Valuing the 5 capitals for nature-based adaptation for London's future drainage

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Highlights

- A framework is presented for evaluating benefits across the 5 capitals for drainage adaptation options.
- In a London case study, £13 million of wider benefits can accrue from blue-green infrastructure.
- Benefits to natural, social, and other capitals can be delivered through partnership funding.

Introduction

The most urgent risk to London posed by climate change is flooding due to intense rainfall (GLA 2016). By 2050 the probability of a rainstorm likely to overflow London's drainage systems is expected to increase from a 1 in 30 to a 1 in 13 chance in any one year (GLA 2016). The quantities of surface water entering sewers has increased significantly over time due to very rapid urbanisation and the increase in impermeable surfaces. Pollution of receiving water bodies from combined sewer overflows (CSOs) is receiving increasing focus in London (EA 2019), as only 1 of the 39 rivers within the Greater London boundary achieves "good ecological status". By 2040 London's major wastewater treatment works are projected to have insufficient capacity to handle the flows of the city's wastewater and drainage, and by 2045 many assets will have exceeded their design lives (Thames Water 2018). Responsibility is shared between several players: the Environment Agency has a national oversight role for developing a flood risk management strategy; Borough Councils assume the role of the Lead Local Flood Authority for their areas, co-ordinating action to mange local surface-water risks. Thames Water (TW) is London's water and sewerage utility company responsible for managing the sewer network and ensuring effective drainage.

In 2022 TW is required to deliver its first Drainage and Wastewater Management Plans (DWMPs) for each of its catchments, documenting a strategy for managing drainage over a minimum 25 year horizon, whilst being encouraged to consider an 80 year horizon for complex catchments with the intention of driving longer-term planning. To optimise investment, the costs, benefits, and dis-benefits of options need to be understood, including doing nothing or delaying investment. Traditional cost-benefit analysis (CBA) weighs up the cost of flood alleviation against the avoided cost of flood damage, neglecting wider benefits delivered by adaptation options. Projects that address multiple drivers and deliver wider benefits are advantageous, and valuing these can improve the business case for their adoption. As part of developing DWMPs, water companies need to develop and appraise adaptation options and apply natural capital assessments of the environmental and social impacts of each option (Atkins 2018). This paper presents a framework by which this might be achieved, illustrated by application to a case study in the Brent-Harrow catchment of London.

Methodology

Framework for valuing wider benefits and disbenefits across the 5 capitals

Developed from several existing approaches (e.g. CIRIA, 2019), the framework has 6 steps for valuing benefits and disbenefits across the 5 capitals: natural, social, human, manufactured, and financial capital. The framework maps directly on to the DWMP options appraisal and development process (Figure 1). A spreadsheet-based tool accompanies the framework to provide a structured template for completing benefit assessments, with reference to methods or tools for quantification and monetisation. An Options Comparison Tool allows benefits to be weighted when comparing different adaptation options through the Analytical Hierarchy Procedure (AHP), enabling stakeholder preferences to be factored into the assessment.

Application to a Case Study: Brent Harrow catchment, outer North West London

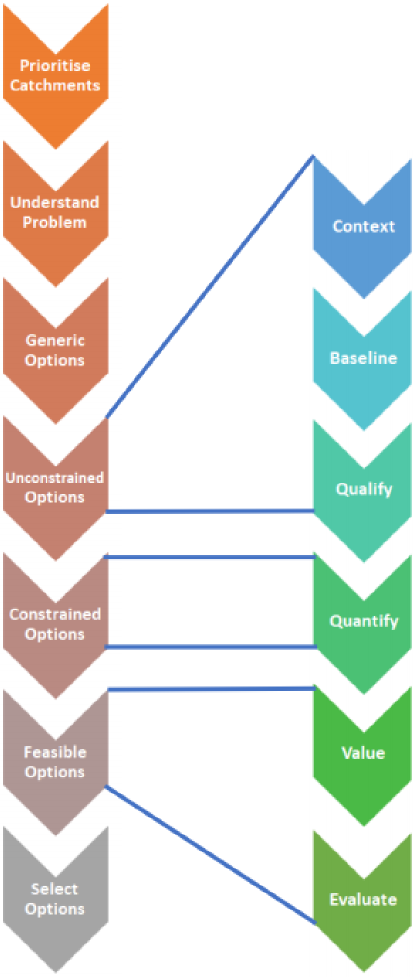

Figure 1: valuing wider benefits during the DWMP process

Table 1: Selected benefits and disbenefits arising from the proposals. Relevant dominant benefits are in red

Benefits	Beneficiaries
Flood alleviation	Homeowners (with reduced food risk)
Amenity	Homeowners (in proximity to the park)
Recreation	Park Users
Health	Park Users
Biodiversity	Society
Water Quality	Society
Carbon Sequestration	Society
Disbenefits	
Disruption	Homeowners (in proximity to the park) Park Users
Potential for Crime	Homeowners (in proximity to the park) Park Users

Context: The area experiences significant flooding issues. An underused park is proposed as a site for the installation of a surface water channel, bio-retention ponds, plants and trees and a dual function sunken sports ground. The site is in a lower socio-economic residential area with limited access to high quality green spaces, and many streets are without trees or front gardens. 21% of the surface cover is impermeable. The present value capital and maintenance costs over 50 years are estimated at £3.9 million.

Baseline: The boundary is 500m around the park including properties that flood downstream, and a planning scenario is adopted with a climate change uplift in rainfall of 12%. The park is underused with a moderately low value of 70,000 visits a year for recreation. Growth in population and urbanisation are forecasted at 0.8% and 0.4% respectively per year.

Qualify: A high-level assessment identifies the likely benefits and dis-benefits that arise from the proposals and they are screened to identify material impacts, based on relevance, dominance, and local stakeholder preference. The relevant dominant benefits are shown in red in Table 1.

Quantify: The relevant dominant benefits were quantified as follows: ***Amenity*** (property value)**:** Estimated 3120 homes within 500m from park**;** ***Flooding***: reduced flood risk at 46 homes in a 1 in 20 year storm (based on hydrodynamic modelling)**;** ***Recreation:*** 100,000 additional visits per year estimated using the OrVal tool, based on enhancements to plants, ponds and sporting facilities (LEEP, 2018). ***Disruption***: Estimated 4 months disruption during construction, disruption due to maintenance not considered significant.

Value: The benefits were monetised using the CIRIA B£ST tool assuming average property price of £353,513 (HM Land Registry, 2019), an additional 100,000 visits each year, and 46 homes with reduced flood risk - monetised using the 2014 EA Flood and Coastal Erosion Risk Management grant-in-aid calculator. The robustness of the assumptions was checked by considering sensitivity to the discount rate, time horizon, benefit values, and project costs. The results were most sensitive to changes in amenity value (see Table 2 Option 1). The benefit cost ratio based only on flood alleviation was 0.13, rising to 3.5 when wider benefits were included, improving the business case for sustainable drainage (SuDS).

Evaluate: Property owners near to the park are the major beneficiaries, as the value of their homes are expected to increase once the proposals are completed. This is a once off benefit, whereas benefits are delivered over 50 years to users of the sports ground and to homes with reduced flood risk. Results from the assessment should be fed back to iteratively inform design of the interventions, to maximise desired and equitable distribution of benefits. For example, the ponds might be positioned so as to maximise the number of homes they can be seen from, to avoid disproportionally advantaging only a few houses.

Results and discussion

To demonstrate the Options Comparison Tool a second adaptation option was included based on installing raingardens at 8000 properties in the Brent Harrow Catchment, each reducing surface water runoff by 2500 litres, and costing £1964 (Thames Water, 2017). Amenity value was estimated at £15.2 million using B£ST due to residents at 8000 properties experiencing a benefit of up to £30 per year due to street greening.

Table 2: Comparison of two SuDS options for Brent-Harrow

	Option 1	**Option 2**
Description	SuDS in Park	Household Raingardens
Cost	£3,900,000	£15,700,000
Benefits	£13,700,000	£20,350,000
Amenity (property value)	£10,000,000	£15,200,000
Recreation	£3,200,000	£0
Flood alleviation	£500,000	£500,000
Reduced surface-water charges	£0	£4,650,000
Disbenefits		
Disruption during construction	1 (Low Significance)	3 (Moderate Significance)
Net Present Value	£9,800,000	£4,650,000
Benefit-to-Cost Ratio	3.5	1.3

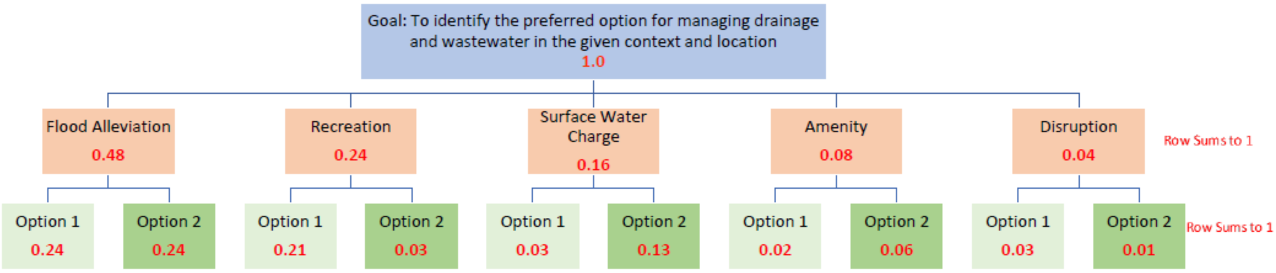

Figure 3: Options comparison based on an Analytical Hierarchy Procedure (AHP) analysis

Applying pairwise comparisons across the benefits, based on the assumed perspective of Thames Water and a method from DCLG (2009), an AHP analysis yielded the results shown in Figure 3. A global priority for each option was found to be 0.53 for the SuDS in park option, compared to 0.47 for the household raingardens. This exercise can also draw on the preferences of other stakeholders, to explore which option is most widely preferred. Valuing wider benefits enhances conventional CBA, in the case study above improving the business case for SuDs by more than £13 million of wider benefits.

Adaptation options have the potential to deliver benefits which accrue to many different parties. However, budget constraints and current regulatory drivers provide water companies with little incentive to fund projects alone. A key enabler to increase support from partners is by enhancing the visibility of the wider benefits delivered through multifunctional use of space. To date Thames Water has co-funded SuDs projects with London Borough Councils, the GLA, the Environment Agency, Transport for London, and not-for-profit groups such as Thames 21. The London Strategic SuDs pilot is seeking to unlock further potential for government funding by demonstrating performance of small-scale schemes which have not previously been eligible for flood defence funding. In the case of SuDs which deliver health and recreational benefits funding could be sought from the National Health Service (NHS) or sporting organisations. The UK Natural Capital Committee has estimated if every person in England had access to quality green space, then the NHS could save £2.1 billion a year in avoided health costs.

Conclusions and future work

The DWMP process is an opportunity for water companies to make the business case for longer term investments which improve climate resilience and sustainability across their regions. Flood alleviation benefits are insufficient to justify investment on that basis alone, so catchment approaches which include widescale implementation of blue-green infrastructure providing wider benefits should be considered.

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