research will be valuable in the future, especially in the

area of sustainable urban drainage. England is behind Scotland with legislation and implementation of the philosophy. At learning alliance meetings I described how the transition came about in Scotland and explained that many mistakes were made but now we are almost there. With the help of SWITCH, some of the most powerful stakeholders (in England) were involved in the Birmingham learning alliance and they are now aware of the possibilities and solutions for a better future and will have the evidence (and hopefully the conviction) to influence policy in England which itself is in a transition state in favour of IUWM.

Researcher

Birmingham is moving forward in IUWM and trying to work with and overcome the city's constraints. The production of water cycle studies, preliminary flood risk assessments and the establishment of SUDS Approval Boards is going to change the city's relationship with water. Although SWITCH has not directly influenced national planning policy, the work of SWITCH can play a major role, particularly the decision support systems developed by this project.

"We are finding that we have become disconnected from local authority planning. The situation is now changing with the water cycle studies. There are more liaisons. They may not have a SWITCH label but there is a movement towards more cooperation and a more integrated approach to deliver sustainable development... there is some legislation that is pulling us back into statutory planning committees."

Water company representative

3.3 Communication and change management

While the approach to internal communication has evolved since the start of the project, with increasing reliance on meetings and the website, person-to-person communication remain a key part of the process.

In the initial stages the learning alliance had to get people to be interested mainly through personal contacts. One-on-one meetings were arranged and stakeholders were interviewed about their vision and willingness to part in the SWITCH learning alliance process.

Communicating with stakeholders has mostly been by attendance at meetings, phone and emails. Emails are responded to reasonably regularly but sometimes it helps to have personal interactions and to meet at other events. Other forums such as Climate Change, Constructing Excellence and Making Space for Water have served as communication opportunities which have been widely used to meet with members and stakeholders.

The City SWITCH website is starting to become a useful tool for communicating with learning alliance members and others. Recently a developer emailed the facilitator to enquire about the research on green roofs as they would like to incorporate them into their developments but currently do not understand the

basics of them never mind the design. A newsletter is planned specifically for Birmingham and this will complement the website.

In general maintaining communications with learning alliance members is done at an individual and often personal level in many different ways. As practitioners in the city the Facilitator and Coordinator use their daily roles as opportunities to speak stakeholders about SWITCH and learning alliance matters.

Change management is vital. The “learning” in the alliance is about, how people accept, adapt to, join and commit to behavioural changes. The learning alliance coordinator said, “From notes kept we will find out why/what we think influenced an increase or decrease in the monitoring and evaluation scores. We need to know what has brought about changes; not just the reporting of the facts that this or that has happened”.

3.4 Challenge of raising awareness in the wider community

Raising awareness can be difficult in a busy society whose focus is often on the topics of today. Seminars, presentations, workshops and attendance at meetings provide opportunities to raise awareness of SWITCH.

The expectation is that as more research is published on the website, it will become a more powerful tool and act as a central platform for knowledge sharing, and also be accessible to those looking for a more general overview of the science.

“The learning alliance has made SWITCH very visible in Birmingham and to the wider group of water professionals in the UK. This has been achieved through a number of presentations at professional institutions, climate change groups, similar meetings and gatherings. The learning alliance was instrumental in organising a workshop in London where SWITCH was presented. They linked up with the publishers of the newsletter for Institution of Civil Engineers (ICE) and suggested it will be good to have a general water summit because SWITCH was looking at all aspects of water and no other body appeared to be right now. They went further and helped to put together Water Summit in London – some of the sessions of the forum were chaired by SWITCH. The learning alliance has also met with students from Huddersfield University and to a school in nearby Worcester to talk about water issues.

The coordinator and facilitator have also actively been sharing SWITCH information on their company’s internal skills forum network. SWITCH has also been represented on a number of committees. SWITCH was a member of the review group for Making Space for Water Workshop. SWITCH also sits on the ICE Water Group, which is an international body.

SWITCH in Birmingham sits as a “stakeholder” in a number of other forums such as the Defra Making Space for Water Study – for investigation into urban flooding in

the Upper Rea catchment, the Midlands Climate Change Adaptation Group and West Midlands Centre for Constructing Excellence. All of these meetings provide the opportunity for SWITCH Birmingham to expand its knowledge, meet with other stakeholders, influence decision making and promote the interest of integrated urban water management approaches.

In 2008 the coordinator and facilitator started to organise a young SWITCH meeting with various young professionals in the water sector. However, although interest was high, securing commitment from organisation to allow staff to work on this (which would be outside of their daily duties) was not possible. In hindsight it would have been beneficial to have this at the outset of the project instead of introducing it half way through.

Emphasis on making presentations has been continued and has included presentations at CIWEM Young Member evenings (2009), International Association of Hydro-Environment Engineering and Research (IAHR) European Congress (2010) and IWA Congress (2010).

4. KEY LESSONS AND RECOMMENDATIONS

4.1 Lessons learnt

The concept of demand-led research is always difficult to implement as funding organisations need to have the project sufficiently structured in order to assess its worth. Demand-led research suggests that the direction of the project evolves. However, direction is important, as was seen by the researcher's comment, already quoted, "We put up a flag and said, 'this is where we are going'."

"A learning alliance needs to be there before you do action research. But if you have to do that you need some quick wins; short research for a learning alliance to get their teeth in to know what to do. If you want to run a learning alliance as we wanted, [then we should have] agree[d] with the funder a pre-defined work for 18 months and there after you can run in the direction that is decided by the learning alliance. [We] would have frontloaded the global knowledge to the learning alliance; who is doing what where, what is worth doing and why/why not."

Through activities such as the Eastside Utility Study and the work on City Water, Birmingham has tried to embrace the concept of demand-led research whilst working within the structure of SWITCH. Comments from stakeholders pointed to weaknesses in aspects of the project design. This included the following:

- The time-frame for SWITCH was too short for a visionary project: one noted that the vision was for a 27-year programme.

- Timing of the different interventions was problematic, with research starting before the formation of city learning alliances – a more phased approach would be better.
- For the UK the project model of integration did not fit well with centralised UK institutional/governance arrangements “[The]water model from SWITCH does not match what happens in UK; here, the city is not responsible for their own water.”
- EU rules about research projects makes responsive action research difficult to implement - e.g. rules about matching funding and accounting made it difficult for the researchers to respond to requests for inputs in locations where they did not already have ongoing activities.
- Research resources were not well distributed – for example the PhD emphasis was not conducive to responsive action-research.

Some things are working well in the SWITCH Birmingham learning alliance and offer useful lessons for other SWITCH cities and similar projects. Others are working OK, but there is room for further improvement. There have also been some less successful experiences over the first couple of years of the SWITCH project in Birmingham and a number of constraints and risks can be identified to sustaining an effective learning alliance process that puts research into use.

“Now we have an idea based learning alliance; for example ideas can inspire and lead other people and companies to develop products and technologies that provide solutions to the challenges identified;

One of the most difficult activities is sustaining interest in the learning alliance process, particularly in the middle stages when researchers are working on their projects. However, in each of the research and demonstration projects key members of the learning alliance were involved and regular feedback given on the process researchers were making.

It is vital to have strong facilitation and management of the learning alliance. You need to draw people in and keep them there. Although Birmingham’s learning alliance is not as large as other cities there is a consistent core group.

Interviewing various members of the Birmingham alliance it was apparent that levels of enthusiasm and optimism varied from one member to the other. While literature on change management points to the potentially important role of “champions” in driving change processes (Ginsberg and Abrahamson, 1991), it was not apparent that there is a specific individual driving the SWITCH vision forward in Birmingham. Most of the learning alliance members had developed a relatively high level of commitment to, and acceptance of, a multi-stakeholder platform at which issues of shared interest relating to water management could be explored,

while a smaller number were distinctly enthusiastic. Given the fairly hierarchical and generally rule-governed organisational cultures inhabited by many of the water sector members the extent to which they may be receptive to a process of change led by an individual “champion” is a question for further exploration.

4.2 Outcomes

The major achievements of the project are given below:

- The modules within the City Water model are at various stages, but as stated above, City Water Balance has been used to assess the impact of water and energy management options on future scenarios devised by the learning alliance and will shortly be available for online download
- Dissemination has been extensive and includes international and national conferences, presentations at professional institutions climate change groups, similar meetings and gatherings, training and reports.
- “SWITCH in Birmingham sits as a “stakeholder” in a number of other forums such as the Defra Making Space for Water Study – for investigation into urban flooding in the Upper Rea catchment and the Midlands Climate Change Adaptation Group. All of these meetings provide the opportunity for SWITCH Birmingham to expand its knowledge, meet with other stakeholders, influence decision making and promote the interest of integrated urban water management approaches.
- The coordinator and facilitator have also actively been sharing SWITCH information on Arup’s internal skills forum network. SWITCH has also been represented on a number of committees.

4.3 Recommendations

The recommendations given below are drawn from the authors’ experience, and are given for the project as a whole and from the Birmingham point of view. The work from the 2008 city assessments provided a useful perspective and insight into the learning alliance, and allowed for sharing of successes and difficulties. It also allowed the Birmingham team to take a step back and act on requests from Learning Alliance members. The Birmingham team acted on feedback and at the start of the year gave approximate dates for all of the meetings.

It is hoped that these recommendations will aid future projects who will be grappling with similar challenges.

The overall project:

- If a project is “demand led”, it would have been useful to have funds for the “added extras” that the learning alliance would have like to have seen enacted.
- Better communication was needed between SWITCH cities – a global Learning Alliance was missing. An attempt was made to rectify this in 2008 but a yearly convention concurrent with the Scientific Meeting would have been advantageous.
- Data sharing between researchers and cities needed improvement. Excellent work has been carried out globally but it was difficult for other cities to obtain this work and share it with the learning alliance.

The Birmingham demonstration city:

- The timing of the project meant that SWITCH research ended at the same time as the overall project. City Water Balance will be available as open source software, while demonstration projects will continue to promote the green and brown roof concept. However, the timing of the project has left no time to actively promote SWITCH products. It would be better in future projects if the research ended six months before the end of the project, to allow this process to take place.
- The groundwater demonstration projects needed increased exposure – a presentation to the learning alliance was planned before the end of the project.
- It would have been beneficial to have Birmingham City Council as a consortium member in SWITCH as opposed to solely a learning alliance member as this would have provided a better opportunity to implant SWITCH within their organisation.
- National influence has not been achieved in the UK, partly due to the high number of national bodies within the UK who are responsible for water management. However, further efforts should have been made with the Environment Agency and the Department for the Environment, Food and Rural Affairs (Defra).
- Publicity – in terms of media coverage of demonstration projects and research – could have been a higher priority within the learning alliance; there has been no local media coverage of Birmingham research or the SWITCH demonstration work.

- Establishment of Young SWITCH at the outset of the project would have allowed for different views to be expressed and would have also allowed the future generation to understand the opportunities and challenges of IUWM – after all it will be their problem!

4.4 Life post-SWITCH

Like many research projects, SWITCH in Birmingham is grappling with the question, “What next?” A learning alliance has now been established and is functioning, however, what will happen from 2011 when the project is completed?

In 2008/9 the Birmingham Water Group was formed which brings together the City Council, the Environment Agency and Severn Trent Water. Although SWITCH does not participate in these meetings, key members of the Birmingham Learning Alliance do, and it is hoped that the ideas from SWITCH will follow through into this newly established group whose remit is to discuss water issues in the city holistically.

In November 2010 a meeting was held on City Water Balance, also featuring the City Water Information System, City Water Economics and City Water Drain. This meeting was attended by representatives from Birmingham City Council, Birmingham Environmental Partnership, the Environment Agency, Coventry City Council and the Consumer Council for Water. This meeting demonstrated the uses of the model based on the learning alliance scenarios. All of the parties are keen on using the model and are eagerly anticipating its general release.

The city learning alliance process initiated by SWITCH generated the required energy and desire for a longer term process of engagement around urban water management. However, in the absence of any funded facilitation or statutory requirement for a more coordinated approach in the UK, there is a question about the extent to which participating organisations will commit resources to such engagement.

It is believed that the work of SWITCH in Birmingham will continue in a number of ways but primarily through urban planning initiatives such as improved green/blue infrastructure and more holistic planning initiatives. In the latter stages of this project, the learning alliance team (research and facilitation) have been working to introduce the SWITCH approach to the wider Midlands area.

REFERENCES

- Chlebek, J., 2008. *Birmingham Learning Alliance Stakeholder Analysis Report*, [online] Available at <<http://switchbirmingham.files.wordpress.com/2008/07/birmingham-stakeholder-analysis-2008.pdf>> [Accessed 09 February 2011].
- Chlebek, J., 2008. *Sustainable water management in the city of the future, Birmingham city learning alliance visioning exercises*, [online] Available at <http://switchbirmingham.files.wordpress.com/2008/08/microsoft-word-switch-birmingham-vision-march-2008.pdf> [Accessed 10 February 2011].
- Coyne, R. Last, E. Mackay, R. & Sharp, P., 2008. *Birmingham Eastside Utilities Report*, [online] Available at: <<http://switchbirmingham.files.wordpress.com/2008/08/eastside-utilities-report-final-april-2008-switch-format.pdf>> [Accessed 9 February 2011].
- Darteh, B. Sutherland, A. Sharp, P. Chlebek, J. & Mackay, R., 2008. *A mid-term review of SWITCH in Birmingham, its learning alliance and engaging research to address the challenges of integrated urban water management*, [online] Available at <http://www.switchurbanwater.eu/outputs/pdfs/W6-0_CBIR_REP_Review_Birmingham.pdf> [Accessed 9 February 2011].
- Defra, 2010. *Implementation of the Lead Local Flood Authority Role under the Flood and Water Management Act*. (Improving surface water drainage) [online] (Updated 17 September 2010) Available at: <http://www.defra.gov.uk/environment/flooding/manage/surfacewater/index.htm#implement> [Accessed 10 February 2011].
- Ginsberg, A. & Abrahamson, E., 1991. Champions of change and strategic shifts: the role of internal and external change advocates. *Journal of Management Studies* [e-journal] 28 (2) Available through: Wiley-Blackwell Online Library database [Accessed 9 February 2011].
- Last, E. & Mackay R., 2007. Developing a New Scoping Model for Urban Water Sustainability. In: *2nd SWITCH Scientific Meeting*. Tel Aviv, Israel 25-29 November 2007, [online] Available at: <<http://switchbirmingham.files.wordpress.com/2008/02/last-and-mackay-2007-tel-aviv.pdf>> [Accessed 9 February 2011].
- Mackay, R. & Last, E., 2010. SWITCH city water balance: a scoping model for integrated urban water management, *Reviews in Environmental Science and Biotechnology*, [online] Available at: <<http://www.springerlink.com/content/b011v68h126lh478/fulltext.pdf>> [Accessed 9 February 2011].

Pitt, M., 2008. *The Pitt Review: Lessons Learned from the 2007 Floods*, [online] Available at:
<http://webarchive.nationalarchives.gov.uk/20100807034701/http://archive.cabinetoffice.gov.uk/pittreview/_/media/assets/www.cabinetoffice.gov.uk/flooding_review/pitt_review_full%20pdf.pdf>
[Accessed 9 February 2011].

Schouten, T., 2007. Learning alliance briefing note 6: Process documentation. In *SWITCH training workshop on process documentation*. Lodz, Poland 1-5 July 2007, [online] Available at: <http://www.switchurbanwater.eu/outputs/pdfs/WP6-2_BRN_6_Process_documentation.pdf> [Accessed 9 February 2011].

Severn Trent Water Ltd, 2010. *Water resources management plan, final version*, [online] Available at:
<http://www.stwater.co.uk/upload/pdf/Final_WRMP_2010.pdf> [Accessed 25 January 2011].

Sijbesma, C. & Postma, L., 2008. Quantification of qualitative data in the water sector: the challenges, *Water International* [e-journal] 33 (2) Available through: Routledge Taylor & Francis Group [Accessed 25 January 2011].

Tellam, J. et al., 2007. Are Viruses a Hazard in Waste Water Recharge of Urban Sandstone Aquifers, paper presented at 2nd SWITCH Scientific Meeting in Tel Aviv, 2007. In: *First SWITCH Scientific Meeting*. Birmingham, UK 9-10 January 2007, [online] Available at:
<<http://switchbirmingham.files.wordpress.com/2008/02/tellam-et-al-2007-birmingham.pdf>> [Accessed 25 January 2011].

ACRONYMS

Acronyms used in this paper are as follows:

ASR	Aquifer storage recovery
AWM	Advantage West Midlands, (regional development agency)
BCC	Birmingham City Council
BEP	Birmingham Environmental Partnership
BVSC	Birmingham Volunteer Service Council
BW	British Waterways
CIWEM	The Chartered Institution of Water and Environmental Management
CCW	Consumer Council for Water
CWB	City Water Balance
Defra	Department for Environment, Food and Rural Affairs
EA	Environment Agency
GIS	Geographic Information System
IAHR	International Association of Hydro-Environment Engineering and Research
ICC	International Convention Centre
ICE	Institution of Civil Engineers
IWA	International Water Association
OFWAT	The Office of the Water Regulator
SABS	SUDS Approval Boards
SUDS	Sustainable urban drainage systems
SUDS-LOC	GIS-based SUDS selection tool for urban surface water management
UWM	Urban water management
WMCCE	West Midlands Centre for Constructing Excellence
WRMP	Water Resources Management Plan

LIST OF APPENDICES

Appendix A: Schedule of Interviews & Documents Referred and acknowledgements

Date	Place	Group	Names	Methods
	University of Bham	City-based researchers, including PhD candidates	Rae Mackay, Mark	Face to face interview
			Ewan Last	Phone interview
		EU-based (partner) researchers		
		City planners		
	Birmingham city centre	City and regional authorities (mayors, councillors but also officials)	Richard Rees	Face-face interview
	Severn Trent office	Water and Wastewater Operators/ service providers	John Martin	
	EA office	Regulators	David Hughes	Face-face interview

Date	Place	Group	Names	Methods
		Developers/consultants		
		Investors/ financiers e.g. donors in developing/ transition countries		
		Demonstration Hosts		
		Demonstration Visitors		
	Arup office	Civil society (Residents, Community and user groups , NGOs)	Raj Mehta	Phone interview
	Arup office	learning alliance facilitator(s) and city coordinator(s)	Geoff Denham	Face-face interview

We are grateful to the following stakeholders for taking time off their busy schedules to share their views with us.

University of Abertay Dundee
 Environmental Agency
 University of Birmingham
 Severn Trent Water Limited
 Consumer Council for Water
 Birmingham Environment Partnership
 Arup
 Middlesex University

Appendix B: Framework for monitoring learning alliance performance

Objective 1: We know who learning alliance members are, and facilitate communication between them effectively

Indicators are the availability of a record of learning alliance members and their participation in learning alliance events and activities and the use of effective communication tools to share information between learning alliance members

Scenarios for objective 1	Score
This is no accessible record of learning alliance members, and their involvement in various events and activities	0
There is an out-of-date record of learning alliance members and their involvement in events and activities	25
There is an up-to-date record of learning alliance members and their involvement, and some basic communication tools are systematically used (e.g. email, phone) between events	50 benchmark
There is an up-to-date record of learning alliance members and their involvement, and archives are maintained through systematic use of advanced communication tools (e.g. a Google group).	75
Member information is accessible to all (e.g. online database), participation in all events and activities is systematically recorded and a combination of methods is used effectively (based on feedback received) to communicate between events.	100
Justification of score (with date)	Score awarded
November 2010 Up to date learning alliance contact List and includes contacts with other similar groups working in the city: e.g Climate Change and Making Space for Water. Contact list updated 6 monthly.	50

Objective 2: Regular, effective and innovative events capture and sustain interest of learning alliance members

Indicators are the regularity and quality of events organized or supported by SWITCH learning alliances. These aspects may be assessed with reference to reports of activities, evaluation sessions and the follow-up generated by events.

Scenarios for objective 2	Score
Events (e.g. workshops, site visits, seminars) are not regular and only announced at the last minute.	0
Regular events are held at least every six months, but have limited impact in capturing the interest of learning alliance members.	25
Appropriate events are announced well in advance and use a mix of mainly standard methods to effectively engage interest of city stakeholders at least once every 3 months.	50 benchmark
Quarterly (or more frequent) events use effective and innovative facilitation methods (not just presentations and discussion).	75
Quarterly (or more frequent) innovative events result in high-quality reports (or other outputs) that capture content and ideas and are rapidly made available.	100
Justification of score (with date)	Score awarded
November 2010 Regular learning alliance meetings usually 2-3 per year plus updates when required. Recent meetings in July 2010 (SUDS) and November 2010 (CityWater)	50

Objective 3: Demonstration activities are undertaken within a framework for scaling-up

Indicators are the availability of demonstration plans, the level of ownership of these plans, and commitments made to scaling-up implementation.

Scenarios for objective 3	Score
Demonstration activities are initiated without significant discussion in the learning alliance	0
Demonstration activities are decided after limited consultation with some members of the learning alliance	25
Demonstration activity plans are consistent and integrated within learning alliance plans (city storylines) and are supported but without clear commitments to scaling-up	50 benchmark

Scenarios for objective 3	Score
Learning Alliance members with potential to scale up demonstration activities pro-actively made suggestions and proposals that were addressed in demonstration plans.	75
Learning alliance members maintain a keen interest in demonstration activities at all stages and report back against their initial commitments to scale-up interventions.	100
Justification of score (with date)	Score awarded
November 2010 All learning alliance Members have updates on demonstrations and key learning alliance members are actively involved in these demonstrations directly.	75

Objective 4: The SWITCH team and learning alliance understand why change is occurring in IUWM, not just what happens.

Indicators are the amount and quality of process documentation undertaken to capture the change process and its dimensions and motivations, and the sharing of that information to encourage learning.

Scenarios for objective 4	Score
No process documentation is in place	0
Occasional ad-hoc process documentation is undertaken using some of available tools (including different media such as writing, photography, film etc.) but with limited attention to detail or quality.	25
A few process documentation tools are used regularly following a process documentation plan but results are not widely shared.	50 benchmark
Several process documentation tools are used regularly and results are widely shared within the learning alliance	75
Effective process documentation is used for reflection and analysis that results in improved project implementation plans	100
Justification of score (with date)	Score awarded
November 2010 Minutes and reports in hard and electronic version copies issued after each meeting. Now available on the City Web Site.	50

Birmingham - additional objective BM1: Inclusion within active learning alliance membership of key stakeholder that have been only peripheral to the learning alliance process to date.

Indicators are targeted efforts to involve and include identified peripheral but important stakeholders (developers, Association of British Insurers, local community/environmental groups etc.) and the resulting engagement.

Scenarios for objective BM1	Score
No real efforts are made to include peripheral actors or their representatives in the learning alliance activities.	0
Initial contacts made with peripheral actors and invitations made to events but no sustained effort to entice them to maintain regular attendance.	25
Peripheral actors are informed well in advance of meeting date, time and agenda and there is active follow up prior to and after meetings.	50 benchmark
Peripheral actors are informed well in advance of meeting date, time and agenda, and in addition special efforts are made to help prepare them to attend.	75
Location, time, topics (agendas) and convenience were well considered in organising meetings to maximise participation of peripheral actors.	100
Justification of score (with date)	Score awarded
<p>November 2010</p> <p>We have been successful in getting some of the peripheral actors (Natural England and Advantage West Midlands to attend learning alliance meetings. Recently the Birmingham Environmental Partnership have joined and Defra is currently being encouraged to attend the "summary" sessions. Meeting invites have been issued by people who have personal relationships to external organisations and where they have not been able to come to the meeting, SWITCH has offered to go to their offices.</p>	100

Appendix C: Table of some major activities in the process of the development of the Learning Alliance in SWITCH Project Birmingham, UK

Y e a r	Q t r	Training and Monitoring activities	Learning activities in the city	Creating wider awareness	Behind the scenes facilitation and other activities
2006	1		Scoping Meeting involving the members of the SWITCH Management Team and core Birmingham learning alliance (12 members participating)		Interviews, face-to-face meetings, presentations for identification of the core learning alliance members Presentation of the project concept: World Water Forum in Mexico
	2				Setting the Action Plan for establishment of Learning Alliance
	3		SWITCH Birmingham		Preparation to the 1st Visioning Workshop – face to face meetings, letters and e-mail communication
	4		Various, small meetings with the learning alliance members (e.g. EA, BCC) held to review the purpose of the learning alliance and to get integration between research and industry.	Sharing of activities ongoing and planned for the city	Production of an integrated City Story Line (12-36M)
	5		Invitation for SWITCH to be a member of the Regional Climate Change Adaptation Group	Presentation on SWITCH and workshops with other stakeholders looking at climate change adaptation strategies.	Increased awareness of SWITCH and greater acceptance of the aims of the project in the city Preparation for the 1 st Scientific Meeting which is to be hosted by Birmingham.

Year	Quarter	Training and Monitoring activities	Learning activities in the city	Creating wider awareness	Behind the scenes facilitation and other activities
2007	1	learning alliance Facilitation training for the SWITCH learning alliance facilitators (4 SWITCH cities)	SWITCH 1 st Scientific meeting hosted in Birmingham	Presentation and approval of the SWITCH Birmingham Project goals and objectives to the Birmingham City Council by the University of Birmingham and ERCE	Presentation of the RTD report to the learning alliance
	2	Making Space for Water Pilot Study in Birmingham	SWITCH Birmingham invited to be member of the Making Space for Water Pilot workshop group and sit as a stakeholder in the city.		Review of inputs and outputs from the Study communication with the local residents, key stakeholders and media for assuring the project dissemination Meetings between the city coordinator and researchers (Prof. Mackay and Ewan Last) about City Water and the Eastside development.
	3	Participated in the establishment and delivery of the Water Summit in London in October 2007	A National Water Summit for Water Stakeholder in the UK to hear some 15 papers on various aspects of water management. SWITCH was presented to this audience by the LA Coordinator.	Sponsoring, supporting and providing information on the Global SWITCH Project enable key participants in the National Water sector to hear and learn about what SWITCH is doing.	
	4	Coordinator participated			Appointment of the Learning Alliance Facilitator

Y e a r	Q t r	Training and Monitoring activities	Learning activities in the city	Creating wider awareness	Behind the scenes facilitation and other activities
		in training on process documentation.			
	5		1 st visioning workshop held		Meetings held with British Waterways on the application of canal water to combined heating and power plants, and using the canal network for transportation of Biofuel within the Eastside redevelopment.
	6	Training on establishing and co-ordinating of LA Platforms Accra		The Birmingham City Facilitator, with colleagues from Lodz and Accra, presented papers in the Accra Training Workshop in December 2007.	Helped to share information and techniques for developing and sustaining an learning alliance Platform. Launch of Birmingham LA website.
2 0 0 8	1	Participation in learning alliance learning and sharing workshop on M&E framework City facilitator undertook online Stormwater course through the University of Abertay, Dundee.	2 nd Visioning workshop	Setting up of City Website for SWITCH	First draft of Stakeholder analysis Identification of further institutions to be invited to join Birmingham learning alliance Setting the City Story line (25-42M) Facilitator attended meeting in Delft
	2	Presentation to Chartered Institution of Water & Environmental Managers	Training session on SWITCH given to CIWEM Local Association followed by debate on Climate Change Impacts	Enabling younger members of CIWEM to learn more about IUWM and climate change impacts.	Facilitator attended Theme 2 (stormwater management) meeting in Essen, Germany, which included a number of site visits
	3	SWITCH invited to act as		Opportunity to expand awareness	Attendance at Lodz training on city reviewing.

Y e a r	Q t r	Training and Monitoring activities	Learning activities in the city	Creating wider awareness	Behind the scenes facilitation and other activities
		expert commentator on Eastside Sustainability Review Workshop		of the SWITCH project and to comment on sustainable water services in the city.	
	4	Coordinator and facilitator spend 5 days in Hamburg to review the activities of their LA. Mid-October: SUDS and planning for stormwater management training Stormwater Online course commences	Learning alliance meeting in August	Facilitator attended the Expo in Zaragoza, and represented SWITCH at the World Water Research Day as part of the Expo.	Attendance at SWITCH learning alliance workshop in Ouro Preto
2 0 0 9	1		City Water progress meeting	Regular update of SWITCH website Presentation of paper on SWITCH research and learning alliance at CIWEM meeting in February, 2009.	
	2		City Water Workshop		
	3		Scenario Planning workshop in September, 2009.		Establishing links with the Birmingham Environment Partnership
	4		Follow up questionnaires on Scenario Planning	City Facilitator and coordinator took part in SWITCH Scientific meeting and city water workshops	Working with Middlesex University of assist in provision of ground LiDAR information for stormwater model

Y e a r	Q t r	Training and Monitoring activities	Learning activities in the city	Creating wider awareness	Behind the scenes facilitation and other activities
2 0 1 0	1		Birmingham learning alliance scenarios being analysed using CWB		Training for City Reviews
	2			4 SWITCH papers presented at 1 st European Congress of IAHR	
	3		SUDS-LOC presentation from Bryan Ellis	Paper presented on the SWITCH impact in Birmingham, IWA Congress	Hamburg city assessment 5 th Scientific meeting
	4		Workshop on CityWater		Working with Middlesex on development of SUDS-LOC Planning for Paris Conference, Jan 2011

Appendix D: Learning alliance gender and disciplinary survey

Note: All information will be kept confidential with regard to personal details

City: Birmingham

Stakeholder	Gender	Role in SWITCH LA	Profession	Academic Training										Other – explain
				Hydro- logist	Env. Scientist	Civil Engineer	Systems Engineer	Urban Planner	Micro- biologist	Chemist	Social Scientist	Economist	Architect	
1	M	Coordinator of LA	Chartered civil engineer			X								
2	F	LA Facilitator	Civil engineer	X		X								
3	M	LA member – regulator	Engineer											BSc Physics; CIWEM Diploma
4	M	LA member – rep from city	Senior climate change adaptation officer									MSc		BSc History and Politics
5	M	Researcher	Professor	X		X								PhD
6	M	Researcher	Research fellow	X										
7	M	LA member- water utility/operator								BSc				MSc in Applied Hydrobiology