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First Steps in Urban Water

Managing Water as a Resource

Trees & Design Action Group

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References
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6 DEFRA 2023. Link
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Climate change is creating more extreme weather[1], and the frequency and severity of both flooding events and droughts is increasing[2]. Sustainable water resource management is essential to mitigate both effects while improving water quality.

Managing water as a problem

Historical land and water practices have modified our river catchments. Rural land uses (eg intensive farming) can increase the volume of rainfall runoff and flow of sediment into rivers; channel straightening moves the water more quickly downstream; and impermeable urban surfaces create runoff and flood easily (Fig. 1). Moreover, traditional *combined sewers*[3] treat surface runoff as wastewater and were not designed for the current or future extreme rainfall events, or urban population densities. When heavy rainfall events inundate combined sewers, storm overflow pipes permit untreated sewage and wastewater to enter rivers and seas. Between 2019 and 2022, 10 million hours of storm overflows[4] polluted rivers and bathing waters.

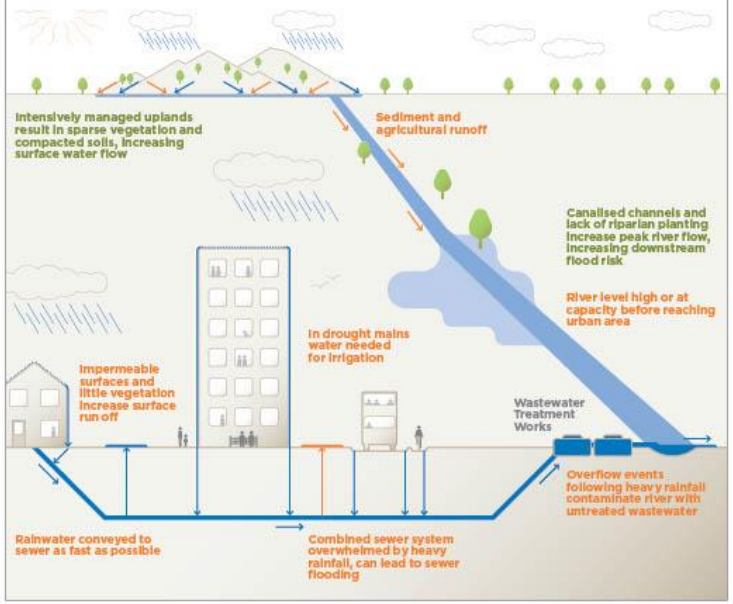
Our water resources face challenges from both climate change[1] and population growth[5]. In the UK, we currently use ~14 billion litres of water per day and will need 4 billion more by 2050[6], with future water shortages likely[7].

Managing water as a resource

We must slow the flow and improve water quality upstream by altering land management[8]; reduce urban runoff by intercepting rainfall and increasing infiltration; harvest rainwater and recycle greywater[9] (Fig. 2). This will reduce flood and storm overflow risk, provide irrigation for hot summers[10], and preserve water resources for drinking. *Green infrastructure (GI)* is fundamental for managing water. It reduces costs compared to traditional drainage[11] and provides a multitude of other benefits[12].

Globally, strategies for managing urban water include site-specific designs – *low impact development (LID)* and *sustainable drainage systems (SuDS)*; broader frameworks for city or regional management – *integrated urban water management* and *water sensitive urban design (WSUD)*; nature-centric approaches – *nature-based solutions (NbS)*; expansive city-wide concepts – *sponge cities*[13]. In the UK, the 2010 Flood and Water Management Act (FWMA), National Planning Policy Framework (NPPF) and local policies encourage or mandate SuDS. Schedule 3 of the FWMA, proposed for implementation in 2024, makes SuDS mandatory in all new development, with drainage systems needing approval from the SuDS approval body (SAB) before construction work can begin[14].

Fig. 1 **Water as a problem: urban water management without positive interventions**



Green infrastructure (GI) for water resource management

By storing or slowing surface water, the use of SuDS and other GI reduces flood risk[15] and improves water quality (Table 1). To design for more extreme rainfall events, it is important to manage *exceedance* flows (Box 1). SuDS should be designed in accordance with DEFRA's technical standards[16]. Table 2 overleaf outlines the key considerations for the planning, delivery, and management of such interventions.

Table 1 **Effectiveness of GI interventions**[17]

Green walls	Retain up to 75% of rainfall. Remove 33-99% of total suspended solids and 30-83% of nitrates.
Street trees	An average tree can intercept 3.2m³ of rainfall per year*, with SuDS-enabled trees reducing peak flow by 81%.
Greenspace	30% of annual rainfall is infiltrated or retained, with 42-100% reduction in suspended sediments.
Green roofs	Can reduce peak flow by up to 88% and delay it by up to five hours.
Filter strips and swales	Reduce runoff by an average of 70% and total suspended soils by 79%.

*There are significant variations between broadleaf and evergreen trees, species, age and maturity.[15,19]

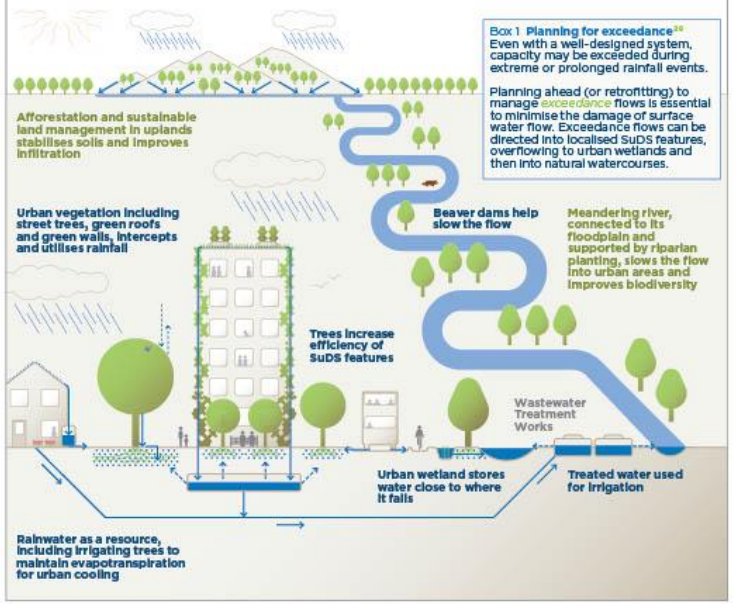
Integrated planning

It is important to make SuDS and other GI interventions integral to the overall development design. This enables different design elements to complement each other and can make the individual interventions more cost-effective. For instance, new cycleways and car parks can be integrated into SuDS by using permeable paving and bioswale tree pits. SuDS can be retrofitted into existing places[20], providing an opportunity to increase biodiversity and improve the urban fabric.

Financing improved water management

As part of their Plan for Water[6] the UK government will create a Water Restoration Fund, using money from water company fines and penalties to support habitat improvements and catchment projects. Natural England's Nutrient Mitigation Scheme[21] is being trialled in the Tees catchment whereby developers fund schemes that remove pollution to offset the impact of their development. The Green Finance Strategy[22] sets out how private finance will be mobilised to support public sector investment, which can help meet the scale of investment needed to manage water sustainably. On a household scale, capturing rain and surface water on property may reduce sewerage bills[23] and some water companies offer free water butts[24,25].

Fig. 2 **Water as a resource: urban water management with positive interventions**



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35 Interpave. Link
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37 Interlay. Link
38 Environment Agency 2023. Link
39 Living roofs. Link

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Ciria 2017. *Guidance on the construction of SuDS (C768F).* Link
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Guide layout

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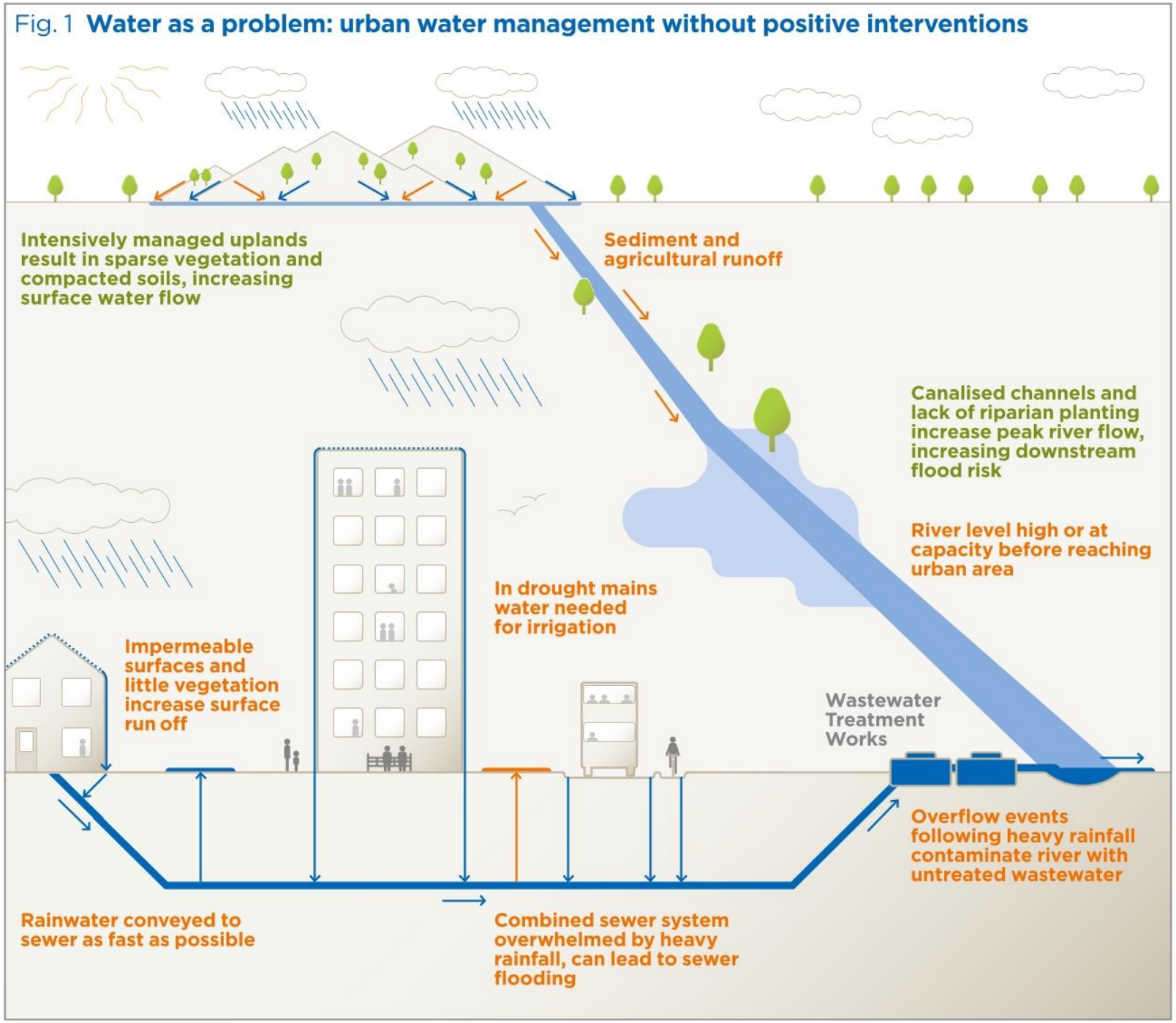
Water as a problem



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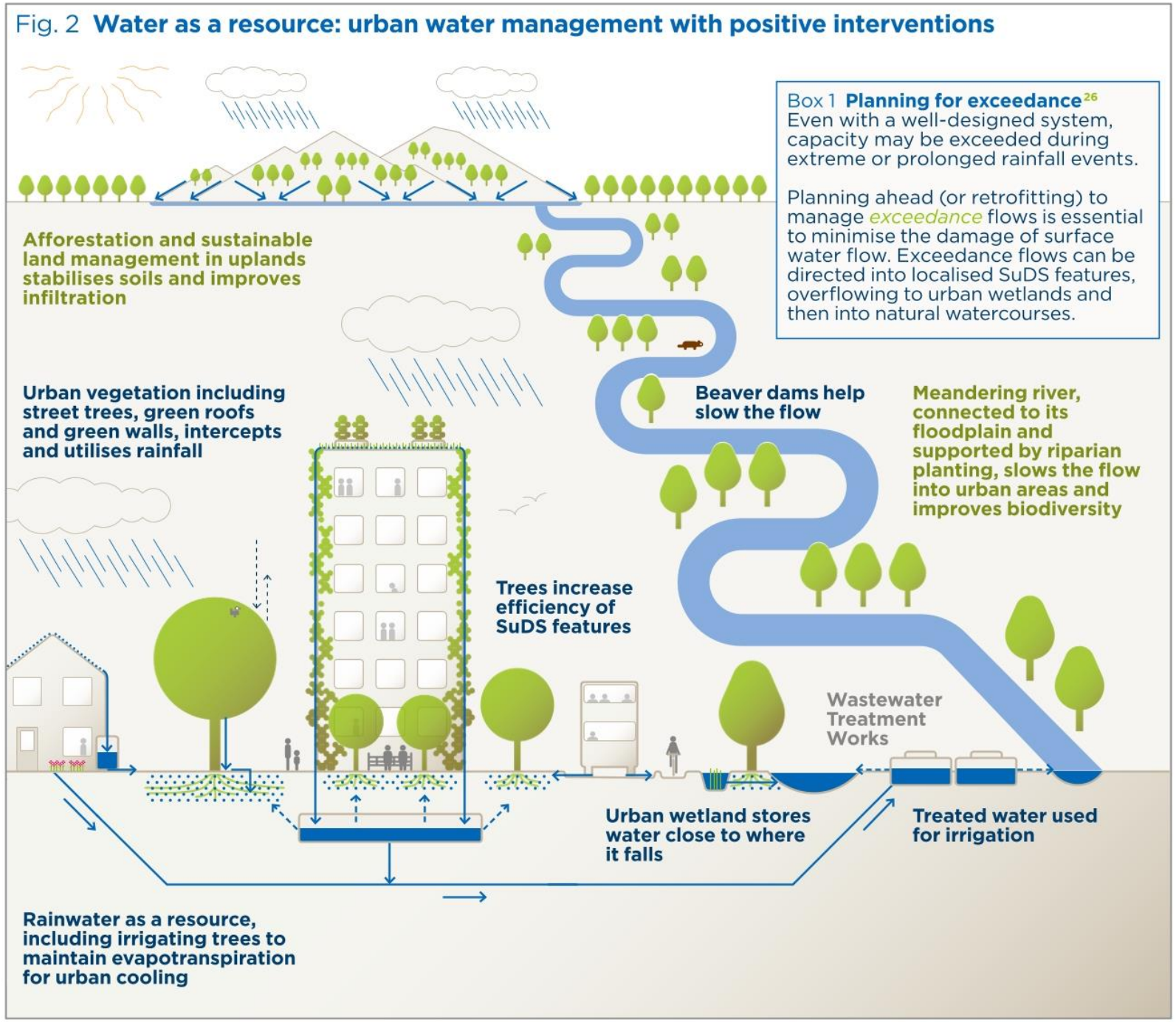

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Key Elements

1. Treat water as a resource
2. Small changes have a large effect
3. Integrated water management
4. Use trees wherever possible
5. Use of mapping and modelling
6. Design with maintenance in mind
7. Plan for SuDS adoption

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Any questions?

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