The role of green infrastructure at the city scale

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1. INTRODUCTION

The water industry in the UK is facing increasingly stringent environmental, economic and technical challenges. Compliance with the Water Framework Directive and carbon emissions targets (regulated by the Carbon Reduction Commitment, CRC) appear to be in dispute, since the improvement on the quality of urban water discharges would require an increase in the use of energy-demanding conventional drainage infrastructure and treatment processes, and therefore carbon emissions.

Delivering more capable waste water infrastructure and services that are able to solve such challenges may involve uncertain long-term expenditure, as related to operational and/or capital costs.

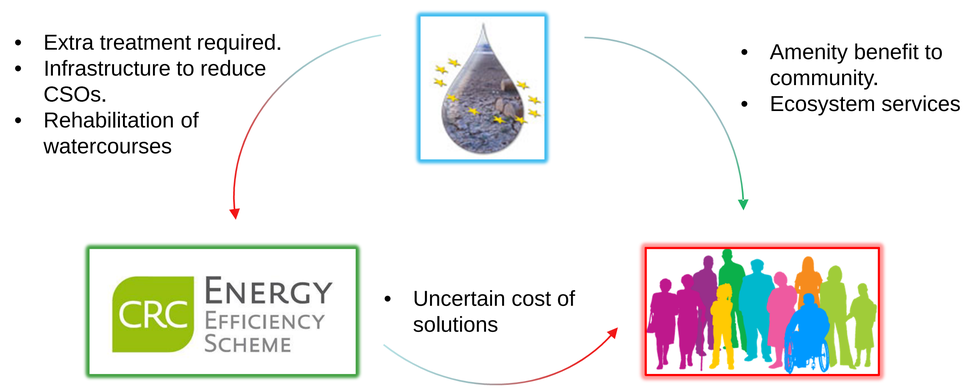

Figure 1. *Conflicts between different socio-economic (e.g. costs, amenity value) and environmental (WFD and CRC) objectives.*

2. THE VALUE OF GREEN INFRASTRUCTURE

In this context, green infrastructure (GI) has been deemed a low carbon solution that can serve a variety of purposes. Further, the multifunctional character of green infrastructure presents great potential to address conflicts such as that one concerning water quality, carbon emissions and costs.

In this sense, retrofit green infrastructure, which is implemented in already developed urban areas (Figure 2), may be particularly beneficial as it can enhance the condition of deteriorated city centres in a number of ways, for example:

- Increasing infiltration and reducing the amount of runoff causing floods and the failure of combined sewers.
- Enhancing the quality of urban watercourses by re-introducing natural forms as well as by reducing pollution events.
- Improving the aesthetic value of urban areas lacking green and water features.
- Acting as a traffic calming feature and supporting alternative transportation modes (e.g. walking, biking).

Figure 2. *An example of retrofit GI implementation process in a residential street.*

The multifunctional character of green infrastructure facilitates its financial feasibility since different costs can be accommodated in a variety of budgets, such as those of water companies, local authorities, property owners, etc.

3. PLANNING CITY SCALE GREEN INFRASTRUCTURE

One of the main challenges when planning large-scale green infrastructure schemes is to identify which combination of measures is more beneficial in complex urban systems, such as drainage systems or the wider urban water cycle, overall.

Retrofitting GI requires knowing how much space is available and what type of characteristics are there on site in order to adequately implement any potential solution.

In a first part of this project a number of case study areas within the city of Newcastle will be broken down into common urban development types (e.g. terraced housing). A ‘palette’ of possible retrofit GI solutions serving each areal unit of urban development type (see Figure 3) will be then constructed to ensure that different strategies are accounted for.

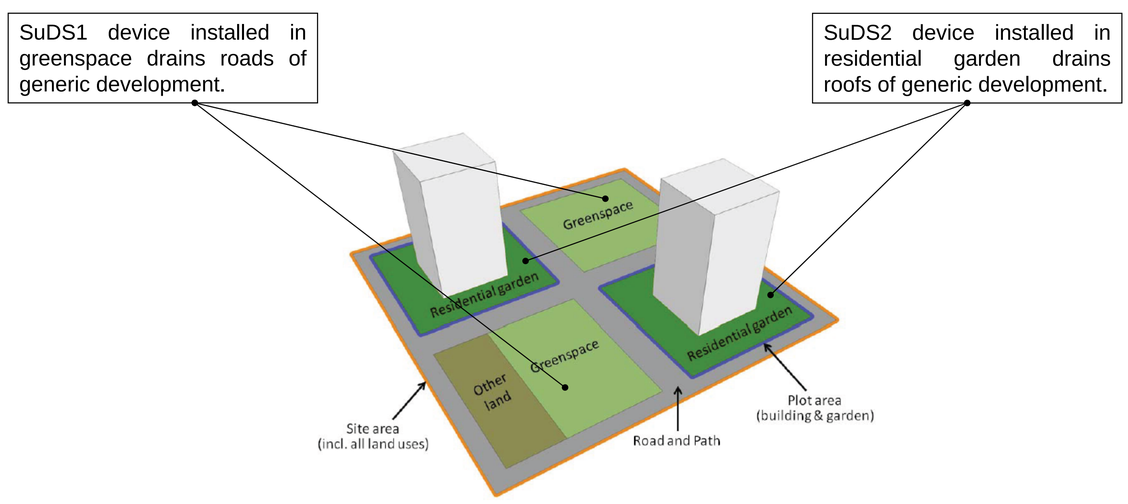

Figure 3. *A possible solution for a generic development type of the ‘palette’.*

4. INTEGRAL EVALUATION TOOL

In a second part, all the possible combinations of solutions in the ‘palettes’ are evaluated using an integrated model (see Figure 4) containing all the parts of the urban drainage system (i.e. catchments, sewer network, treatment plant and urban watercourses).

The integrated tool will allow us to optimise the selection and placement of retrofit GI solutions for each type of development in the whole urban catchment, and select suitable retrofit strategies so that:

- Whole life costs are minimised.
- River water quality is maximised.
- The carbon footprint of the drainage system is minimised.

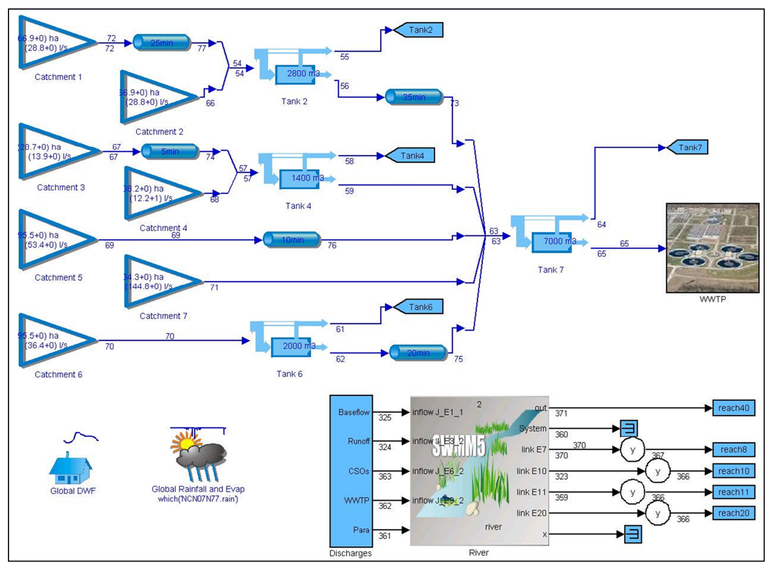

Figure 4. *Integrated evaluation tool, featuring SIMBA6.*

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