

Collective Finance Models for Sustainable Water Projects

Douglas Crawford-Brown, Jean-Baptiste Gossé

Cambridge Centre for Climate Change Mitigation, Research Department of Land Economy, University of Cambridge, Cambridge, UK

Email: djc77@cam.ac.uk

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Abstract

Waterbasin management is an exemplar problem of collective action, since many actors influence and are influenced by changes in a waterbasin. The present paper uses the example of finance of control of surface water run-off as an instance of (potential) collective action involving finance. Five innovative financing schemes for new waterbasin management infrastructures are assessed with respect to the actors who provide the finance and how the projects are governed: 1) financing through taxes; 2) third-party financing; 3) financing by stakeholders; 4) financing through full-cost pricing; and 5) financing by developers and/or landowners.

Keywords

Waterbasin Management, Environmental Protection, Collective Action, Finance

1. Introduction

The task is to identify where, and under what models and terms, finance might be provided to create projects and practices that bring greater sustainability to water-related issues at basin scale (for a general discussion of infrastructure finance models, see [1]). “Basin scale” is taken here to mean projects and practices that, when coordinated, simultaneously improve the sustainability of water management and provision within the basin.

Many of the issues around waterbasin management concern governance, including regulation and planning by both public and private sector groups [2]. The current paper focuses solely on finance issues and mechanisms within the broader sphere of governance. These issues and mechanisms can arise under any combination of actors, motives, projects or governance structures. Hence focus here is on an array of different models of finance. The model chosen for any particular waterbasin, or perhaps even a specific project within that waterbasin, will depend on the combination in place. Coordination of the actions of the stakeholders in a waterbasin will only in

part be through finance; governance and social agreement are likely to be equally powerful drivers of coordination. It is for this reason that the current paper considers diverse finance mechanisms, any one of which might be optimal under some circumstances of governance and social agreement.

The aim of the current study requires clearly separating three *issues*:

- Actors in the waterbasin may carry out individual projects purely from self-interest to tackle specific challenges. *Reference to a larger basin goal may cause a project to be redefined by an actor, and/or unlock additional finance or better terms for that actor.*
- When actors conduct individual projects, coordination across projects—funded by whatever individual means they have to hand—may ensure they are complementary in reaching basin-level aims. *The act of coordination may cause one or both projects to be redefined, may provide a new finance mechanism that shares the finance and risks between the actors, and/or unlock additional finance or better terms for both actors.*
- There might be an organisation set up to aggregate finance, projects and delivery, to best provide for basin-scale management for sustainability. *This mode of project identification, delivery and finance is the one requiring the greatest innovations in finance and governance.*

We also consider three *drivers* of decisions on sustainability in a waterbasin, with different implications for finance models.

- Basin-scale management without a policy driver.* One can imagine a waterbasin has a suite of projects being done, but where there is no over-arching policy driver (only whatever driver applies to any specific project). *This situation will have implications for finance options, or at least the terms under which finance is provided, because the lender or equity holder cannot point to a specific policy driver that necessarily creates demand for coordinated projects.*
- Basin-scale management with a general policy driver.* One can imagine a waterbasin has a rather general policy driver such as the EU Water Framework Directive, and that this driver is being used to justify or require a suite of projects. In this instance, there is some “loose” specificity in the aims behind projects (clean water, reasonable prices or whatever are the stated aims of the directive), but the generality means the policy driver may target only a sub-set of the overall sustainability aims that might be found under item A. *This will have implications for finance options, or at least the terms under which finance is provided, because the lender or equity holder now can point to a general policy driver that creates demand for reaching policy aims, even if it does not create demand for specific coordinated projects or their services.*
- Basin-scale management under a specific policy driver.* Finally, one can imagine a waterbasin having a quite specific and narrowly focused policy driver, such as a requirement for Sustainable Drainage Systems (SuDS) in the UK. *The point is that there is in this instance a specific regulatory requirement or at least motivation for action of a particular kind to which the actor can point in seeking finance, because a project cannot go forward without satisfying this requirement.*

These combinations (of three Issues and three Drivers) have different implications as to i) whether the solution to problems that emerge are ones of finance, governance, social agreement or all, ii) who has “value” invested in or deriving from a project or suite of projects, iii) the most appropriate model for finance and iv) the terms under which finance is sought and/or provided, including whether finance is as debt or equity. The finance models developed later in this paper apply under all combinations of these Issues and Drivers, although specific models will be preferred under some combinations [2].

2. Framing Basin-Scale Issues to Understand Finance

We turn now to the *values* brought to a water basin by projects (2.1), the policy drivers under which decisions are taken (2.2) and the actors who find value in a project (2.3).

2.1. Value in Catchment Management

Designing and assessing finance options begins by understanding who (which *actor*) finds *value* in changes within a waterbasin. The meaning of “value” here is taken to be broad, and not restricted at the moment to financial value. An Actor might value the outcome of a project simply in the sense of caring personally; in the sense of being willing to put some additional effort into achieving it; or in the sense of putting money on the table to achieve it. The current study is concerned primarily with this third meaning of “value”, since it is a study of finance; however the other meanings of “value” will influence the willingness to take on the finance.

What are the sustainability *attributes* of a project or suite of projects to be financed, where these Attributes might potentially be the basis for value? These are divided here (see **Figure 1**) into the three classic pillars of sustainability: *economic*, *environmental* and *social*.

2.2. Aims of Waterbasin Management

The following four *aims* of waterbasin management are considered [3]:

- *Control of loading of pollutants to water bodies.* This control—related to the Attribute of Water Quality—includes policy aims to reduce discharge from economic activities, reduce discharge from buildings as such as households, reduce municipal waste water discharge, reduce discharge from agricultural areas, reduce discharge from animal habitats, and/or reduce the transfer of pollutants from the point of discharge to the point of loading. This control in turn involves projects that reduce use of pollutants at the source (e.g. through process change), prevent their discharge into the environment (e.g. through pollution control technologies), and/or prevent or impede their flow into receiving waters after being discharged (e.g. through provision of riparian buffers).

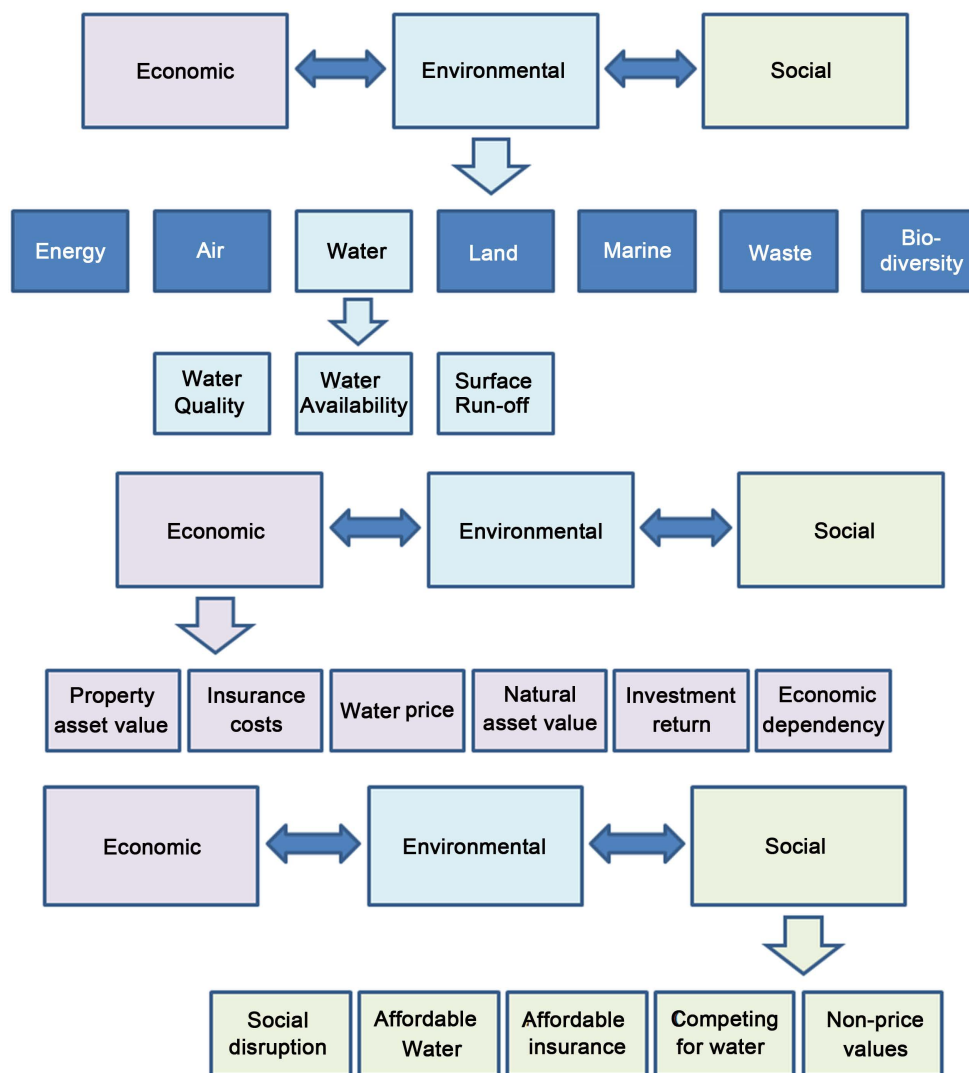


Figure 1. Linking the three pillars of sustainability (economic, environmental, social) on the top rows of each sub-figure to the aims or attributes sought by stakeholders (bottom rows). For environment only the example of water is considered. Improvements in attributes are the ultimate source of any value that can be invoked for finance.

- *Water treatment.* This control—related to the Attribute of Water Quality—includes policy aims to provide for reduction in pollutant levels after those pollutants have entered the receiving water. This control in turn involves projects that remove pollutants from those waters *in situ* (e.g. through dredging of contaminated water bottoms), improve treatment capacity, separate run-off volumes from sewage, provide point-of-use treatment, or create or maintain wetlands and other ecological areas that provide a natural service of water purification.
- *Control of the availability of water.* This control—related to the Attribute of Water Availability—includes policy aims of making water available to all users in the waterbasin, at reasonable levels of availability and price. This control in turn involves projects that reduce water demand (in households, industries, agriculture, power generation, etc), increase the recharge rate into waterbodies, increase rainfall capture and make that available for use, increase retention of water in natural systems such as wetlands, or allow for transfer of water between geographic areas with differing levels of availability.
- *Control of surface water run-off.* This control, related to the Attribute of Surface Run-Off, includes policy aims of reducing risks from surface water, including risks from the pooling and flow of rainfall as well as risks from waterbodies exceeding their banks (which might also be related to climate adaptation aims if sea flooding increases), as well as being relevant to strategies of reduced loading to waterbodies (from the first bullet). This control in turn involves engineered projects that channel and pool run-off in ways that reduce risks of flooding, keep run-off out of sewage systems to prevent unnecessary treatment or overflow of raw sewage, create or maintain wetlands and other ecosystems that provide a natural service of storm buffering, or provide barriers against damage to assets when flooding does take place.

2.3. Actors in Waterbasin Management

The next question is which *actors* find value in reaching any of these sets of Aims. There will be several potential reasons behind value, which can be related broadly to:

- *Statutory obligation.* A project may help an Actor discharge a duty of service. For example, the Environment Agency has a duty to protect against flood risk, and so may “value” a project that reduces flood risk.
- *Personal concern.* An Actor may “care” about some feature of the waterbasin, and wish to contribute to its protection or enhancement. For example, the RSPB and its members may value a project that helps maintain habitat for those birds.
- *Service benefit.* A project may give an Actor a direct benefit through the services provided by that project. For example, an insurance firm may benefit from lower flood risk to the assets it insures, reducing their flood risk losses.
- *Asset value.* A project may increase the financial value of an asset owned or managed. For example, homes built by a developer may have a higher sale price due to landscape amenities or decreased flood risk.

Any of these four factors affecting value may drive finance, and any one Actor may have connections to a project through one or more of these factors. This points to the complexity of particular waterbasin projects, which is why this study provides a number of different finance models that might be adopted under different circumstances of the nature of value derived from a project.

There is then the issue of the particular Actors to be considered. Thirteen sets of Actors who influence one or more of the Indicators, and/or who find value in improvements to one or more of these are identified:

- **Developers:** Creators of new buildings and supporting infrastructure, taken to include the entire supply chain from materials to labour to construction to sales.
- **Water companies:** Owners and operators of water treatment, water distribution, sewage collection and treatment, (potentially) stormwater systems, and billing functions.
- **Insurers:** Providers of insurance coverage of assets through premiums by the asset owners/managers.
- **Property owners:** The owners of assets such as buildings, or perhaps the occupants of buildings.
- **Financiers:** The providers of finance for projects in the form of debt.
- **Investors:** These also finance projects, but as equity holders.
- **Energy providers:** These use water—including discharging water—in their operations.
- **Local authorities:** The primary governance group for the land and properties in the catchment.
- **Regulators:** Framers of action through regulation, standards, price-setting, etc.
- **Tourists:** Providers of revenue to a waterbasin.

- Other infrastructure: Providers and/or managers of non-water infrastructure such as IT, power and transport.
- Industries: Economic activities that make use of water and discharge it during industrial operations.
- Farmers: This refers to the broad category of agricultural production.

3. The Nature of the Case Study

Instead of exploring all combinations of factors (Issues, Drivers, Values, Aims and Actors), a case study is selected here that might evolve in such a way as to be representative of the range of factors that influence finance in the sense of selecting finance instruments and models, terms of finance, and the relationship to governance structures. The discussion uses the River Wissey Catchment as the central example, but any and all of the finance models developed could be applied to any set of projects in any other waterbasin.

3.1. General Governance and Finance Structures

There are 3 general governance *structures* through which an actor might participate in delivery and operation of the project or suite of projects (each with implications for finance as discussed later):

- *Centralised governance and project delivery* might be through a central body (e.g. a catchment water authority) that i) identifies projects based on a balance of the aims, ii) assembles finance, iii) procures delivery agents and iv) oversees project execution and performance monitoring. Finance for projects is through a fund into which finance flows to the central body (e.g. through bonds, investors or contributions by actors) and out to specific projects. Servicing the finance is through contributions by actors through a central pool of contributions (similar to a community infrastructure fund) and/or pay-as-you-realise-value schemes (similar to pay-as-you-save schemes in the energy sector), supplemented by the projects of individual actors who could take on a project themselves under whatever finance terms they wish.
- *Centralised project coordination and assistance* might be through a central body (e.g. a catchment water advisory board) that identifies projects based on a balance of aims, and then assists the actors to i) coordinate their projects, ii) attract finance, iii) reduce delivery costs through economies of scale and iv) monitor execution and performance to ensure catchment scale aims are being met. Finance for projects is through arrangements between actors obtaining value in a project, delivery agents and financiers—arrangements that are bespoke to each project—with the central body helping to mobilise finance and perhaps even serve as a backstop to risk, but not holding the finance itself or carrying out the projects directly. Servicing the finance is through whatever means are arranged by the coordinated actors.
- *Confederation of actors* collaborating through a communications and “mutual interest” function (e.g. a public-private sector waterbasin collaboratory) in which individual actors or consortia of actors take on projects for whatever reasons drive them and under whatever finance means are desired, and invite other actors to create projects that enhance the reaching of catchment management Aims. Finance for projects is through arrangements between actors obtaining value in a project, delivery agents and financiers—arrangements that are bespoke to each project—with the collaboratory helping to identify opportunities for project coordination, collective finance etc. Servicing the finance is through whatever means are arranged by the collaborating actors. The collaboratory might be facilitated by a central organisation (such as a local authority or a university), but the collaboratory does not operate formally through that organisation.

3.2. Mapping Actors to Projects and Aims

The variety of potential relationships between actors, structures, projects and aims are shown in **Figure 2**. A line connecting a project to an aim indicates the project brings some value in reaching that aim. Where a given actor finds some value in reaching that aim, there may be a motive for contributing to one or more of the projects linked to the particular aim.

4. The Case Study

As mentioned, the case study uses the River Wissey Waterbasin as the geographical location; this case study was selected through a stakeholder project developed by the Cambridge Institute for Sustainability Leadership to explore governance and finance options in the UK. The various finance models explored cover the range of issues, values, drivers, aims and actors, as well as governance structures arising in the waterbasin.

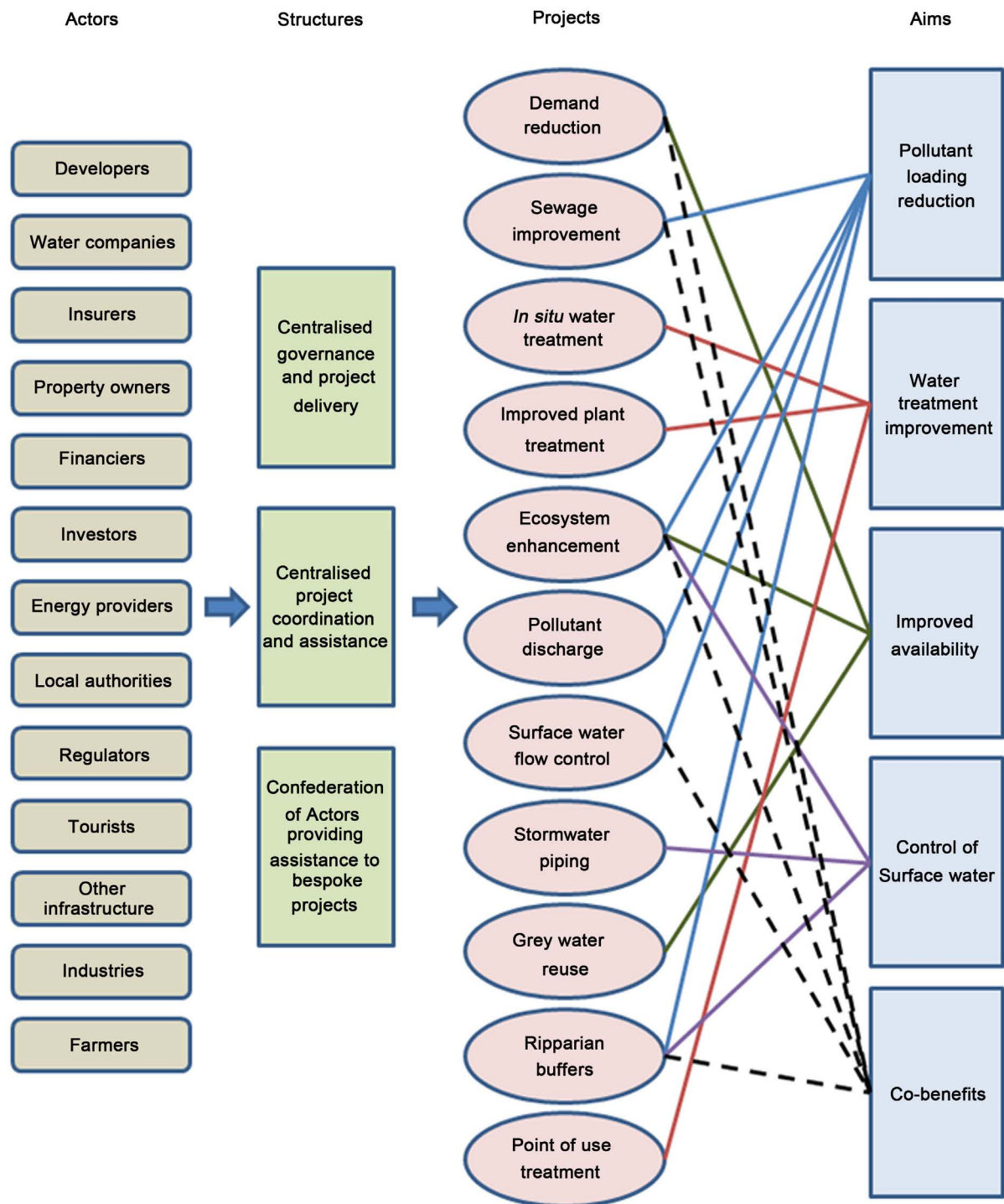


Figure 2. An example mapping of actors to projects and aims, mediated through three example governance structures.

The case study is further confined here to the aim of storm-water run-off control. Again, the general nature of the finance models does not depend on this aim, so the same finance models would be applicable to other aims. Storm-water run-off control is selected to make the discussion more concrete, and in any event it is sufficiently complex as to be amenable to use of any of the finance models potentially available for projects. The questions addressed are: How to better finance storm-water run-off control? How to reduce the cost of flooding? How to

reduce the cost of water services? How to incentivise insurance providers, developers, water companies, local authorities, property owners and other stakeholders (who might find value in co-benefits) to contribute more to the building of storm-water management infrastructures?

4.1. Context

The water sector will face major challenges in the coming decades. A larger population will have to be provided with drinkable water. The British population is forecast to keep increasing, particularly in the south-east of Britain. According to recent projections, there should be an increase in the British population of 17 per cent by 2035. In the county of Norfolk, where River Wissey is located, the population is set to grow from 852 thousand to 1.023 million inhabitants in 2035, a growth of 20 per cent¹. In the meantime, climate change should have twin effects in the UK. First, it will marginally reduce water resources as the annual level of precipitation may decline slightly. Second, the summers should be 10 - 20 per cent dryer and winters 10 - 20 per cent wetter in the River Wissey basin², which means a higher risk of (summer) droughts and (winter) floods in the future.

The Environment Agency (EA) is currently working on improving National Flood Risk Assessment. This may provoke moves in premiums to better reflect flood risk, with a small decrease in most places but a sharp increase in a few places [4]. The new information on flood risk will also allow better assessment of where to invest in new waterbasin management infrastructure to minimise the risk of floods in the river basin.

Among the OECD countries, the UK has the highest rate of the population served by the private sector: 90 per cent for water, and 93 per cent for sewerage [5]. It thus makes sense to find finance (and governance) mechanisms to incentivise the private sector to contribute more to the investment in waterbasin management. In particular, wastewater service companies and insurance companies, who will directly benefit from the new infrastructure, might substantially contribute to the financing of basin-scale controls on surface water run-off.

4.2. Surface Water Run-Off Control

The management of surface water run-off will depend on the standards imposed on dwellings in the next years. One can distinguish between standards applying to new constructions that may increase or decrease the flood risk and standards applying on existing built areas. The Sur 1 clause deals with new dwellings. This measure is important in the River Wissey basin since, as noted by the King's Lynn and West Norfolk borough council [6], the construction of new buildings in this area may significantly affect fluvial flood downstream. The SuDS standards [7] apply to any rainwater falling on roofs and other surfaces. A high level assessment of the geology confirmed that SuDS techniques have the potential to manage surface water run-off.

The case study is built around projects for control of surface water run-off. CSH is a government programme that assesses new dwellings against nine categories of attributes, including surface-water management. Surface-water run-off is considered in the Sur 1 clause, which is a mandatory requirement for attainment of the upper levels of CSH certification. This clause requires developers to design surface-water drainage in order to "avoid, reduce and delay the discharge of rainfall run-off to watercourses and public sewers" [8]. This is intended to have two advantages in terms of water management: it reduces flood risk and protects watercourses from pollution and other environmental damage to watercourses.

The assessment criteria of Sur 1 are based on the Sustainable Drainage Systems (SuDS) management train. *Hence in this case study SUR 1 may either be considered an example of a specific policy driver that falls within the scope of a more general policy driver related to development of SuDS, or the inverse: SuDS being one way in which the SUR 1 criterion can be met.* The former interpretation is used here, although that is not necessary for consideration of the finance models developed.

The Department for Environment, Food and Rural Affairs (Defra) is in charge of developing the SuDS national standards to manage surface run-off in accordance with the Flood Water and Management Act of 2010. The SuDS approach aims to reduce surface-water flooding, improve water quality, and enhance the amenity and biodiversity value of the environment by using techniques such as infiltration and retention. Permeable paving, soakaways, trenches and basins are amongst the infiltration drainage techniques. Depending on the geological

¹Office for National Statistics, data sets and reference tables, release date 21 March 2012, viewed on 1 November 2012. <http://www.ons.gov.uk/ons/datasets-and-tables/index.html?pageSize=50&sortBy=none&sortDirection=none&newquery=components+of+change>

²See central projections made by UKCIP for 2080, located at UK Climate Projection. <http://ukclimateprojections.metoffice.gov.uk/>

characteristics of the ground, infiltration may not be feasible. In that case, attenuation techniques such as wetlands, rainwater harvesting and detention basins have to be put in place.

The Sur 1 criteria consist of: i) a peak rate of run-off and ii) a volume of run-off. These two criteria apply only when new development results in an increase in the man-made impermeable area. The volume run-off criterion ensures that the post-development volume of run-off is not greater than before the development. The implementation of the water catchment management standards could have two kinds of implication for stakeholders. Direct implications result mechanically from their implementation:

- Control of the volume of wastewater to be treated.
- Mitigation of wastewater flows in order to avoid floods.

The implementation of these standards also presents indirect opportunities for some stakeholders:

- Source of free water for non-potable use.
- Reduction of the volume of wastewater to be treated.

4.3. Assessment of Costs and Benefits

4.3.1. Actors

In this case study, ten classes of actors are considered as identified in stakeholder workshops, each of whom are concerned with or find value in implementation of SuDS standards:

- Regulators (Environment Agency, Ofwat, Defra);
- Water companies (wastewater service providers);
- Developers;
- Insurance companies;
- Property owners;
- Local authorities;
- Investors;
- Financiers;
- Water Services Company (WASCO);
- Tourists.

4.3.2. Cost of Infrastructures

- Cost of Sur 1 implementation. According to the cost review established in 2010, the cost of Sur 1 implementation is estimated at £1100 per site [8]. The new infrastructure includes an attenuation system with percolation to regulate the flow of run-off by using a flow regulator and reduce the volume of storm-water discharge with infiltration technique.
- Cost of maintenance and depreciation period of new infrastructures. The O&M costs are estimated to be 10% of project cost per year; the depreciation period is taken to be 20 years.
- Cost of sewerage treatment. In 2006/2007, the average cost of wastewater treatment in the United Kingdom was £0.09 per litre (half the price of delivered water) and the average household bill rose to £152 for sewerage treatment [9]. The reduction in the volume of water treated could thus constitute an important source of cost reduction for water companies and their customers. Water companies propose to reduce the sewerage standing charge if storm water is drained into a soak-away in the garden. For example, Anglian Water estimates that by showing that none of the surface water from a property is going to the sewerage system, one can reduce the charge by £37 per year³.
- Discount rate. The discount rate is the rate of return requested by investors. In the case of households, for instance, this study uses the average of the interest-bearing sight-deposit⁴ over the past ten years. This rate is applied in order to assess the profitability of the investment and to determine the payback period (*i.e.* the time needed for the cash flows to compensate the initial investment).

4.3.3. Potential Gains from Surface Water Run-Off Control

The implementation of SuDS standards is assumed to provide four major sources of benefit (see **Figure 3**). First,

³Anglian Water's website, viewed on 1 November 2012.

<http://www.anglianwater.co.uk/household/your-account/tariffs/charges-explained/index.aspx>

⁴This measure is provided by the *Statistical Interactive Database* of the Bank of England.

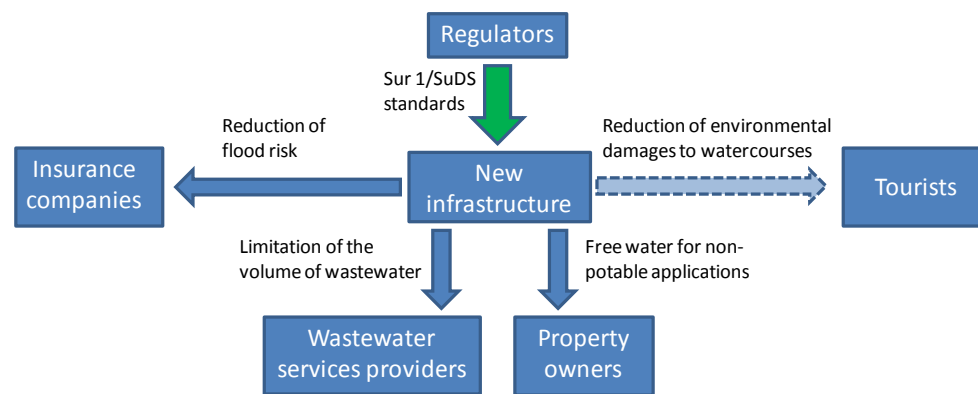


Figure 3. Benefits of SUDs from the perspectives of 4 key groups of stakeholders.

the development of water-catchment management infrastructure will regulate inflows into the water-catchment system and thus reduce the risk of insurance companies paying flood compensation, as well as their need for technical provisions⁵. The reduction of flood risk will also reduce the risk on banks' portfolios located in the basin. Second, it will limit the volume of waste water handled by sewerage service providers (either private or public). At the same time, the reduction of the water to be treated will reduce CO₂ emissions through reduced energy use in treatment processes. Third, it will provide real-estate buyers with a source of free rainwater for non-potable applications such as gardening, car-washing, toilet-flushing or washing clothes. The premium attached to “greener” buildings might also reinforce the attractiveness of these properties (although it is not clear such a premium is in fact in operation in the current market). Fourth, it will help to preserve watercourses from pollution and other environmental damage.

Evaluating the potential gains requires assessment of the following:

- **Flood insurance premiums.** By mitigating storm-water flows, flood-risk management techniques reduce the level of this risk and the costs of flooding. With climate change, winters will become wetter and will bring a significant change in the frequency and intensity of flooding. The impact of this evolution on the flood-insurance premium depends on the mitigation policy that is put in place. One can anticipate a significant increase in the flood premium in areas exposed regularly to floods, which would exclude purchase of affordable insurance by a significant number of households and small businesses at risk. Insurance firms should take into account the positive impact of flow regulation on the catchment-basin flooding risk when calculating the premium of SuDS compliant sites.
- **Cost of floods.** The new waterbasin management infrastructure will reduce the probability and the amplitude of floods in the river basin. This leads to a reduction in the payment of compensation by insurers.
- **Setting of the water prices.** In England and Wales, water companies determine the increase in the price of water following the current inflation rate plus an extra charge K . This factor is defined by Ofwat in order to take into account financing of the future improvements programme. The value of K may therefore change under surface water control.
- **Use of rainwater harvested.** The use of the rainwater collected allows a reduction in demand for water and thereby pressure on a decreasing supply. Households will also be able to reduce their water bills by using it for toilet-flushing, washing clothes, outdoor use and car-washing as these activities represent 45 per cent of households' consumption in England and Wales [10].
- **Green premium.** There may be an increased asset value of properties under surface water control, due to decreased flood risk, increased availability of free “grey” water or any amenities that might be created by the control measures (e.g. constructed wetlands being bird habitats).
- **Protection of watercourses.** Control of surface water run-off protects water courses both from volumes of water that might be incapable of being handled by the watercourse, and by reduction in run-off of pollutants that harm wildlife and/or require additional treatment by water companies before distribution. On the one hand, untreated waste water can provoke chronic ecosystem damage due to biodegradation of organic matter

⁵The technical provisions are the amount of capital that an insurance company needs to hold to cover the obligations arising from its insurance contracts.

and eutrophication of waters (River Wissey is sensitive to nitrate), and possible health risks from water-borne pathogens. On the other hand, sewage solids can damage commerce by making beach and riverside resorts unattractive to potential tourists [11].

4.4. Financing Schemes

Alternatives for financing the new waterbus in management infrastructures were developed, extending from a centralised system through taxes with a centralised government agency which allocates investments, to a more decentralised one through investment at the level of individual developments with very little coordination.

4.4.1. Option A: Financing through Taxes

A straightforward way to finance waterbasin management infrastructures is to introduce taxes and centralise the allocation of new investment in a dedicated government agency. This option (see Figure 4) presents some advantages and disadvantages. On the one hand, the different stakeholders contribute to the funding via taxes (developers, wastewater service providers and insurance companies), or by higher charges from other stakeholders (property owners), which have to pay higher taxes. On the other hand, the centralisation of waterbasin management investments potentially allows a better allocation of new investments in order to minimise flood risks. Such a result can be reached by allocating the funds collected to the most efficient investments rather than focusing on new developments. For instance, the Community Infrastructure Levy (SN/SC/3890) is used by local authorities to fund new infrastructure. However, this mechanism concerns only new developments, although it can be extended to other stakeholders that benefit from the infrastructure, and runs afoul of backlash against increased tax rates. Another example can be found in the State of Oklahoma, where a state gross production tax⁶ for community water funds was created to provide a funding source for municipal water projects.

4.4.2. Option B: Third-Party Financing

Third-party Financing (TPF) is defined by the European Parliament⁷ as “a contractual arrangement involving a third party—in addition to the energy supplier and the beneficiary of the energy efficiency improvement measure—that provides the capital for that measure and charges the beneficiary a fee equivalent to a part of the energy savings achieved as a result of the energy efficiency improvement measure.” (Note that the EP considered TPF in the context of energy provision, although similar lessons may be applied to issues of water, at least

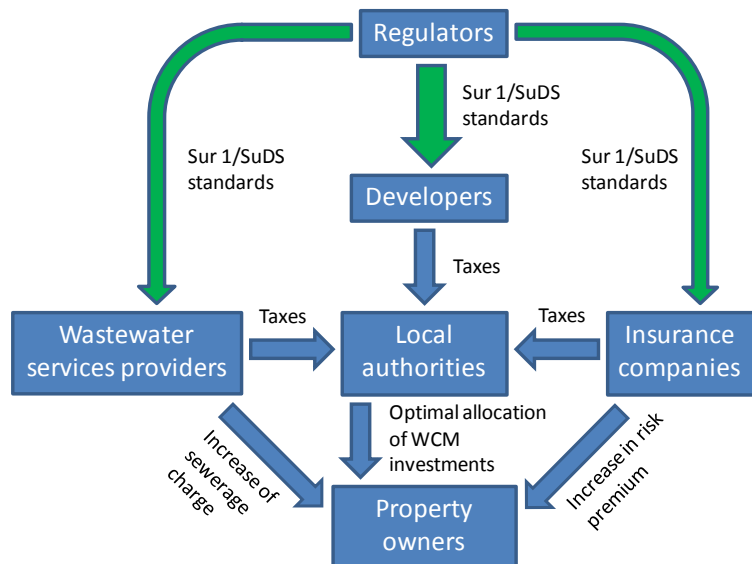


Figure 4. The finance and governance model in which taxes provide the base of initial finance and the local authority governs the project.

⁶House Bill 2928, State of Oklahoma.

⁷European Directive 2006/32/EC, Chapter 1, Article 3.

in principle) The initial investment can be financed by actors benefiting from the new infrastructures, such as local authorities, local communities, insurers and water companies, as well as banks and other financial institutions (see **Figure 5**). The new entity created—here called Water Services Company (WASCO)⁸ although there can be many variants on this such as a local authority being the provider—rents the infrastructures to the users who benefit from it⁹ (Finance structure 2). A WASCO might sit in the private sector, the public sector, or be a Public Private Partnership (PPP). It can be funded by equity, debt and grants.

Equity investments generally demand higher rates of return than bonds but are a stable source of funding. The level of equity is a determinant in the financing process since it is a limiting factor to obtaining debt. The provision of equity is often dominated by local authorities. Further equities have two sources: internal equity stemming from the existing company's cash flows, and external equity coming from external investors. In the case of water infrastructure, internal equity generally is not sufficient to finance the required investments. External equity can therefore supplement equity funding. It is an interesting option for investors seeking long-term investment with low risks, such as large pension funds, infrastructure funds of investment banks, and insurance companies.

A WASCO can be debt-financed by commercial bank loans, corporate bonds, and international financial institutions. Bank loans have the best speed of acquisition but they are less attractive than other debt instruments as their relative short-term maturity obliges them to more refinancing operations for long-term maturity projects such as water infrastructure projects.

Corporate bonds offer two advantages. First, varying maturity allows better matching of maturities on the balance sheet. Second, when ratings are good, bonds are a cheaper way to finance. Waterbasin bonds can be created for investment in the water-saving infrastructure. Holders of such bonds are both general public and pension funds, and receive a coupon based either on returns or on payments from the government (if facilities are publicly owned). Pension funds can play an important role as infrastructure investments meet their own objectives of long-term inflation-linked cash returns. A large number of pension funds have already agreed to become Founding Investors in a Pension Infrastructure Platform (PIP) for the UK. This new investment vehicle should help the financing of government infrastructure projects when fiscal policy is tightly constrained by the slowdown in the UK economy.

Access to international financial institutions' funds is particularly interesting at the development stage as it is a source of low-interest-rate loans (e.g. project loans and intermediated loans), and guarantees to help attract investors and reduce the cost of borrowing. Community funds such as the Community Water Project provide low-or-zero interest loans that help local communities, for instance, to meet water quality standards. The European Investment Bank (EIB) should soon propose to separate the debt into tranches, the senior tranche for private investors and the subordinated tranche for public institutions.

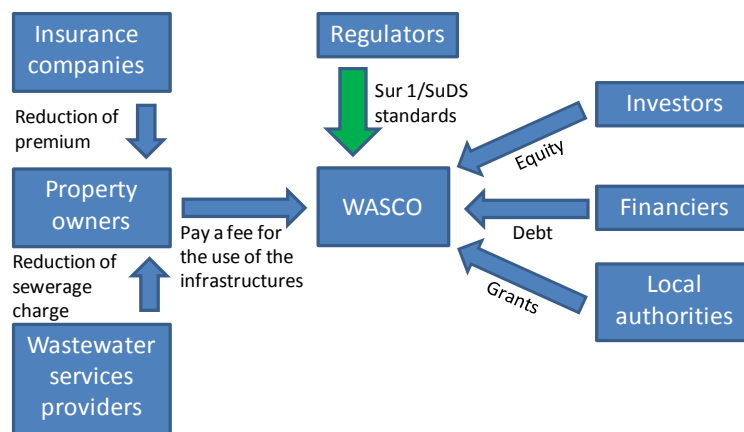


Figure 5. The finance and governance model involving creation of a Water Services Company WASCO.

⁸Another alternative would be the Multi-Utility Service Company (MUSCO), which offers a wider range of services, including water services.

⁹The company can alternatively get payments from a public authority.

Grants permit an easing of the difficulty involved in raising new equity. For water, DG CLIMA could give grants through calls for proposals for water-catchment infrastructure projects. Service suppliers are invited to submit a proposal on a specific service and, if elected, can obtain a direct financial contribution from the European Commission “to support a specific action or project of a non-commercial nature, to cover eligible costs directly incurred by the beneficiaries”. For example, the EIB has also recently provided the Bristol local authority with a \$2.5 million grant to meet most of the costs of developing an energy services company and investment programme. This company will be owned by the City Council on behalf of the citizens of Bristol. It is intended that half of its funding will be secured from the EIB and the rest from private sector investment. This may provide a model or template for WASCO creation and finance. A summary of these sources of finance is provided in **Figure 6**.

4.4.3. Option C: Financing by the Stakeholders

Stakeholders may find several advantages in investing directly in new infrastructure. They will not be subject to further taxes and they guide investments and better serve their interests. First, property owners may either invest and/or pay a fee. They can create community funds intended to provide new funding, directly linked to waterbasin management, to the local area. They are often used to support projects that cannot be exclusively funded through other sources. Property owners will try to realise investments that maximise the use of storm and rainwater as it may replace 45 per cent of their current water consumption.

Second, local authorities aim at reducing public money use and look for partners. The creation of Local Enterprise Partnerships (LEP), made up of local businesses working in partnership with a combination of local authorities, can allow financing of infrastructure projects¹⁰. Local authorities of a catchment basin can also decide to create a Local Government Investment Pool (LGIP) to better manage water catchment at the local level, provide liquid assets, and enjoy economies of scale. This investment vehicle allows local agencies to benefit both from overnight availability and improved earnings. However, the LGIP often uses the pool fund for portfolio investments rather than for infrastructure financing.

Third, insurance companies want to minimise the flood risk and may focus more on the mitigation of surface flows as this relates to flooding than on the control of the volume of water to be treated. Their priority is to

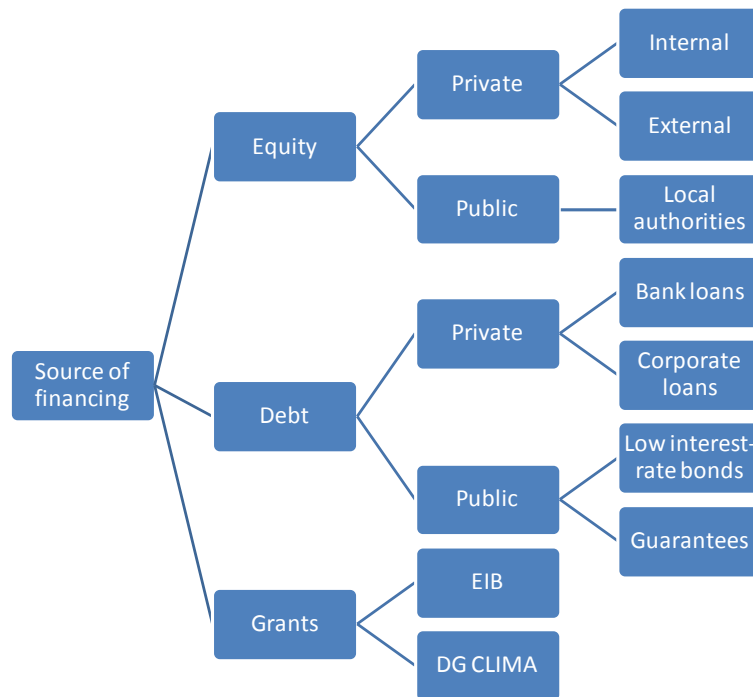


Figure 6. Potential sources of financing for the structures in **Figure 4** and **Figure 5**.

¹⁰There are already 39 approved LEPs in the United Kingdom.

reduce the cost of flooding that they have to cover in a context of increasing probability of extreme events. Moreover, infrastructure investments are in line with insurance company preferences for long-term and low-risk investments.

Fourth, wastewater service providers have an interest in reducing as much as possible the volume of water to be handled, which in turn reduces the volume to be treated by the water company engaged in treatment (which is not always the same company as the sewerage company). As waterbasin management infrastructure should lead to a decrease in water consumption, water providers have an interest in substituting revenue stemming from water consumption by revenue resulting from new infrastructure. Households would pay a fee to use the facilities to collect and use rain and storm water.

Fifth, developers may have an interest in investing in the pool of stakeholders to avoid supporting alone the cost of developing new infrastructure. Participation in the pool clears them of any further responsibility. They will not have to pay more taxes (option A) or risk supporting the whole infrastructure cost (option E), and they can even expect stable returns on equity.

The finance and governance structure are shown in **Figure 7**.

4.4.4. Option D: Financing through Full-Cost Pricing

Full-cost pricing is a way of reinforcing the involvement of the private sector in infrastructure investments. This financing scheme is a pricing structure which fully recovers the cost of providing the service and promotes efficient water use by customers (see **Figure 8**). This strategy of financing implies that an increase in user fees finances new infrastructure. However, as noted in [12], very few systems in the world are fully funded by customer

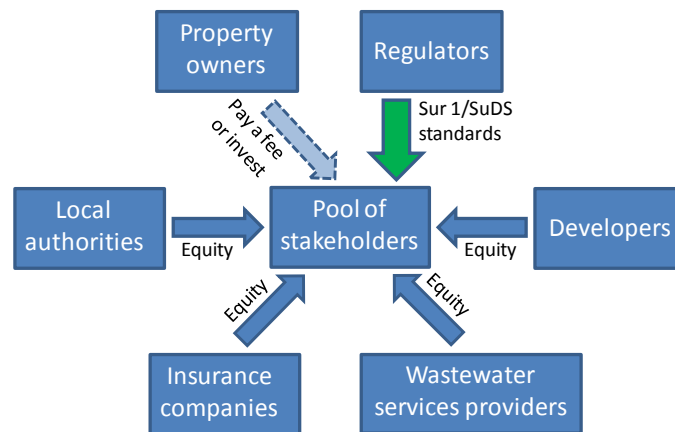


Figure 7. The finance and governance model in which partnerships between stakeholders are formed for joint venture projects.

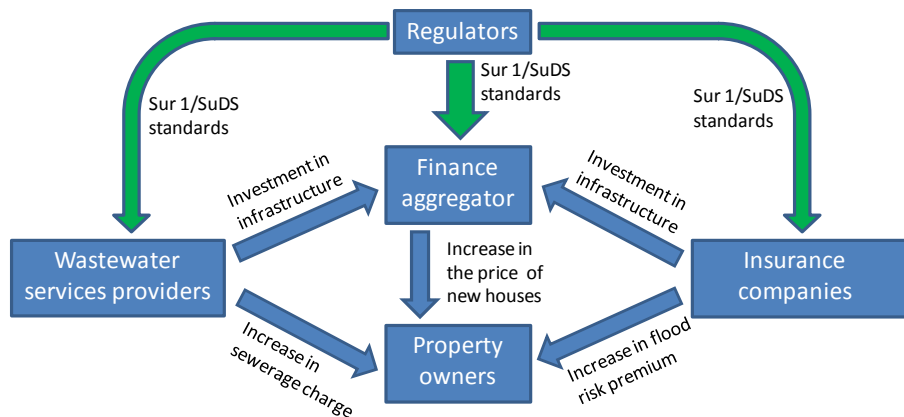


Figure 8. The finance and governance model in which a new entity—the Finance Aggregator—is created to bring portfolios of projects to potential investors.

charges, and financing of the water sector is generally completed using general tax revenue. Regulators may not want to fully recover the cost of new investments through higher charges since the economic cost of poor health due to increased water charges (caused by people displacing health care expenditures to continue their current level of water consumption; see [13]) may be higher than the cost of financing new infrastructure by taxes.

4.4.5. Option E: Financing by the Developers and/or the Landowners

The most straightforward option is to consider that the initial investment is paid by the landowners, developers or asset owners/managers in a waterbasin, who expect to recover the investment by increased asset value, selling or letting the real estate at a higher price (see Figure 9). The cost of new infrastructure is thus paid by these various landowners, who can finance the investment through savings, loans and subsidies. Landowners can expect three sorts of compensation. First, they can use the stormwater and/or rainwater collected. Second, water companies can reduce the sewerage charges for these properties since the new infrastructure reduces the volume of water to be treated. Third, insurance companies can reduce the insurance premium for these properties since the new installations contribute to reducing the overall flood risk and consequently the amount of flood compensation to be paid. The regulator (Ofwat) will have to check that insurance and water companies share the benefits obtained from the new infrastructures with the landowners who paid for them, but this issues are already being addressed in OFWAT’s Regulatory Futures revisions to pricing.

This option assumes that the landowners/developers are the price-makers or that the price of houses will be affected by the building of new infrastructures. Developers are more usually price-takers, which implies that an increase in the cost of building will reduce their mark-up rather than increase the price of new houses. At the end of the day, they will thus become the financier of waterbasin infrastructure. The question is then to determine whether the building of new infrastructure is taken into account in the price of houses. Some empirical studies investigate whether sustainable building certification generates a green premium. In the United States, ENERGY STAR certified buildings benefit from a rental premium and show higher building occupancy rates [14]. In the United Kingdom, no evidence was found that the EPC rating had any effect on market rent or market value [15].

5. Barriers and Solutions

Finally, barriers exist for innovations in finance structures. They and their potential solutions are as summarised in Table 1.

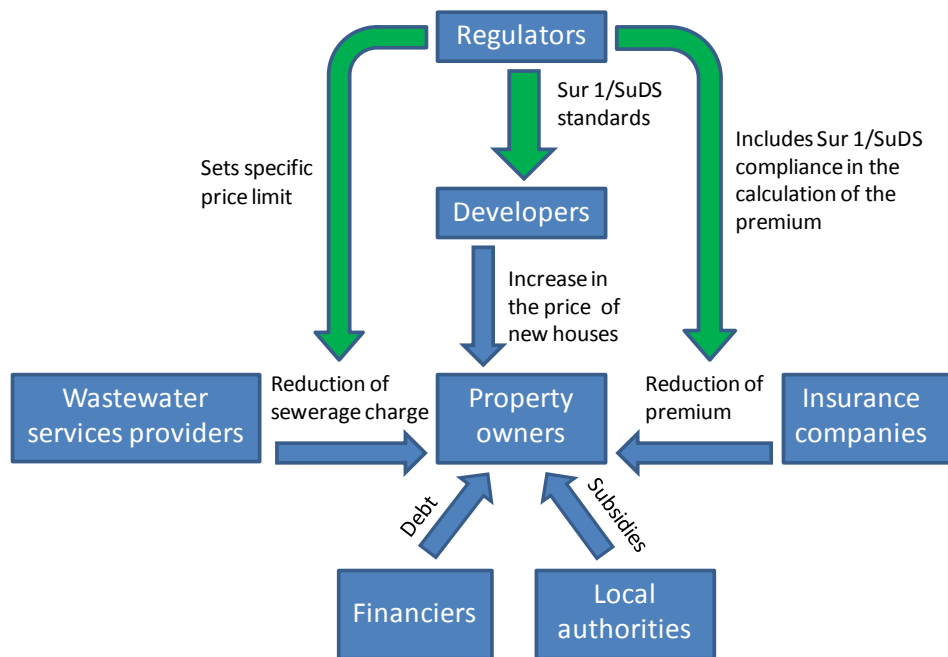


Figure 9. The finance and governance model in which developers and property owners bear the costs of the services provided, and receive incentives from the other actors.

Table 1. The most significant barriers to collective action solutions identified by UK stakeholders, and potential solutions to remove these barriers.

Barriers	Solutions
Low priority of water efficiency measures	Regulatory measures and reinforcement of awareness of the moral obligation of improving water efficiency.
Low awareness and lack of information	Presentation of water efficiency advantages for companies' competitive advantage and improvement of green image. Dissemination of information by the government.
Mistrust from the client	Demand enhancement: 1) Customer-oriented information about costs and benefits 2) Evaluation of future gains 3) Payments related to a contractually agreed level of water-efficiency improvement (performance contracts) 4) Development of a supportive and favourable legislative framework (e.g. model contracts, mandatory audits or water-efficiency certificate)
High perceived technical and business risks	Explanation of how the business model works and examples of success. Development of more tools to cover the risk of guaranteed savings.
Lack of accepted standardised measurement and verification procedures	Capacity-building to create a comfortable and confident market with the creation of standardised contract models, terminology and procedures, and the establishment of an accreditation system.
High transaction costs resulting from administrative barriers	Active public support: establishment of procedure to favour WASCO (adaptation of the legislation); preparation of WASCO model contract.
Lack of appropriate forms of finance	Stimulate the involvement of a third party by improving the knowledge of the WASCO concept and by better explaining its business model. Government support through subsidies, public banks, credit lines opening, and the establishment of appropriate framework conditions that channel private financing to this sector.
Only one-third of domestic properties were metered in England and Wales in 2008 [16]	Installation of a water meter to be included in the regulation to incentivise users to reduce their consumption: water used by metered customers is about 10 per cent less than non-metered customers [17].
Economic downturn	Reinforcement of the public sector role in the initiation of projects.
Lack of incentives for insurance companies to reduce risk premium	Regulatory measure could help insurers consider the contribution to the macro-risk in the risk premium, which is usually based on micro-risk.
Lack of clarity and stability of regulation (future of CSH is uncertain)	Regulators must define clear and stable rules.

An increase in taxes could be a simple way of financing new infrastructure projects. However it is doubtful that taxpayers are prepared to increase their contribution in the current economic context. Full cost pricing—*i.e.* increasing user charges to fulfil new objectives—is an interesting alternative but examples of infrastructure projects fully financed through this mechanism are rare. Moreover, water is not like other goods for sale and must be treated as a special case as its access is essential for life, health and well-being. Third-party financing could provide an additional source of funds such as bank loans, bonds, external equity or grants that brings greater access to finance for projects that benefit actors within a waterbasin.

In addition, financing infrastructure investment through increase in bills on water consumers will draw extensive scrutiny from regulators. Bills for water provision in the UK have risen by 45% in real terms since 1980 and are estimated to rise by a further 27% by 2030 [18]. Water companies are also highly leveraged through borrowing in the capital market which adds risk to the companies [18].

To determine what the drivers of the different stakeholders are, one must be as specific as possible regarding the costs and the benefits of the financed infrastructure. This will require the collection of more data on specific project categories in order to forecast the expected gains and costs for each financing scheme. Such an exercise is crucial as it will offer a firm basis for investment decisions.

There is no generic problem and therefore no one-size-fits-all solution. Specific financing schemes have to be developed for each situation. For instance, a local enterprise partnership can be the best solution to coordinate a group of farmers willing to develop infrastructures. However, public intervention may perhaps be required to provide equity or grants when private investment is insufficient. Sometimes—in particular when the business

model is very clearly defined—banks, pension funds and insurance companies may also want to lend or invest.

Any of the financing structures presented here will require a coordination of governance. On the one hand, the willingness of the stakeholders to participate will have to be taken into account and there is clearly a need to facilitate the understanding of each other interests. On the other hand, any financing approach will have to work in concert with regulation, legislation and tax efficient approaches.

Some barriers still make it difficult to implement the different financing schemes, in particular administrative barriers, high-perceived risks, the lack of appropriate forms of finance for some of the Actors, and a lack of clarity and stability of regulation. Amongst the solutions available to transcend these barriers are a wider diffusion of the WASCO (or related) concept, an explanation of the underlying business model to potential investors, the development of better tools to cover the risks involved, and the definition of clear and stable rules by regulators.

6. Conclusions

Over the coming decades, the UK (and other nations) will have to adapt to climate change and a growing population that place increasing strains on water quality and quantity. New water catchment management infrastructure will be required to deal with these new challenges. In this paper, five alternative financing schemes that may allow financing the building of such infrastructure are reviewed. Each is a different means of treating water infrastructure investment as a collective action problem. They are summarised as follows:

We propose five main financing schemes for new water catchment management infrastructures:

1) Financing through taxes: Introduction of new taxes and centralisation of the allocation of new investments in a dedicated agency. This option presents two advantages: i) it makes the various stakeholders contribute to the financing and ii) the centralisation of water-catchment management investments potentially allows for better allocation of new investments to minimise flood risks.

2) Third-party financing: The initial investment is financed by actors benefiting from the new infrastructures, as well as banks and other financial institutions. The Water Services Company (WASCO, or perhaps a municipal variant of this) created by the pool of investors rents the infrastructures to those users benefiting from them. A newly created entity can be funded in various ways, including equity investment, bank loans, corporate bonds or grants.

3) Financing by the stakeholders: Stakeholders (property owners, local authorities, insurance companies, waste-water service companies and developers) invest directly in new infrastructure so as not to be subjected to further taxes and to be able to guide investments towards activities that better serve their interests.

4) Financing through full-cost pricing: This strategy of financing implies that an increase in user fees will finance new infrastructure. It could be a good way of reinforcing the involvement of the private sector in infrastructure investments. However, if higher charges result in a deterioration of quality of life or economic performance, the economic cost may be higher than the cost of financing new infrastructures through taxes.

5) Financing by the developers and/or the landowners: The initial investment is paid by the developers, who expect to recover it by selling the real estate at a higher price. The cost of new infrastructures is thus paid by the landowners, who can finance the investment through savings, loans and subsidies. However, this option assumes that the developers are the price-makers or that the price of houses will be affected (presumably increased) by the building of new infrastructures.

Recent examples found around the world are encouraging. Innovative financing schemes have been developing for energy services for a long time. Recently, more and more examples can be found in the water industry. New taxes were introduced to finance water infrastructure and there are more third-party investors interested in infrastructure investments. Moreover, waterbasin management infrastructure can be very attractive for insurance companies, infrastructure funds of investment banks or pension funds looking for long-term investment with low risks. Therefore, there are growing incentives for the finance and governance models considered here to be explored for collective action solutions.

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