Assessing the potential for large scale implementation of sustainable drainage systems in South West UK (SWEEP)

Évaluation du potentiel de mise en œuvre à grande échelle de systèmes de drainage durables dans le sud-ouest du Royaume-Uni (SWEEP)

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RÉSUMÉ

Gérer les eaux de surface à l'aide de systèmes durables de gestion des eaux de ruissellement (SuDS) présente des avantages bien documentés. La pratique actuelle a permis d'acquérir une solide compréhension technique des performances à l'échelle du site, mais l'adoption de nouvelles stratégies de gestion est encore limitée par plusieurs facteurs, notamment les incertitudes liées à la mise en œuvre des stratégies à l'échelle des villes et des régions. Le projet SWEEP évalue le potentiel d'application du SuDS à l'échelle régionale, dans le sud-ouest du Royaume-Uni, pour faire face aux défis des inondations et de la pollution urbaines, exacerbées par le changement climatique, la croissance urbaine et le recours à des infrastructures anciennes. Ces travaux de recherche portent sur la mise en application à grande échelle et font appel à des partenaires régionaux des mondes universitaire, industriel et gouvernemental. Ils visent à élaborer et à mettre en œuvre un criblage régional pour identifier les dangers des eaux de surface et les régions qui doivent bénéficier en priorité de la mise en place de systèmes durables pour la gestion des eaux de ruissellement. Le projet en est actuellement à ses débuts, mais son impact initial a permis de constituer un groupe actif et motivé de parties prenantes qui bénéficient de la cartographie des opportunités du SuDs au niveau régional.

ABSTRACT

The advantages of managing surface water using sustainable drainage systems (SuDS) are well documented. Current practice has developed a strong technical understanding of performance at the site scale, however uptake of novel management strategies is still constrained by several factors, including uncertainties over implementing strategies across city and regional scales. The SWEEP project assesses the potential for regional scale application of SuDS in South West UK in response to the challenges of urban flooding and pollution, exacerbated by climate change, urban growth and a reliance on legacy drainage assets. Research addresses large scale implementation through engaging regional partners from academic, industry and governance to develop and implement regional screening to identify surface water hazards and prioritise regions for implementing sustainable drainage. The project is currently in its early stages, however initial impact has developed an active and motivated group of stakeholders benefitting from regional level SuDS opportunity mapping.

KEYWORDS

Decision support, hazard screening, stakeholder engagement, surface water flooding, sustainable drainage system.

1 INTRODUCTION

The South West Partnership for Environmental and Economic Prosperity (SWEEP) is a multi-disciplinary collaboration focused on developing a regional transformation to deliver economic and community benefits in the South West UK. This study represents one component of the SWEEP collaboration, aimed at assessing the potential for large scale adoption of sustainable drainage systems (SuDS) across the region.

Surface water causes significant damage, disruption and loss of life in the UK and globally. These impacts have historically been managed through application of conventional urban drainage systems designed to meet specified design standards. Conventional strategies have performed well in the past, but are becoming increasingly unfit for purpose due to intensifying hazards caused by several emerging challenges, including climate change, urban growth and aging drainage infrastructure (Wong and Brown, 2009; Barbosa et al., 2012; Wing et al., 2018).

A general consensus amongst urban drainage research and practice is the need to move towards sustainable drainage solutions, capable of managing runoff whilst achieving multiple benefits to the surrounding communities (O'Donnell et al., 2017). The advantages of managing urban water using sustainable drainage solutions are recognised widely across academic, government and industry guidance, evidenced through growth of international surface water management agendas such as SuDS (UK), sponge cities (China), water sensitive urban design (Australia) and low impact development (USA), to name a few (Fletcher et al., 2015). However, despite technical understanding, supportive legislation and a wide range of novel and tested options, recent studies indicate application of strategies still faces multiple challenges (Mijic et al., 2016).

Barriers for implementation include failure to accommodate new measures within institutional decision making frameworks, uncertainty regarding application of novel interventions in a heavily regulated and risk averse water industry and a lack of evidence regarding the performance and cost effectiveness of strategies at the catchment and regional scale (Cettner, 2012; Gersonius et al., 2012; Woods Ballard et al., 2015).

2 METHODS

This study addresses the challenge of transferring technical understanding of SuDS performance at the site scale through to identifying opportunities for regional scale implementation. This is achieved through implementation of GIS screening to identify surface water hazards and prioritise regions for implementing management strategies, followed by site scale optioneering using high level assessment of treatment trains and engaged local stakeholders.

A new GIS screening tool has been developed. This tool applies readily available data to identify surface water catchments where sustainable drainage can be implemented to achieve benefits managing water quality or quantity issues. Surface water catchments are defined using regional scale digital elevation models and GIS processing. These catchments form the basis for spatial analysis of hazards and opportunities to manage them. Hazards include surface water flood risk and water quality issues. Flood risk is identified using UK Environment Agency surface water mapping which specifies extent, depth, velocity and hazard information. Water quality is screened using the locations of CSOs and sensitive waters alongside water quality compliance data. Opportunities for implementing SuDS are evaluated through analysis of flow paths, land use and available drainage options throughout the catchment. Outputs from screening include regional sustainable drainage opportunity mapping and prioritisation of catchments to implement SuDS management options.

Site scale optioneering is then undertaken using a multi criteria ranking approach, which facilitates a high level comparison of SuDS attenuation, water quality, environmental impact and cost benefit.

3 RESULTS AND DISCUSSION

The research project is in its initial stages; however, preliminary results have developed catchment screening capable of prioritising surface water sub-catchments (Figure 1). Identification of urban catchments enables decision support to target management interventions across contributing regions to manage flooding using decentralised SuDS. Catchment descriptors enable prioritisation of measures depending on water quality and quantity risk factors present. This information is carried through to optioneering to determine goal setting for multi-criteria analysis.

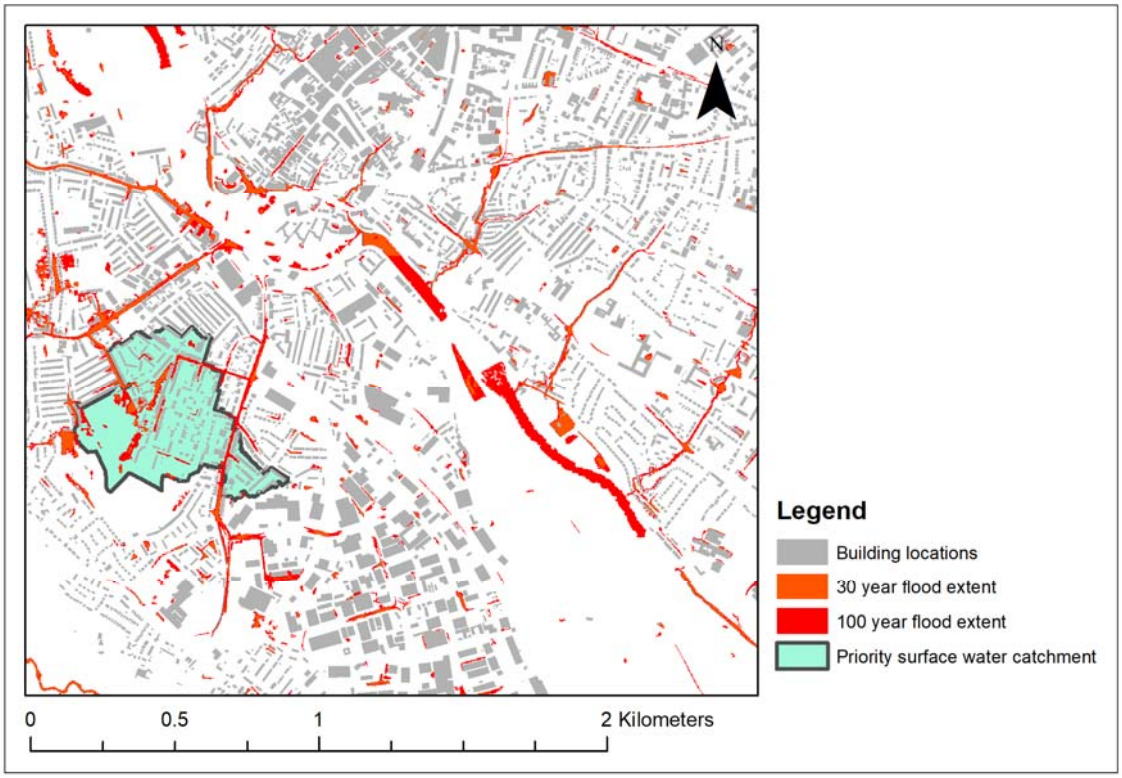

Figure 1: Snapshot of prioritising a surface water catchment based on flood risk using the GIS screening tool

Key findings from city scale analysis have identified sub-catchments for prioritising SuDS implementation and engaged catchment stakeholders within these areas. Geospatial analysis is advanced through application of sub-catchment scale optioneering to identify suitable SuDS options at a site scale. Current evaluation highlights the benefits of large scale, decentralised strategies across these sub-catchments.

Data types present in the screening methodology are currently based on open source products. These easily accessible resources have been selected due to widespread availability ensuring adequate coverage across the regional scale study area. However, the approach remains adaptable to enhanced data as further resources can be iteratively implemented to enhance the resolution of areas prioritised by initial screening. This develops the approach to be used collaboratively as the basis for learning and communication across stakeholder partnerships. Analysis is now progressing towards upscaling evaluation through engaged regional partners including Pell Frischmann, South West Water, Westcountry Rivers Trust and Exeter, Torbay and East Devon local councils.

4 CONCLUSION

Surface water management is a global issue, with many international government reports and academic studies emphasising the need for management strategies to be implemented. Recent UK Government reviews (Committee on Climate Change, 2015) indicate current implementation of management strategies is insufficient, despite clear and established legislation. Although in its early stages, this project evaluates the potential to collaboratively screen and implement SuDS to manage flooding and water quality hazards at a regional scale. Future work will enhance the utility of the tool and develop applications and case studies in line with project stakeholders.

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