PUBLICFIRST

The Case for Water Smart Housing

RESEARCH PAPER

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1. Executive Summary

This report summarises the results of a landscape piece of research into water smart housing in the UK. Public First ran a representative poll of 4000 adults in the UK, qualitative "immersive" research, and an economic modelling exercise with a focus on understanding the impacts of water smart housing on the growth of the housing stock in the East and Southeast of England, where water scarcity is greatest, over the next five years.

This work was carried out as part of the Ofwat Innovation project, Enabling Water Smart Communities.

The note explains:

- There is a clear economic case for building water smart homes**.** Water scarcity is a blocker on development; both commercial and housing. This research (which focuses only on the cost of scarcity as a blocker on housing) estimates that more water efficient housing development **would deliver £20bn of value to the UK economy over the course of parliament.** The total value when accounting for commercial development will be higher, although it is not within the scope of this project.

- This figure is calculated based on the capacity to deliver more housing stock when housing developments are water smart compared to when they are not. Our modelling suggests that water scarcity is set to **cost the UK economy £25bn over the next five years in undelivered housing**. To put it another way, you can build almost 50,000 more homes in areas with high productivity over the course of this parliament if those homes are water smart compared to if they are not.

- **Relatedly, there is a strong political case for the building of water smart homes.** The Labour government has committed to building 1.5 million homes over the course of this parliament, and the new method for calculating the number of homes that each local authority needs to plan for has increased by approximately 65,000 per year (370,000 compared to 305,000). **Our analysis suggests 12,300 of the additional homes that local authorities need to plan for will be undeliverable this parliament due to water scarcity, a total of 61,600 over five years.**

- The new method for calculating housing needs results in the local authorities in the Southeast and East of England being collectively asked to plan for and release land for 31,300 more homes per year, not accounting for those Local Authorities with lower housing needs in London for example. **We can therefore say that 12,300 or 39% of Labour's additional homes (implied by the new housing calculation) in these areas are undeliverable due to water scarcity each year.**

- Through planning reform, this Government is determined to clear the way to 1.5 million homes. **Removing the regulatory barriers to water smart homes is a quick win – a practical measure the Government can take to help it meet its target and demonstrate ambition in this area.**

- Importantly, the cost is not spread evenly across the UK; it **is most pronounced in the Southeast, where productivity is highest in England and the value of new housing is greatest.** Our analysis demonstrates that the most affected geographic areas are **those where the housebuilding pledge is best suited to achieving growth** Many of these areas are sites of strategic importance to the UK economy such as in Cambridge, where limits on housebuilding and commercial development are substantial over this parliament and beyond.

- There are other areas of strategic importance to the economy not covered by this research due to specifics of the method for calculating house need. For example, London, where costs from water scarcity will be felt largely on the commercial development side - but will be substantial.

- It's often argued that there is no public appetite for water smart housing, or more precisely, any form of water recycling. This is why it's crucial to understand what the public really thinks. **Our research demonstrates the public are very willing to use specific types of water recycling in their homes, and will certainly accept more water smart housing in some form**. Still, there are conditions to that support, largely based on what water is recycled and how it is used.

- On an individual level, it is clear the public regards water as a precious resource. **69% of people claim they have taken steps to reduce their daily water consumption**. This is of fundamental importance when thinking about water efficiency and reuse. Very few said they would be unwilling to use recycled water at all, only 11% say they would not use non-treated greywater for any purpose.

- But the type of water reuse matters to people. Rainwater and recycled toilet water represented polar ends of the scale on all questions. **People were highly averse to the concept of recycled toilet water, and very willing to reuse rainwater.** Similarly, what water was being reused for also matters. Proposals to use **recycled water for drinking were controversial,** but proposals to use **recycled water for outdoor taps and for toilet flushing were looked upon favourably.**

- Our polling also demonstrates that **messaging has an impact on public perceptions of water reuse**. Put simply, there are ways to discuss the issue which will garner more support, and messages that should be avoided given the associations of the public. Positively, regardless of messaging, the majority support water recycling in the abstract, and would be willing to use some types of reuse in their home.

- Generally, messages revolving around cost-savings performed better than other messages centering around sustainability, quality assurance, and 'common sense'. **The fact that water reuse *can* save money on bills is most likely to persuade people of the benefits of water reuse**. People recognise the environmental advantages, but they expect and want cost saving benefits.

- Respondents were receptive to the negative arguments about the health risks of water recycling. **An average of 75% of respondents found these statements convincing.**

Given the concerns around potability from the experiments, this is the crucial challenge for water recycling. Phrases like "toilet-to-tap" are doing no favours in winning people over. **Respondents are clear and consistent on two things; that rainwater recycling is desirable, and that toilet water recycling is not so.** Emphasising the right water sources (particularly rainwater) and water uses (particularly toilets, although outdoor taps are also viewed positively), and ruling out the wrong ones would meaningfully change the trust people had in the approach for the better.

- **Public support for water smart housing could be undermined by arguments about negative health implications**. Helpfully, people are not instinctively repulsed by the concept of water recycling, but explaining it in detail appears to shift views to the negative, and health-related negative messages had a substantial impact on interest. This is a key challenge and requires careful consideration, but **could be substantially mitigated by emphasising the need for non-potable water over potable water (in simpler terms).**

- Finally, thinking more broadly about the importance of water smart housing, it's important to note that water-related issues such as drought and water shortages (as well as flooding) are far down on the list of people's concerns for their local areas. But, importantly, the single biggest issue is the availability and affordability of housing. Most people see water scarcity as an issue that will drive up water bills; the vast majority **(87%)** do not see it as an issue that has any impact on the availability of housing.

2. Economic Modelling

The economic modelling aspect of the research comprises three core categories:

- The number of homes that will be undeliverable due to water scarcity, in total and broken down by local authority.
- The economic cost of undelivered housing, in total and broken down by local authority.
- The number of homes that can be built and the economic cost that can be 'recouped' if housing is built to higher water efficiency standards.

These are estimated costs over the remainder of parliament in real terms in 2024 prices. We have not considered the economic cost of stifled commercial development as part of this project, and acknowledge that our estimates will not take full account of the cost of water scarcity for this reason.

Methodology

Our modelling first estimates the economic cost of water scarcity through its prevention of home building over the next five years before estimating how much of this can be recouped by introducing water smart home building.

To evaluate the extent to which water scarcity acts as a constraint on house building within local authorities we draw on the Water Resource Management Plans (WRMPs) developed by water companies every five years. Extensive water supply and demand modelling carried out as part of the WRMP process feeds into a plan to ensure water supply will meet demand over the relevant period (and beyond). Where supply is stretched, WRMPs will specify a range of investments to ensure supply can meet demand, for example additional water abstraction or leakage reduction measures. With the latest WRMPs for 2024 published or about to be published, this modelling is now set for the next five years. This means that Water Resource Zones (WRZs) where there is no supply surplus above the target headroom have no capacity to accommodate housing *above that which was assumed in the WRMPs.*

Recently, the Government announced a proposed new methodology for calculating local authority housing needs. This new method *increases housing needs and, by association, housing targets for many local authorities across the country.* However, the house building assumptions that feed into the WRMP modelling are sourced from housing targets contained in local plans or regional spatial strategies, targets largely derived from the previous housing need methodology. As such, increases in house building may not be possible where water scarcity is a constraint. We provide further explanation of this in **Appendix A.**

Our modelling identifies which local authorities will be unable to increase their housing targets due to insufficient water supply outlined in WRMPs; estimates the number of houses that will be affected, and the economic cost of not building them; and finally estimates the economic value of introducing more water efficient home building that allows us to recoup some of this housing loss. It should be noted that building residential development is complex and that water availability is only one part of the decision making process that developers and local authorities go through. As such there is some uncertainty in our modelling, particularly at a granular level

when looking at a particular local authority. We therefore suggest focussing on the aggregate economic impacts, viewing them as an overall estimate of the negative effect of water scarcity.

Identifying places where water scarcity is a constraint to building

We first identify areas of the country in which there is no surplus water available for additional housing. To do this we interrogated the Water Resource Management Plans (WRMPs) from 2024 of nine companies that operate in the Southeast and East of England and categorised all the Water Resource Zones (WRZs), the geographic areas designated for the management of water resources. **We focussed on parts of the country where both water scarcity is most problematic and new housing targets are higher than previous ones**. Where possible we accessed the supply-demand modelling tables that accompany the WRMPs to identify WRZs in which there is no spare surplus over the next five years above the target headroom, the additional surplus all WRZs must allow for natural variation in demand. For both Cambridge Water and Essex and Suffolk Water, neither a final WRMP 2024 was available nor were the data tables available. As such we looked for evidence within the draft plans and at the Regional Water Resources Plan for the East of England[1].

Estimating the impact on housebuilding due to water scarcity

We next estimate, for each local authority, the number of additional homes that would be prevented from being built due to water scarcity, according to the new calculation of housing need. To do this we first estimated the percentage of land within each local authority boundary that was in a WRZ designated as having no spare surplus (this was done by finding the spatial intersection of the GIS shapefiles of WRZs and Local Authority boundaries). For each local authority in which housing need estimates have been increased we apply this percentage to the additional housing to estimate the number of these additional homes that cannot be built due to water scarcity[2].

It's important to note that we are not suggesting these houses will not be built at all - rather their construction will be delayed beyond the five year period, as the issues to do with water supply are resolved. It's worth also noting that these additional supply pressures will ultimately add to the risk of drought and water shortage in these areas, which, in turn, will have a knock-on effect on the economy as outlined in **Appendix B.**

Estimating the economic cost of the limit on house building as a consequence of water scarcity

We next take the number of homes that cannot be built as a consequence of water scarcity and estimate the economic cost of not building them. This includes a measure of land value uplift (LVU), construction impacts and agglomeration effects.

Estimating the number of homes that could be built were water smart technologies to be implemented

Next, we take the estimate of the number of homes that can't be built due to water scarcity

[1] Regional Water Resources Plan for Eastern England
[2] Mapped: Housing targets for each council under proposed method | Local Government Chronicle (LGC)

(described above) and estimate the number of these homes that could in fact be built were ***all*** new homes in the local authority built 30% more water efficient[3] - assuming a baseline of 110 lppd, a standard assumption of water use.

Our calculations rest on the simple assumption that if each house is more water efficient, more homes can be built. Specifically, in areas where there is no extra capacity, building each new home to a standard of 30% greater efficiency allows 43% more homes to be built without increasing water demand. This means if the housing need has increased by 43% or less, the additional housing can be delivered (other barriers to construction permitting). If, on the other hand, the housing need has increased by 86%, only half of the additional homes can be built. We estimated for each local authority the number of homes that can be 'recouped' by using water efficiency measures and aggregated to find the total for the area assessed.

Estimating the economic value of building homes that are more water efficient

Once the number of 'recouped' homes has been determined, we calculate the economic value of building these homes through three drivers of economic value:

- **Land Value Uplift (LVU):** For each local authority, we estimate the total LVU associated with this housing. LVU estimates the additional value of the economic activity that takes place as a result of land use change, in this case from brown- or greenfield use to residential. The economic value of residential properties derives from the fact that without homes workers would have nowhere to live and wouldn't be able to contribute to the local economy via productive workers. In this way converting land from brownfield to residential creates economic value. To calculate LVU we applied the appropriate LVU estimates from estimates made by the Valuations Office Agency (VOA)[4]. We then aggregated up across all local authorities. We adjusted for inflation and modelled the cost over the next five years.
- **Construction Value:** We take the total number of homes and apply an average cost of construction of housing evidenced from a variety of sources. We carried out input output modeling on UK input output tables to estimate the Gross Value Added (GVA) type two multipliers, and applied them to the total construction spend. GVA type two multipliers are applied to construction costs to estimate the total additional direct, indirect and induced economic activity that results from this construction spending[5].
- **Agglomeration:** We estimate the increase in economic density of the additional housing that is at risk by finding this quantity as a percentage of total housing stock in each local authority[6]. We then apply a productivity elasticity density of 0.046, a commonly used

[3] We have used a variety of sources to estimate the impact that water efficiency measures such as water re-use can have on the amount of water used per home. We believe 30% is a reasonable estimate, although we have also included an estimate for the benefits accrued at 20% higher efficiency.
[4] Land value estimates for policy appraisal 2019 - GOV.UK
[5] UK input-output analytical tables: product by product - Office for National Statistics
[6] Dwelling stock (including vacants) - GOV.UK

estimate of this effect to reach the total impact on productivity[7]. Finally we apply this to the GVA of each local authority, data provided by the ONS.[8]

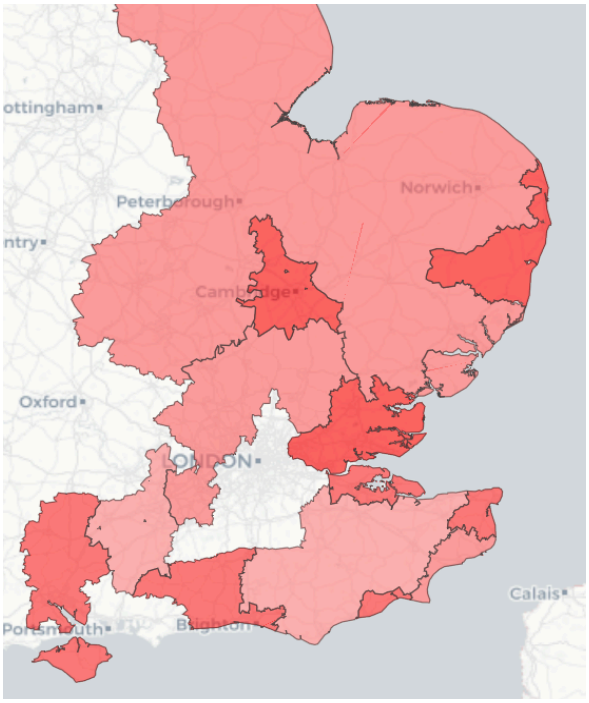
A note on the economic research

Of course, many other barriers to housing exist that will put downward pressure on development and limit the degree to which the Government can meet its targets. But this research is not focused on the impact of these barriers – which would be a topic for a separate paper. Here, **we try to abstract from these issues and look at the underlying impacts of water scarcity on housing.** This is an analytical device and in no way tries to discount the impact of other barriers in planning and the economy more widely which will jeopardise the Government's efforts to hit their house building targets.

Further to this, we have focussed on the economic impact of water scarcity through its ability to block housing development. There are of course many other channels through which water scarcity can impact the economy, such as blocking infrastructure and commercial development, and hindering agricultural output. It is expected that the impact through commercial development could be significant.

Findings

The Labour government has committed to building 1.5m homes over the course of this parliament. The new estimates of housing need are over and above the previous calculations by approximately 65,000 per year. Within this, the number of homes to be planned for in London has decreased from 99K to 87K. **We focussed on parts of the country where both water scarcity is most problematic and new housing targets are higher than previous ones.** As such, our impact estimations consist of areas within the boundaries of seven water companies:



- Affinity Water
- Anglian Water
- South East Water
- Southern Water
- Cambridge Water
- Essex and Suffolk Water
- Portsmouth Water

[7] Quantifying Wider Economic Impacts of Agglomeration for Transport Appraisal: Existing Evidence and Future Directions" by Daniel J. Graham and Stephen Gibbons

[8] Regional gross value added (balanced) by industry: local authorities by ITL1 region - Office for National Statistics

The areas **not** marked in red in this map were not included in our estimation since they did not see increases in targets for housing over and above previous government targets, and so have been factored into 2024 WRMPs. These areas include Thames Water and Sutton and East Surrey Water (SES).

Total Economic Cost

We estimate that the cost of unbuilt housing due to water scarcity will be **£25bn to the UK economy over the course of parliament due to 61,600 homes not being built.** The total value when accounting for commercial development will be higher, although it is not within the scope of this project. This figure is calculated based on the economic value of housebuilding within different geographical areas.

As Figure 1 below demonstrates, GVA through construction spending is the largest economic cost at **£18.3bn over five years**, partly driven by significant cost inflation in recent years. Land value uplift is less significant due to lower land values in some of the areas where water scarcity is at its worst and where additional housing is greatest, although still reaches **£6.3bn** over five years. Agglomeration effects over five years subsequently **total £344m.**

Figure 1

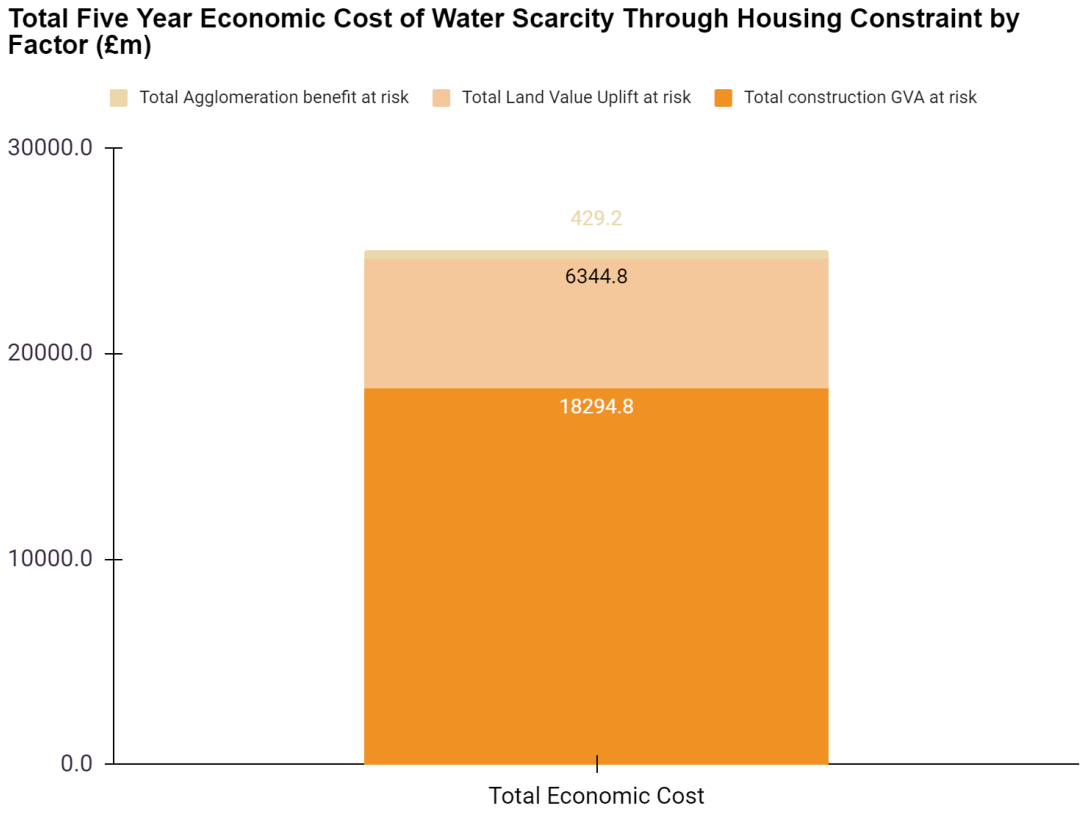
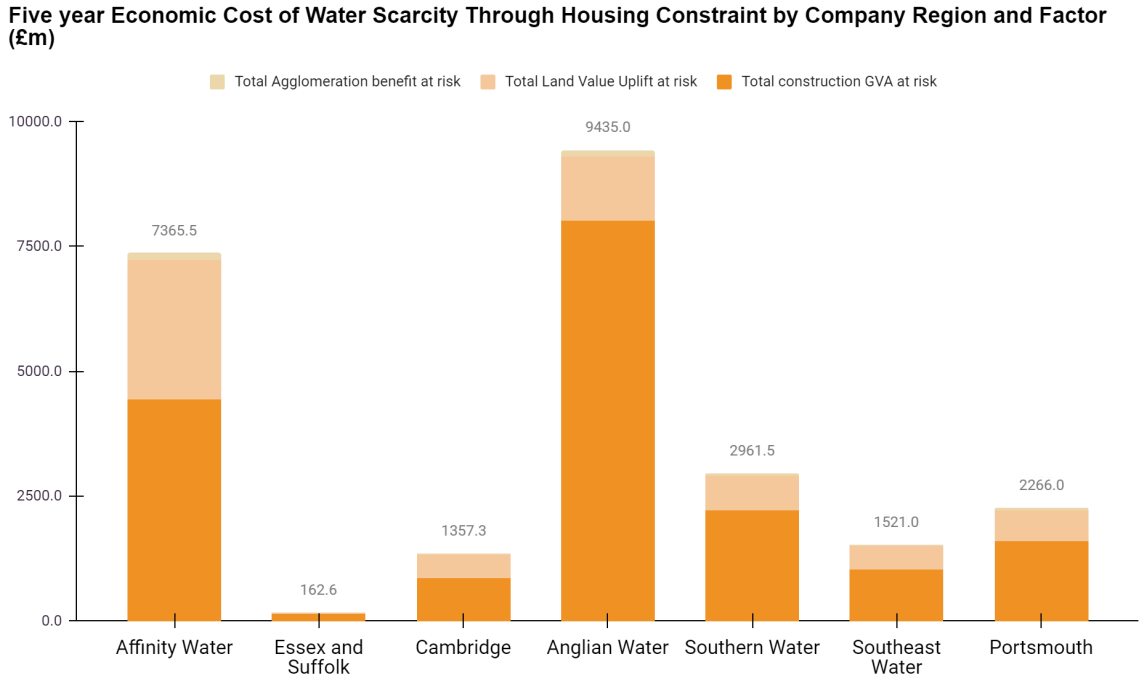


Figure 2 shows that the economic cost varies by company. The area within Anglian Water has

the **highest economic cost at £9.4bn per year due to higher water scarcity** and its larger land area. Affinity also experiences a high cost at nearly **£7.4bn** per year due to the higher land values within its geographic area.

Figure 2



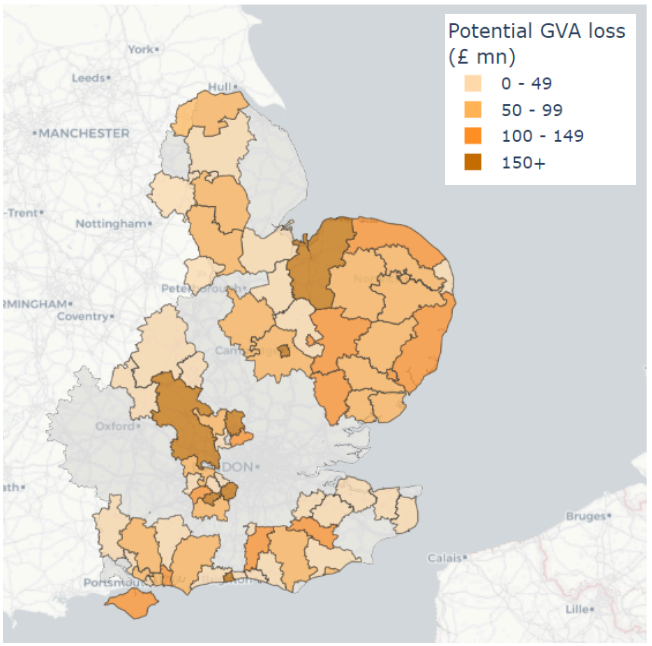
We calculated the cost of undelivered housing to each local authority, this calculation has been conducted based on the yearly cost, which can be extrapolated over the course of parliament. This is because longer-term projections are less reliable on a smaller scale and will be more accurate on the basis of costs per year. The ten local authorities facing greatest costs are outlined in the table below.

Table 1: Highest economic cost per LA (yearly)

Local Authority	Cost (£m per year)	Local Authority	Cost (£m per year)
St Albans	354.8	**Elmbridge**	170.3
Worthing	187.9	**King's Lynn and West Norfolk**	151.8
Cambridge	182.9	**North Norfolk**	133.7
Buckinghamshire	182.3	**Isle of Wight**	133.7
Woking	178.3	**West Suffolk**	115.9

St. Albans, Worthing and Cambridge represent the areas with greatest economic value lost per year over the course of parliament due to undelivered housing.

Although we carried out this analysis only in the East and Southeast of England, it is this part of the country that suffers the most from water scarcity and as such we expect this to be the most significant contributor to the economic cost through its constraints on house building over this parliament.



The economic impact of housing constraint in this part of the country is exacerbated by the fact that these geographies contain some of the areas with the highest productivity in the UK. A lack of housing delivery in areas such as these will act as a drag on economic growth by constraining access to the labour that is vital to the health of high productivity sectors.

Further still, many of these areas are places of strategic importance to the UK economy such as in Cambridge, where limits on housebuilding and commercial development are substantial over this parliament and beyond, and the economic case for building more efficiently is substantial.

Our research has not looked at the many additional costs resulting from limitations on commercial development, which in these areas specifically, as well as in London, will be substantial.

Total Housing Numbers

The costs outlined in the modelling are determined via an assessment of the number of houses that will not be built. Our models suggest that, across all local authorities tested, the total number of houses that will not be built each year reaches **12,300. Over the course of parliament this** reaches **61,600.**

The new method for calculating housing needs results in the local authorities in the Southeast and East of England being collectively asked to plan for and release land for 31,300 more homes per year, not accounting for those LAs with lower housing needs in London for example. **We can therefore say that - 12,300 or 39% of the additional homes implied by Labour's new housing calculation in these areas are undeliverable due to water scarcity each year.**

Table 2 below provides a summary of which local authorities lose the most houses to water scarcity as a proportion of their yearly need.

Table 2: Houses lost by local authority as a proportion of need (yearly)

Local Authority	Houses missed per year (% of need)	Local Authority	Houses missed per year (% of need)
Worthing	51%	Cambridge	36%
Woking	45%	Isle of Wight	35%
King's Lynn and West Norfolk	44%	Surrey Heath	34%
North Norfolk	38%	Havant	30%
Ipswich	38%	West Suffolk	28%

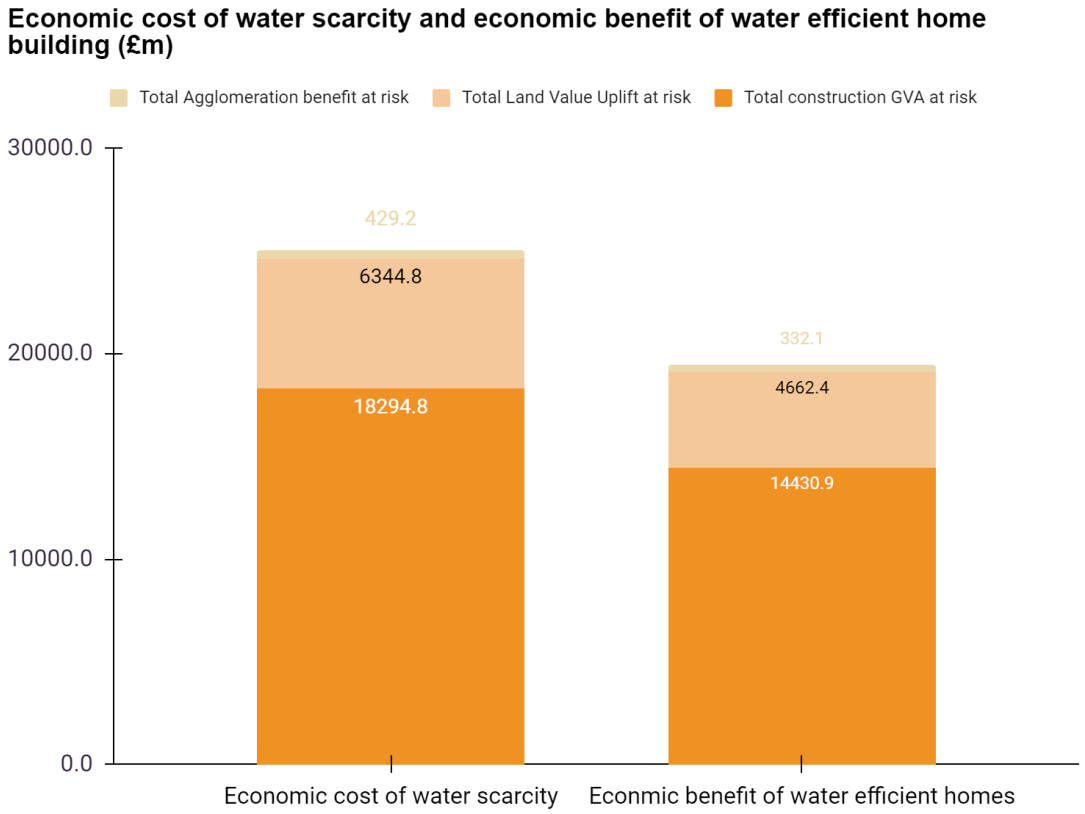
Total economic benefit of water efficient homes

We also sought to calculate the benefit of water smart housing to the economy, relative to the cost outlined above.

We used a 30% water efficiency improvement benchmark as a way of calculating how much of the economic cost can be 'recouped' by building new housing to water smart standards. We took this to be a reasonable estimate of the impacts of water smart housing on water use, although we also calculated the economic benefits of a reduced 20% water efficiency improvement.

As Figure 3 shows, below, **the total economic benefit that can be recovered equates to £20bn**. This represents 77% of the economic cost over the next five years, a significant proportion. This economic benefit is captured by ensuring that **49,000 of the 61,600 'lost' homes can be built.** In local authorities where the increase in housing need is less than 43%, an improvement in water efficiency of 30% ensures all of these homes can be built. Where the increase is greater than 43% there are still homes that are 'lost' to water scarcity.

Figure 3



Sensitivity testing

As outlined above, we also ran the analysis assuming new homes are built with 20% more efficient water use. Our modelling suggests that **the economic benefit of only building all new homes with 20% more water efficiency would be £13.5bn**.

Analysis

In the context of the Government's ambitious house building target of 1.5m over the course of parliament, **our findings demonstrate a strong political case for the building of water smart homes.**

Our analysis suggests **61,600 of Labour's 1.5 million homes will be undeliverable due to water scarcity this parliament.** More specifically, the new method for calculating housing

needs results in the local authorities in the Southeast and East of England being collectively asked to plan for and release land for 31,300 more homes per year, not accounting for those Local Authorities with lower housing needs in London for example. **We can therefore say that 12,300 or 39% of the additional homes implied by Labour's new housing calculation in these areas are undeliverable due to water scarcity each year of the coming parliament.**

Removing the regulatory barriers to water smart homes represents a quick practical measure the Government can take to help meet its target and demonstrate ambition.

Similarly, a cost of £25bn to the economy over the course of this parliament *is incompatible with the Government's economic growth mission*. This is especially true when **the cost is most pronounced in the Southeast, where productivity is highest in England and the value of new housing is greatest.**

Subsequently, our analysis demonstrates that water smart housing can 'recoup' £20bn of that value in these areas of high productivity - which by definition - are **those where the housebuilding pledge is best suited to support the Labour Government meet its mission for growth**. Many of these areas are sites of strategic importance to the UK economy such as Cambridge, where pressure on housebuilding and commercial development are substantial over this parliament and beyond.

3. Attitudes to water shortages and water reuse

Public First also conducted an anonymous, online survey of 4,000 UK residents from 25th Oct - 6th Nov 2024. The poll tested a number of issues including **attitudes towards water shortages, attitudes towards greywater and awareness and concerns over water reuse.** The poll also included a number of demographic and habit questions, such as: age, region, gender, income, religion, typical water use (bathing method, garden usage etc.), working location (in office, home), possession of smart appliances and so on. Finally, the poll involved a number of 'experimental designs' elaborated on later in this chapter.

The large sample size allowed us to assess attitudes according to social and demographic differences with a high degree of confidence. It can be considered the most comprehensive poll on this issue in recent times.

Alongside the quantitative polling, Public First undertook an 'immersive research' exercise around the same period, in Colchester – a location chosen due to its characteristics as a seat facing water scarcity, whilst also being a Labour-held seat with the prospect of switching back to Conservative in the future.

The immersive research we conducted is different from traditional focus group research. Immersive research involves spending multiple days in a single location, meeting voters in the places where they live, work and socialise – while taking care to ensure that the sample of interviewees is demographically representative. This enables researchers not just to speak to many more people than they would in a focus group but, most importantly, to have natural conversations which encourage greater candour. Immersives also allow researchers to speak to people who would never attend a focus group or fill in a polling questionnaire, and to thereby gather more representative insights.

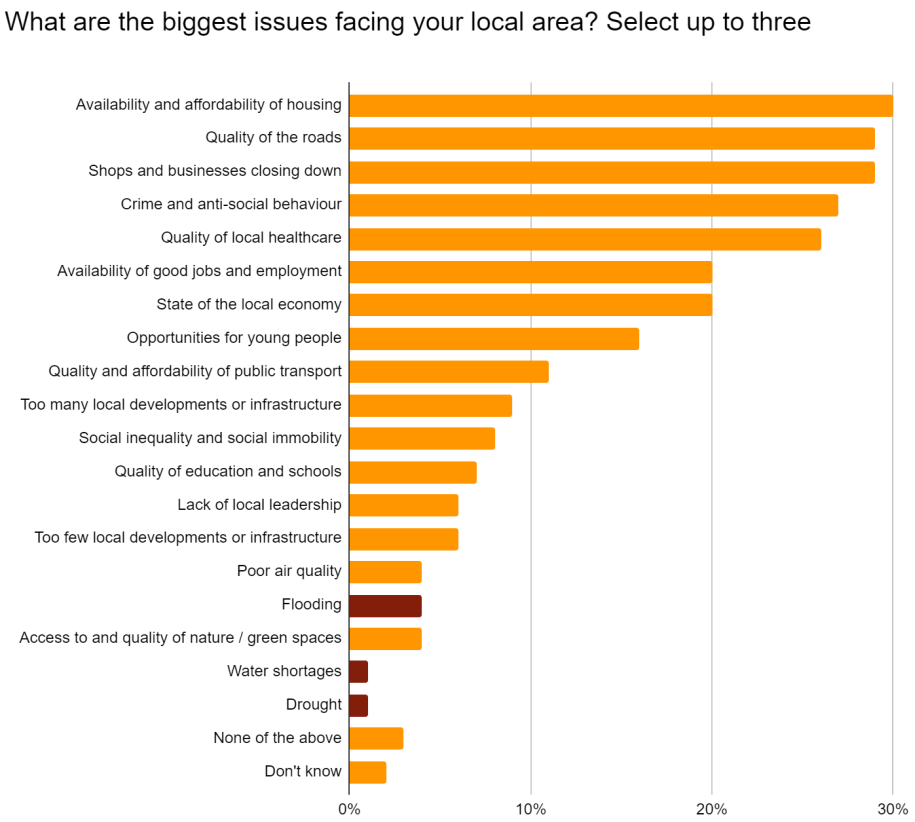
What did we find?

It's helpful to start with an outline of baseline attitudes to these issues to get a sense of where the public stand at present - before going on to consider their attitudes on the specifics, and how those attitudes change when presented with new information.

Firstly, the public do not see issues related to water - we tested drought, water shortages, and flooding - to be high order priorities either nationally or in their local areas. At the national level, concerns about the climate are lower than the economy, the NHS, and immigration. They are roughly level with crime.

At the local level, as Figure 3 shows, people's top concern is housing, followed by crime, infrastructure and the economy. Flooding, water shortages and drought are among the lowest concerns. Although there are notable regional differences. For example, in London air quality is clearly ahead of flooding (12% to 2%), whereas in East of England, this is reversed (2% to 9%).

Figure 3



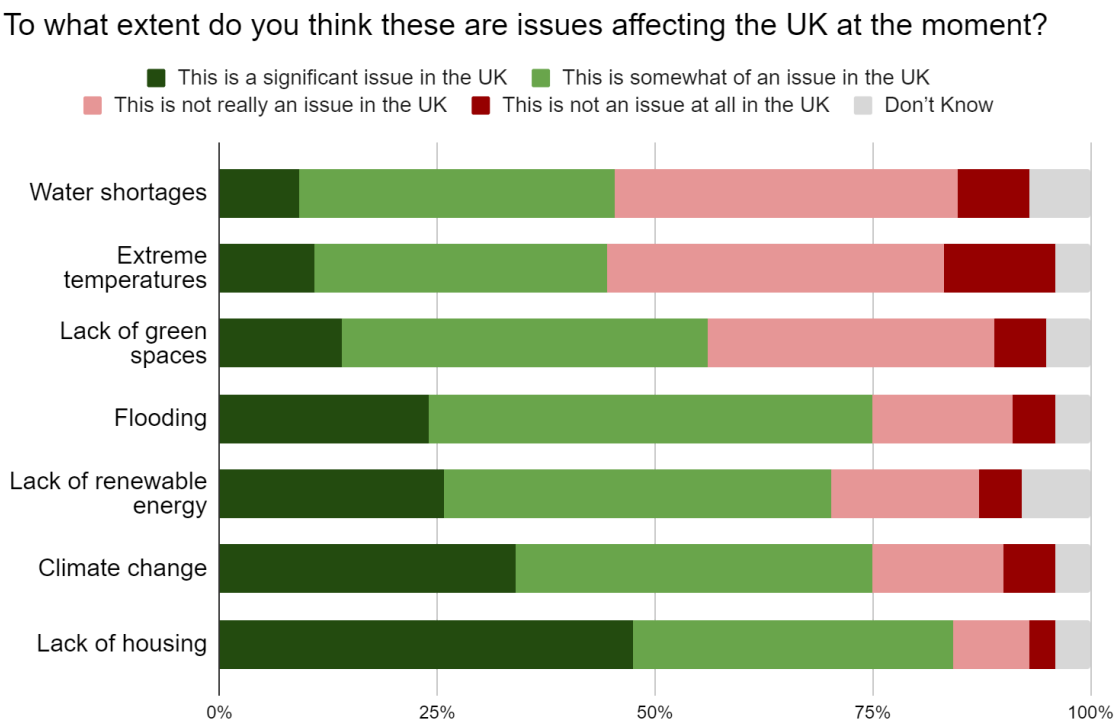
Importantly, the top concern for people in their local area relates to the 'availability and affordability of housing'. This issue was echoed in our qualitative research. Even in an area of water scarcity like Colchester, very few people had even heard of difficulties with water supply. Instead, housing - and the lack of it - was a far larger priority.

> *"I feel as though one of our main struggles and one of our main frustrations is the fact that there isn't housing. There's also not enough GP spaces, there's not enough school places, things like that."* Woman 35-44

Whilst people believed a lack of housing to be a serious issue, many thought there was a lack of infrastructure to go alongside new housing that was being built. However, people did not consider the growth in housing stock to have any impact on water supply - or at least it was not something they thought about.

When asked directly about the importance of some of these issues to the UK, a majority believed them to be serious. Although, once again, it was a lack of housing that was seen as the most severe problem in the country rather than specific water-related issues. This is shown in Figure 4 below.

Figure 4



Whilst 45% of the public believe that water shortages are a significant or somewhat of an issue for the country, 85% see the lack of housing as an issue. Flooding is seen as slightly more important than water shortages at 75% of respondents, which is in line with climate change generally.

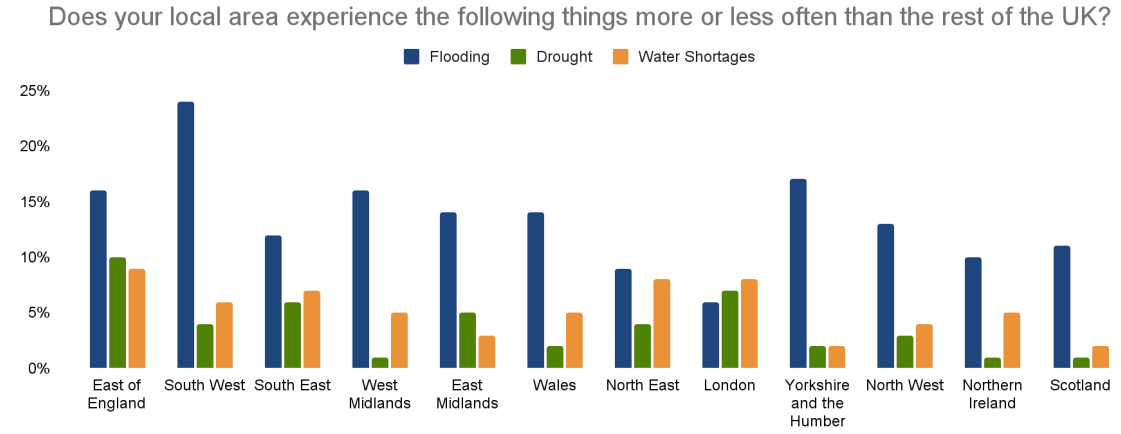
There are some regional trends, with those who say they live in areas that experience flooding more frequently being more concerned **(90%)** than those who say they live in less frequently flooded areas **(72%)**. Still, when asked about the likelihood of these issues to get worse, a majority (**56%)** of respondents believed that shortages would become more frequent in future.

One of the most eye-catching demonstrations of the limited awareness of some of these issues is that the vast majority of respondents consistently underestimate the likelihood of their areas being affected by them. As Figure 5 shows below, only 12% of the population thought that they received above average amounts of flooding in their local area, 5% for water shortages, and 4% for drought, with limited small regional differences on drought and water shortage.

> *"Nothing like [water shortages] at the moment. No droughts this summer, it was raining all day long."* Man, 35-44

Meanwhile, flooding was felt more by respondents in the South West **(24%)**, and Yorkshire **(17%)**, than elsewhere in the UK, as well as by people who say that they live in rural areas **(21%).**

Figure 5



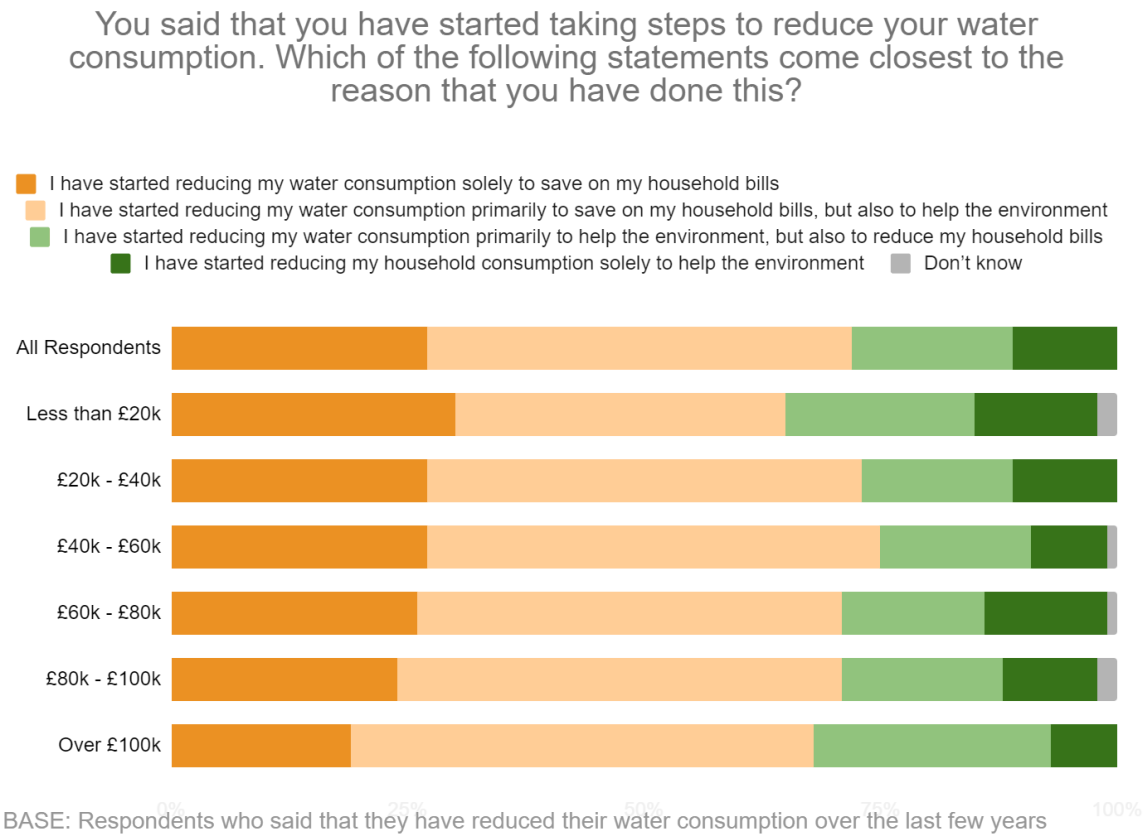
These baseline findings tell a clear story; people do not think often about water issues, and they do not see them as having a real impact or material effect on their lives or the country at large, especially when compared with other first order priorities. This is not to say that they don't see them as important. When asked directly, the public do consider them to pose problems for the country, and a majority expect them to get worse, but they are frankly not worrying about these things on a day to day basis, even when they are more likely to have experienced flooding or drought firsthand.

This is not necessarily a good or bad thing. It simply gives us an indication of where the public are on this. For example, as we expand on below, the majority of people believe they conserve water - we now know that this behaviour is not being driven by a concern about water shortages in the local area. The findings also indicate which consequences of water scarcity will be most important to the public and so on - bills and housing - which we'll get to later.

Attitudes to water use

Conserving water is consistent across income brackets. **69%** of people in our sample say they have taken steps to reduce their consumption. Whilst this figure can be taken with a slight pinch of salt (people may claim to be conserving water even if they are taking only minimal action to do so), it is significant that so many people report to be engaged in this behaviour. Figure 6 shows that most people who conserve water on a day-to-day basis say they do so on the basis of cost as opposed to for environmental reasons.

Figure 6

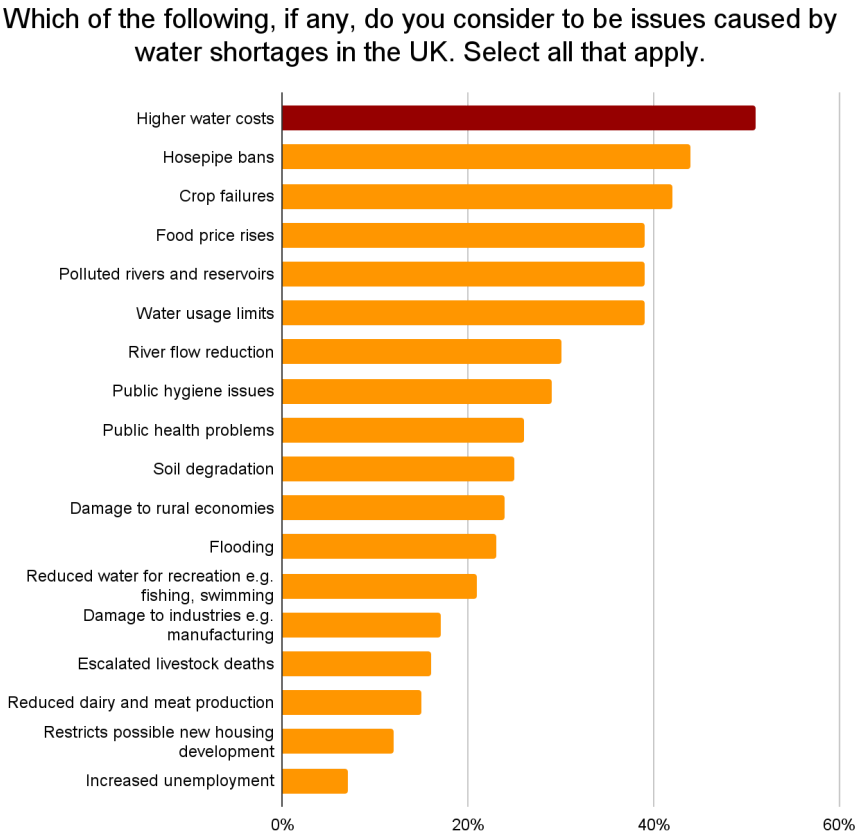


The fact that this reasoning is consistent across all income brackets suggests that, although cost is at the forefront of people's minds, it is a behaviour that is fairly independent of disposable income. In other words, conserving water is to a large extent ingrained in a wide cross-section of society. This shone through in our qualitative research time and again. Most people view water conservation in the home as 'the right thing to do', rationalised on the basis of a combination of cost and common sense.

> *"Water shortage? I don't know of any but I mean, it's just economical, isn't it? Saves a lot of money and it just makes sense really." Woman, 18-24*

When asked to consider what the negative impacts of water scarcity could be, it was clear that most people believed higher water bills to be the most frequent issue. For older respondents, cost came level with hosepipe bans, crop failures, and more polluted rivers. However for younger people, who tend to be more cost concerned on a range of issues, it was clearly ahead of other concerns.

Figure 7



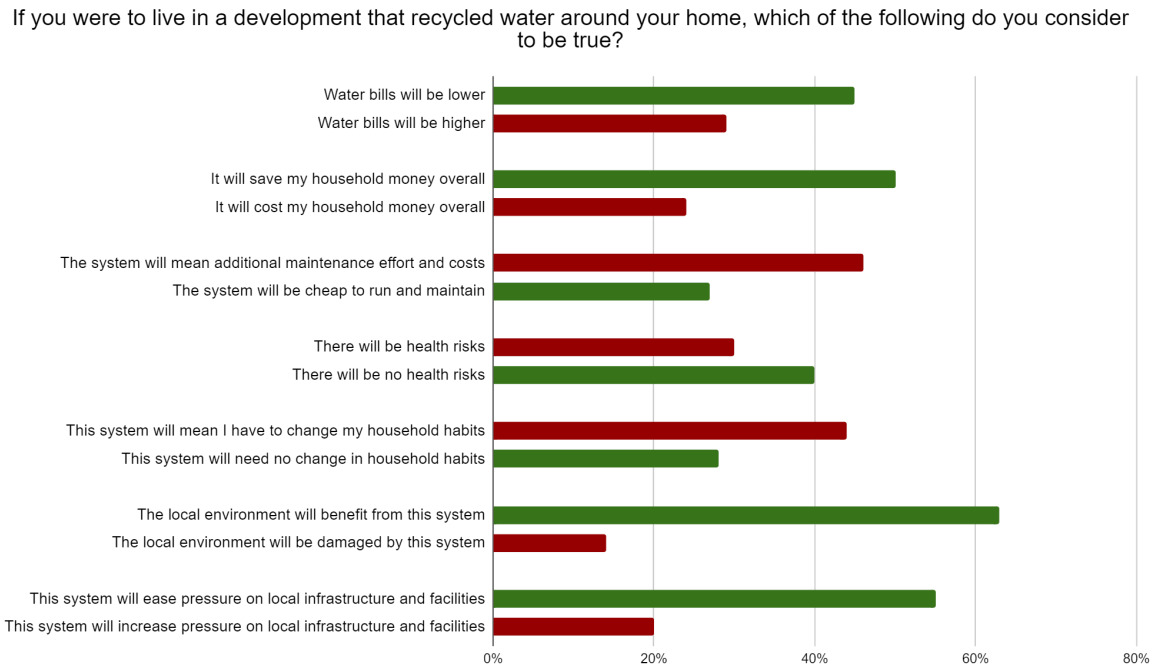
Restricting possible new housing development was low down the list. Again, this finding was supported by our immersive research where people understood that housing put a strain on infrastructure but did not consider water supply to be included in that.

Attitudes to water reuse

We introduced water reuse concepts to the sample slowly in order to track how opinions developed as the sample were introduced to more information. This allows us to understand how people may react to different arguments in the real world, if and when the public debate on water reuse becomes more prominent over time.

Firstly, consistent with the finding that the public consider water shortages to be primarily an issue of cost, when presented with the concept of water recycling in the abstract, most people assume it to be a cost-saving measure. As seen in figure 8, additional maintenance costs were anticipated, but on the whole people expect 'recycled water' to save their household money overall.

Figure 8



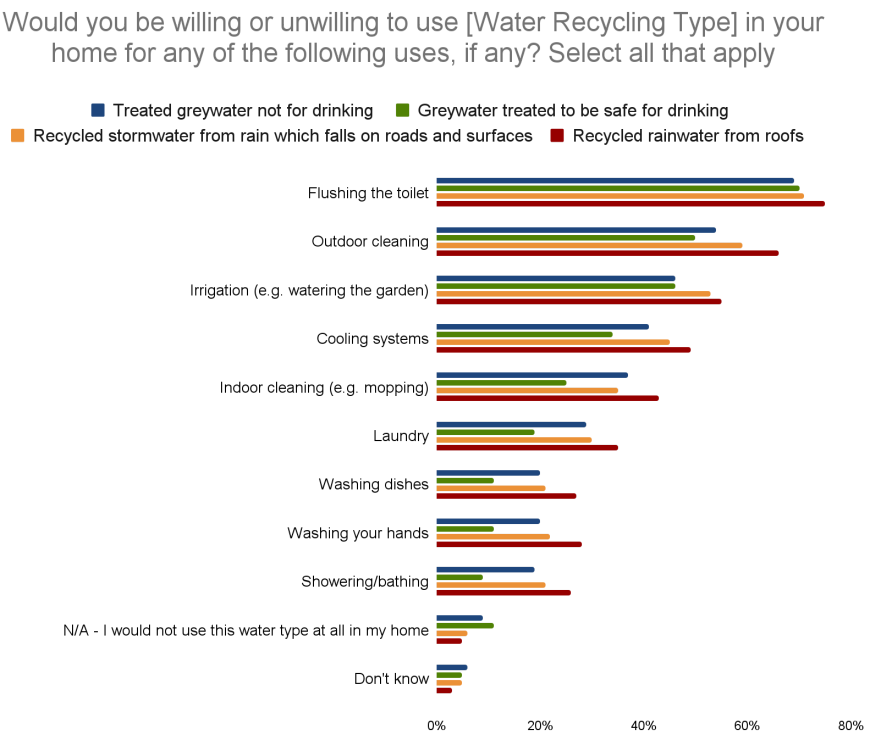
When asked directly, the public were open to water recycling. **Very few respondents said they would not be willing to use recycled water at all** (11% for non-treated greywater, 9% for treated greywater, 6% for recycled stormwater, and 5% for recycled rainwater from the roof). Only a third of the UK think that the concept of recycling water is 'disgusting', and 63% actively disagree that it is.

> *"We've got three or four of those water butts and we try and save as much of that as we can for our gardening. And when we have a bath, we save the bath water to flush the toilet and the washing up we try and use for plants. For the economy I suppose, lower bills… it's what you use, isn't it?"* - Woman, 65+

Following on from this, we tested the public's preferences for water recycling by specific technology type. We found that the public were consistently more willing to use recycled water for toilet flushing and outdoor tasks (cleaning and irrigation) than for other uses. This was true of greywater[9] (both treated for drinking or not) as well as other forms of recycled water, as shown in Figure 9, below:

[9] Respondents were given the following explanation for greywater: *"greywater (or gray water) refers to wastewater generated from everyday household activities such as bathing and showering, handwashing and sinks, laundry, and dishwashing. It does not include wastewater from the toilet."*

Figure 9



Conjoint Experiments: Testing public attitudes towards water reuse

To test the public's willingness to use a wider range of water recycling types and uses in more depth, we conducted two 'conjoint' experiments designed to test how water recycling type, location, water use, and treatment (when randomised in a statement) affect the public's attitudes. These experiments allow us to control for other variables and identify the impact of individual changes on public support for specific elements of water recycling systems.

We first presented respondents with a water recycling scheme, detailing the source of the water (e.g. rainwater, sink water), the scope of the recycling scheme (e.g. single household, estate level) and the intended use of the recycled water (e.g. drinking water, shower and bathing). The recycling scheme was described in little detail, providing just the core experimental information, with no reference to e.g. the decision making process around the scheme, the costs of water under the scheme, the treatment approach to the water. This highly top-level approach means we can focus specifically on how people respond to the core information.

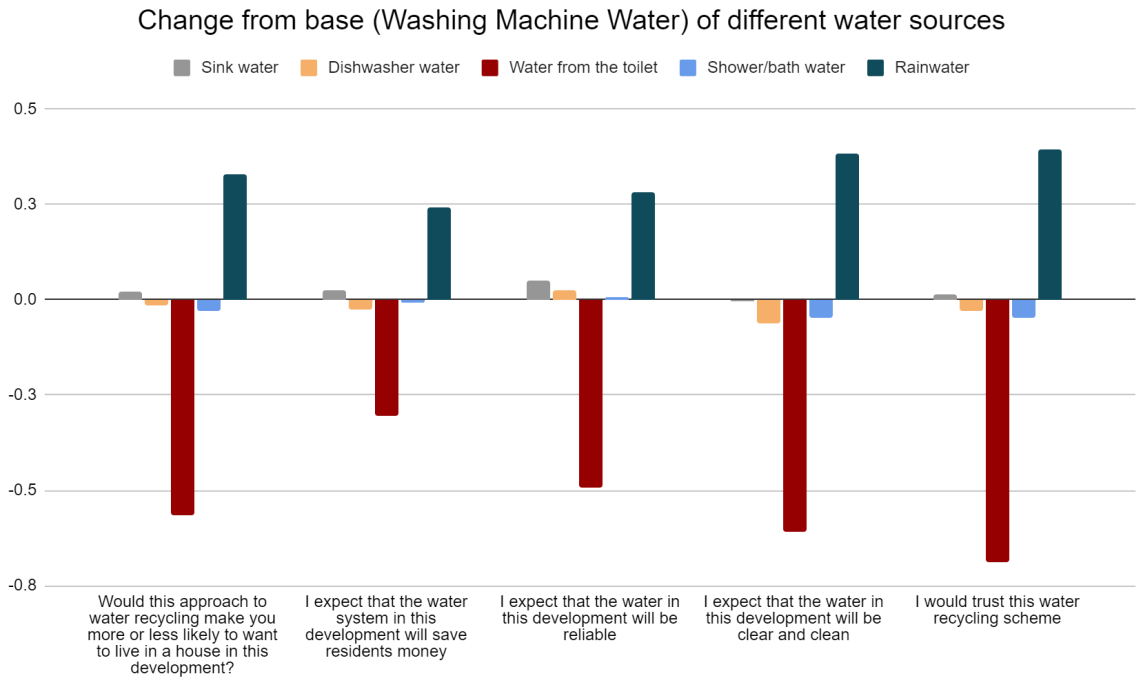
We found that when comparing the impact of different water sources (rainwater, dishwasher water, washing machine water, sink water, shower/bath water, or water from the toilet), **rainwater and recycled toilet water represented the polar ends of the scale on all questions.**[10]

[10] Schemes which described rainwater recycling would consistently score over 0.3 points higher on the 1-5 point scales which participants evaluated them on. In all instances the mean scores for rainwater were significantly higher than other sources (*p<0.0001, T-test*).

Even when it came to seemingly more neutral questions, such as the expectations for how much money each recycling type saves, respondents indicated that the toilet water would be less likely to save money, probably indicating the level of aversion to the concept more than anything else.

Figure 10 shows the consistency of these sentiments. 0 is the baseline sentiment which correlates to recycled water from a washing machine.

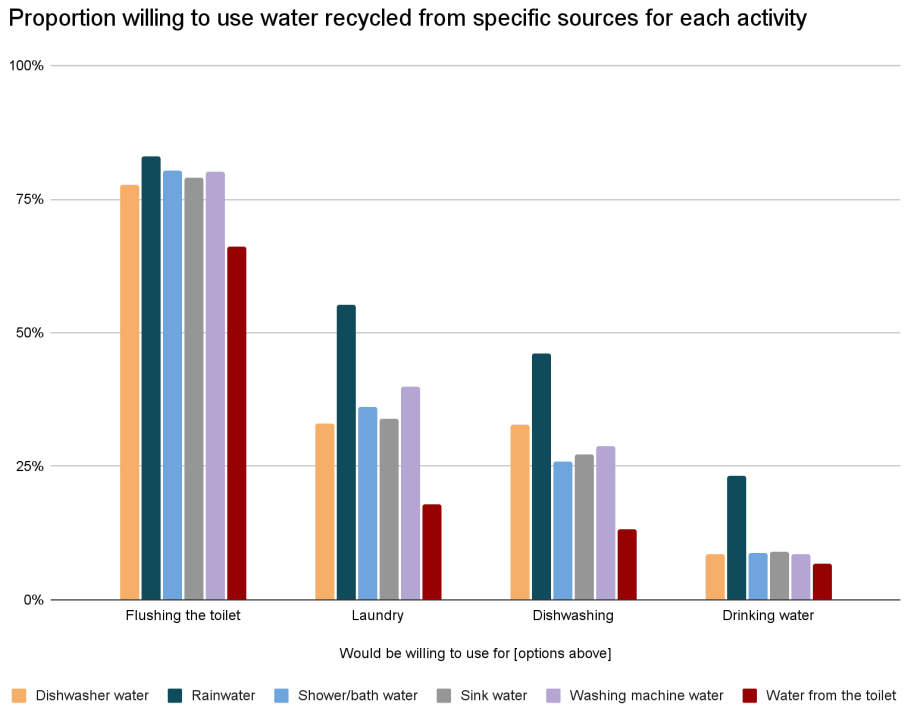
Figure 10



As Figure 11 below demonstrates, rainwater as a *source* made a clear difference to the use cases participants were willing to accept, especially when it came to dishwashing, laundry, and drinking water, where rainwater performed significantly better than other water recycling types.[11]

[11] In this experiment, participants were told only the source of the recycled water, and given some information about the storage and treatment process. In this instance, rather than evaluating the scheme along a series of measures like trust, they were asked to identify the activities they would be comfortable using the water recycled in the way described for. Again, the information provided to them was deliberately light; they saw only the source, the scope of the scheme, and the information about storage and treatment (e.g. “stored and treated in the home”, “treated and merged with the standard water supply”).

Figure 11



When asked to consider what recycled water is used for, **over 75% would be willing to use recycled water to flush the toilet** (except in the case of recycled toilet water). A majority would use rainwater for laundry, although not any other types of water sources. It's clear from the entirety of the poll, that **any proposals to use recycled water for drinking are unpopular and viewed sceptically by the public.** Notably, while less than 10% would be comfortable using recycled water for drinking with most sources, when it came to rainwater this was closer to a quarter.[12]

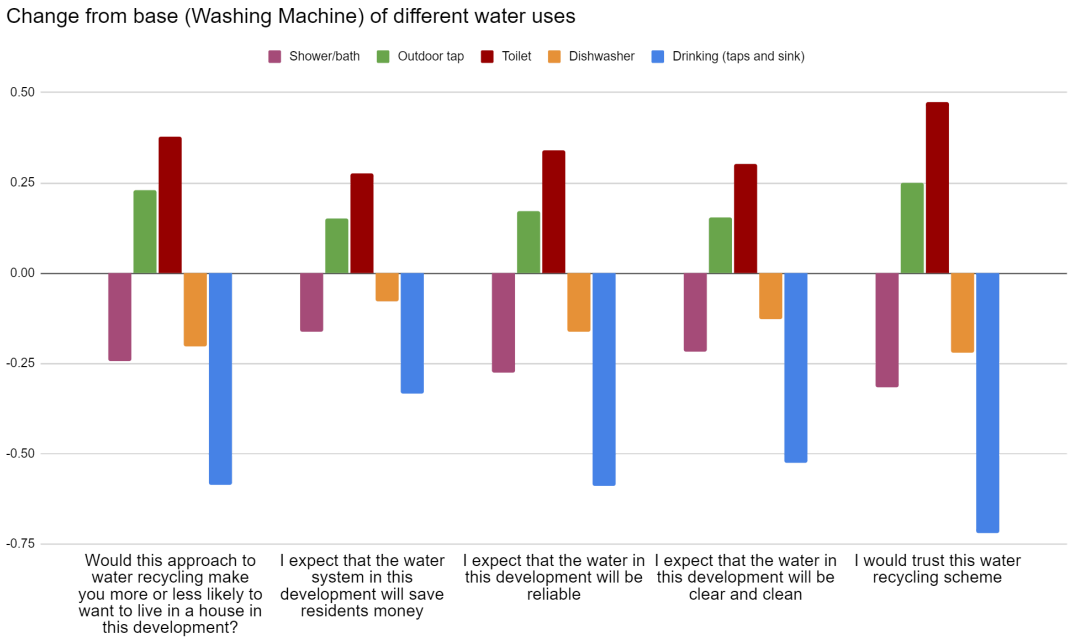
Details about the treatment and storage of the recycling scheme did not shift responses by much**.** While there was a statistically significant difference between water being stored in a reservoir away from the home, and other water storage systems (*p<0.005 or highly statistically significant*), the magnitude of this difference was very small. 12.2% would be comfortable using water stored in a reservoir, compared to 10.3% across other treatment approaches. At best, we could say that we're confident it makes a very small difference, though miniscule compared to the scale of difference produced by different water sources. The takeaway from this is that, **regardless of how you communicate the treatment process, what people hear and pay attention to is the original source of the water.**

The results of these experiments align with many of the poll's findings, as well as our qualitative research, which both suggest that the public are strongly averse to the concept of recycling water from the toilet but highly amenable to reusing rainwater.

[12] This difference was statistically significant at the *p<0.0001* level, N-1 $\chi 2$ test.

We also looked into whether the intended use impacts the way people feel about the scheme. As Figure 12 below shows from the first experiment, what recycled water is used *for* also has very significant impacts on the levels of public support. Proposals to use recycled water for drinking have negative impacts across the board, and would not be trusted to be safe or reliable.[13] The public would also be far less likely to want to live in a new development with such a technology. The same is true, although to a lesser extent, of reused water for shower or bath water.

Figure 12



The ultimate conclusion is that there are polar opposite effects for "rain to toilet" - which was the most trusted and favourable water recycling scheme - and "toilet to tap", which was by far the least trusted. Table 3 shows these effects in more detail, and also illustrates that the impacts compound when one favourable water type is combined with another favourable use and vice versa.[14]

[13] The average trust level for recycling schemes in general was 4.38/5, however for those involving drinking water this dropped to 3.74/5 (*p<0.0001*, T-test).

[14] Even compared to the second most trusted use (dishwasher water to toilet), rainwater to toilet is more trusted to a statistically significant level (*p<0.05, T-test*).

Table 3: Public desirability according to water use and type (scores out of 7)

For...	Using...					
	Dishwasher water	Sink water	Shower/bath water	Water from the toilet	Washing machine water	Rainwater
Dishwasher	4.48	4.38	4.20	3.51	4.26	4.66
Drinking (taps and sink)	3.62	3.69	3.63	3.36	3.77	4.44
Shower/bath	4.02	4.30	4.25	3.48	4.09	4.76
Toilet	5.05	4.97	4.84	4.46	5.03	5.31
Washing machine	4.41	4.49	4.64	3.59	4.74	4.87
Outdoor tap	4.86	4.86	4.83	4.09	4.72	4.95

Message Testing

Finally, we conducted positive and negative message testing, designed to understand what type of messaging around water recycling is most, and least effective, as well as how this varies by water recycling type. The findings from the experiment indicate how best to communicate the benefits of water recycling to the public, to maximise willingness to adopt reuse technologies in the home.

The results corroborate findings from our baseline questions indicating strong degree of public support for recycling technology. Importantly, regardless of the message, a majority would be willing to use the water recycling types we tested in their home, as shown in **Table 4**, below.

The messages tested related to the following:

- Cost efficiency: *this will save you money*
- Environmental benefits: *this will help the environment*
- Common sense: *this just makes sense*
- The threat of water scarcity: *this helps limit the risks of water scarcity*
- Safety assurance: *this technology will be safe to use*

Across all message types, **rainwater was the most popular type of water recycling that we tested, and performed better than greywater by 10% on average**. Interestingly, there was a limited difference between site-level and single household water recycling practices on public opinion.

Table 4: Average support for water recycling type according to message

Type of water recycling type tested:	**Average support for the following types of water recycling (across the different messages tested)** to be introduced in respondents' homes.
Rainwater	79%
Single Household Water recycling	71%
Site-Level Water recycling	70%
Greywater	69%

Overall, in line with findings from the rest of the research, the strongest messages were based on cost, although not consistently. Generally, cost saving messaging performed better, however for rainwater, already a highly supported option, sustainability, common sense messaging and the threat statement performed equally well. For greywater, cost-based messaging cut through by a substantial degree, adding 11% on to the next best level of support (sustainability messaging). When the messaging was differentiated between site-level and household treatment, there was little in the way of difference, with each message roughly level.

As Table 5 shows, after the cost-efficiency messaging came sustainability and common sense. The 'threat' message came next at **69%** on average. The least powerful and persuasive message to the public related to safety and quality assurance. This was also something that jumped out in our reverse experiment in which we tested a number of corresponding negative messages, which is explained in more detail below.

Table 5: Average impact of message on support for water-recycling type

Type of positive statement tested:	**Average support for water recycling (across water types)** to be introduced in respondents' homes after viewing the positive statement.
Cost efficiency statement	**75%**
Environmental sustainability statement	**73%**
Common sense statement	**71%**
Threat statement	**69%**
Safety/Quality Assurance statement	**67%**

The negative messages we tested related to:

- Cost: *this won't save you money*
- Health risks: *this will be bad for your health*
- Maintenance: *this will be a hassle to keep running*
- Better alternatives: *we should be building more reservoirs instead, for example*
- Ineffectiveness: *this won't have any impact on water scarcity*

Firstly, less than half of people felt convinced that recycling would have a 'lack of impact'. This was the least persuasive message across both positive and negative testing. Respondents were also less convinced by negative cost messages (54%**)** in line with the positive testing. At the other end, **respondents were most likely to find messages stating the health risks of water recycling convincing**. This was clearly apparent in our immersive work, where the willingness people had to use recycled water was high, but only up until the point at which there were health implications.

> *"Well, that's a fine and simple idea, but it's important to make sure it doesn't cross into using washing water for drinking or for showering."* Man 18-24

An average of 75% of respondents found the negative health statements convincing. Given the concerns around potability from the experiments, this is the crucial challenge for water recycling. As table 6 below shows.

Table 6: Impact of negative message by type and use

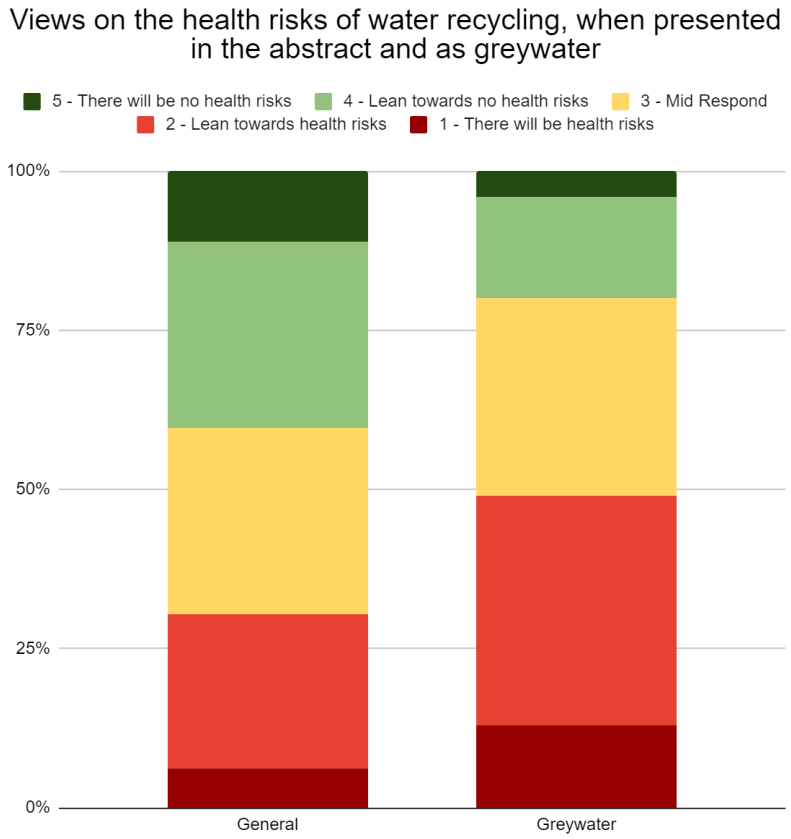
		Type of negative message shown					Average across message tested
		Cost	Health Risks	Maintenance	Better alternatives	(Lack of) Impact	
	Greywater	58%	77%	68%	68%	45%	**63%**
	Rainwater	51%	76%	74%	69%	48%	**64%**
	Single Household	55%	82%	62%	67%	39%	**61%**
	Site-Level	51%	66%	65%	66%	39%	**57%**
Average across water recycling type:		**54%**	**75%**	**67%**	**68%**	**43%**	
		Response to 'How convincing do you find this statement' (% who selected convincing)					

Fundamentally, **this is where our polling has identified as the biggest risk to the public acceptability of water reuse.**

We asked respondents about 'water recycling' in general earlier in our poll; initially, respondents' perceptions that it would be safe outweighed those that it would have risks. However, after explaining the term greywater to our participants and asking the same question - specifically of greywater reuse - these perceptions flipped. In other words, when participants knew more

about the process and definitions of greywater, they were more concerned about the risks, even though it did not shift many *other* perceptions. Figure 13 below indicates how support and positive perceptions for waste recycling declined after the public was exposed to the explanation.

Figure 13



Whilst this represents a challenge to the more widespread use of water recycling, it is not insurmountable, and the opportunities to win public consent identified in this poll for some types of reuse are substantial. Below, we outline some of the implications of the poll findings in more detail.

Recommendations

The upshot is largely positive. Straightforwardly, the Government will not implement reform if it is profoundly unpopular with the public. It's often argued that there is no public appetite for water smart housing, or more precisely, any form of water recycling. **Our research demonstrates the public are very willing to use specific types of water recycling in their homes, and will certainly accept more water smart housing in some form**. Still, there are conditions to that support, largely based on what water is recycled and how it is used.

On a personal level, the public sees water as a precious resource. **69% of people claim they have taken steps to reduce their daily water consumption**. This is of fundamental importance when thinking about water efficiency, and reuse. Very few said they would be unwilling to use recycled water at all, only 11% say they would not use non-treated greywater for any purpose.

But the type of water reuse matters to people. Rainwater and recycled toilet water represented polar ends of the scale on all questions. **People were highly averse to the concept of recycled toilet water, and very willing to reuse rainwater.** Similarly, what water was being reused for also matters. Proposals to use **recycled water for drinking were controversial,** but proposals to use **recycled water for outdoor taps and for toilet flushing were looked upon favourably.**

Our polling also demonstrates that **messaging has an impact on public perceptions of water reuse**. Put simply, there are ways to discuss the issue which will garner more support, and messages that should be avoided given the associations of the public and the perceptions of water use and water reuse generally. Positively, regardless of messaging, the majority support water recycling in the abstract, and would be willing to use some types of reuse in their home.

Generally, messages revolving around cost-savings performed better than other messages centering around sustainability, quality assurance, and 'common sense'. **The fact that water reuse can save money on bills is most likely to persuade people of the benefits of water reuse**. People recognise the environmental advantages, but they expect and want cost saving benefits. This represents a substantial benefit, especially in the context of increasing utility bills (including water) over the coming parliament.

Respondents were receptive to the negative arguments about the health risks of water recycling. **An average of 75% of respondents found these statements convincing.** Given the concerns around potability from the experiments, this is the crucial challenge for water recycling. Phrases like "toilet-to-tap" are doing no favours in winning people over. **Respondents are clear and consistent on two things; that rainwater recycling is desirable, and that toilet water recycling is not so.** Emphasising the right water sources (particularly rainwater) and water uses (particularly toilets, although outdoor taps are also viewed positively), and ruling out the wrong ones, would meaningfully change the trust people had in the approach for the better.

Public support for water smart housing could be undermined by arguments about negative health implications. Helpfully, people are not instinctively repulsed by the concept of water recycling, but explaining it in more detail appears to shift views to the negative, and health-related negative messages had a large impact on interest. This is a key challenge and requires careful consideration, but **could be substantially mitigated by emphasising the need for non-potable water over potable water (in simpler terms).**

Finally, thinking more broadly, when communicating the importance of water smart housing, it's important to note that water-related issues such as drought and water shortages (as well as flooding) are far down on the list of people's concerns for their local areas. But, importantly, the single biggest issue is the availability and affordability of housing. Most people see water

scarcity as an issue that will drive up costs; the vast majority **(87%)** do not see it as an issue that has any impact on the availability of housing. **Referencing this fact - and the positive impact of water efficiency on the overall housing stock and availability of housing - is a useful way to frame the issue when explaining why this issue matters to the public.**

Appendix A: Government housing targets

Estimates of housing need are set by the Government using what is called the Standard Method (SM). Despite the name, this method has changed over time with the most recent modifications occurring after the election of the new Government. The new system follows the folding steps:

1. Take 0.8% of the current housing stock of the area;

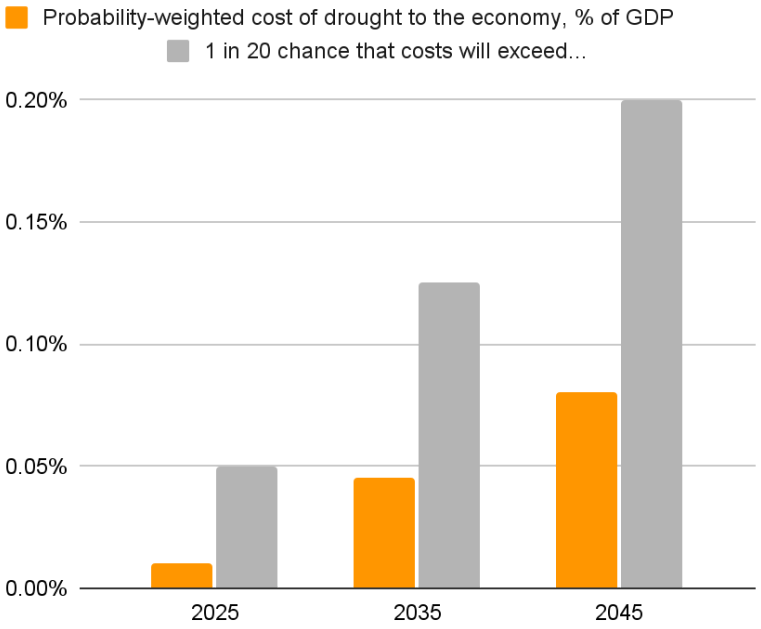
2. Apply an uplift, based on a three-year average of the median workplace-based affordability ratio, with an increase of 15% for every unit above four.

The new method increases the total number of homes that local authorities are to plan for from around 305.7K net additional homes per annum to 371.5K. However, within this the number of homes to be delivered in London has decreased from 99K to 87K.

Appendix B: Impact of drought on the economy

The below figure demonstrates that the probability adjusted-cost of drought to the economy is set to increase tenfold over the next 20 years. Ultimately, we suggest that by 2045, there will be a 5% chance that the cost will exceed 0.2% of GDP, a substantial figure and increase from 2025, at which point there will be the same chance of a 0.05% cost on the GDP.

Figure 14: Probability adjusted cost of drought to the economy[15]



[15] *LSE: What-will-climate-change-cost-the-UK-risks-impacts-mitigation, 2022*