

# Creating a River Thames fit for our future

## A strategic and economic case for the Thames Tunnel

November 2011



---

© Crown copyright 2011

You may re-use this information (not including logos) free of charge in any format or medium, under the terms of the Open Government Licence. To view this licence, visit [www.nationalarchives.gov.uk/doc/open-government-licence/](http://www.nationalarchives.gov.uk/doc/open-government-licence/) or write to the Information Policy Team, The National Archives, Kew, London TW9 4DU, or e-mail: [psi@nationalarchives.gsi.gov.uk](mailto:psi@nationalarchives.gsi.gov.uk)

This document/publication is also available on our website at:  
[www.defra.gov.uk/environment/quality/water/sewage/overflows/](http://www.defra.gov.uk/environment/quality/water/sewage/overflows/)

Any enquiries regarding this document/publication should be sent to us at:  
Department for Environment, Food and Rural Affairs

Area 2A, Ergon House

Horseferry Road

London

SW1P 2AL

PB 13677

An updated version of this document  
was published in October 2015

## Contents

1. What is this document? .....	1
2. Why do we need a Thames Tunnel? .....	2
Protecting our environment and health .....	2
Meeting our legal obligations .....	3
Coping with changing climate and a growing population .....	3
Roles and responsibilities .....	4
The case for change in detail .....	4
3. What is the economic case for change? .....	7
Researching possible solutions .....	7
Alternative options considered .....	8
The preferred solution .....	12
Paying for the tunnel .....	13
Uncertainties to consider .....	14
4. Conclusion .....	15
Further sources of information .....	15

An updated version of this document  
was published in October 2015

## 1. What is this document?

This document is designed to give you an overview of the proposed Thames Tunnel project and why it is needed.

It summarises the strategic and economic case for the Thames Tunnel and explains why we, Defra, believe that a tunnel remains the preferred solution for dealing adequately with the untreated sewage that is polluting the River Thames.

This provides an update to the 2007 regulatory impact assessment<sup>1</sup> and takes into account data emerging since that time.

An updated version of this document  
was published in October 2015

---

<sup>1</sup> See [www.defra.gov.uk/environment/quality/water/sewage/overflows/](http://www.defra.gov.uk/environment/quality/water/sewage/overflows/)

## 2. Why do we need a Thames Tunnel?

The frequency and volume of untreated waste water entering the tidal reaches of the River Thames are increasing. In a typical year, 39 million cubic metres of untreated waste water (a mixture of sewage and rainwater) discharges into the Thames. The level of untreated waste water entering the Thames at present is not tolerated anywhere else in the UK and should not be in the main river in our capital city. Currently, discharges into the River Thames can occur with as little as 2 mm of rain and, in future, sewage may overflow into the River Thames even on dry days unless the situation is managed.

The Thames Tunnel, as a solution to reducing the excessive amount of untreated waste water that enters the River Thames is compared with the other options that have been considered on pages 8-11 which provides more detail on why it is rated as the best of those options.

Much of the sewerage system serving London along the tidal River Thames was designed in the 19th century and consists of combined sewers. Combined sewers convey both foul sewage and rainwater run-off to sewage treatment works for treatment before being discharged. When combined sewers reach capacity, their combined sewer overflows (CSOs) are designed to discharge excess untreated waste water into the River Thames. This avoids overflows from manholes and the backing up of sewage which in turn leads to sewer flooding of roads and buildings and the hydraulic capacity of sewage treatment works being exceeded.

The Thames Tunnel will work with the existing system of sewers, improvements to sewage treatment works and the Lee Tunnel to reduce the frequency of CSO discharges. (An explanation of how the Thames Tunnel will work can be found on page 13.)

The current network of major sewers was designed for a city of 4 million people. Today, London's population is 7.6 million and is projected to increase to 8.3 million people by 2021 and 8.8 million by 2031.
--

### Protecting our environment and health

Currently, discharges from London's CSOs flow into the River Thames approximately 60 times a year. The River Thames between Hammersmith and Beckton is tidal. Therefore, when CSOs discharge, the resulting sewage and litter flows up and down the river with the tide. It takes about one month for non-biodegradable waste to get from the head of the estuary at Teddington to the sea in the winter (when the river flow is highest), and three months in the summer (when river flow is lowest). It is in the summer months that sewage discharges have the biggest impact.

Discharges affect the River Thames in several ways. First, sewage discharges harm the ecology of the river by reducing dissolved oxygen levels in the water. In extreme events this can result in the death of fish and other wildlife, often in very large numbers. Second, polluted water increases health risks to recreational users of the Thames. Finally, CSOs discharge offensive sewage material into the Thames, such as faeces, toilet paper, wipes, sanitary products and other 'flushable' items, including hypodermic needles. (This is sometimes referred to as 'aesthetic pollution'.) All of this causes slicks of pollution to float on the river, which in turn can also wash up on the foreshore.

In a typical year, 39 million cubic metres of untreated sewage discharges into the River Thames – that's enough to fill the Royal Albert Hall more than 450 times.<sup>2</sup>

## Meeting our legal obligations

The Urban Waste Water Treatment Directive (UWWTD)<sup>3</sup> sets requirements for the collection and treatment of waste water to protect the environment. There are no specific standards set in the Directive, so it is up to Member States to demonstrate that the measures they take protect the environment adequately. The Directive acknowledges that pollution from overflows in combined systems will occur but requires Member States to construct and maintain collecting systems using the best technical knowledge not entailing excessive cost. The approach being taken to implementing the Directive in London is consistent with measures taken elsewhere in England and Wales.

In October 2009, the European Commission announced that it was referring the UK to the European Court of Justice (ECJ) in relation to the adequacy of the collection and treatment systems for urban waste water in London. This is discussed in more detail below on page 4.

Alongside this Directive, we also have to comply with the Water Framework Directive (WFD)<sup>4</sup> which aims to protect and enhance the quality of water in rivers, estuaries, coasts and aquifers through the implementation of river basin management plans.

The Thames Tunnel is an integral part of the Thames River Basin Management Plan, which will help to achieve the WFD objectives set for the tidal River Thames.

On 6 June 2011, after 30 mm of rain, more than 250,000 cubic metres of sewage from CSOs at the western end of the River Thames discharged into the river. Combined with a similar level of discharge from Mogden Sewage Treatment Works, this resulted in the death of thousands of flounder, bleak, eels and other species. It was estimated that at least 25,000 fish were killed, including an entire year class of smelt.

## Coping with changing climate and a growing population

An increasing population is leading to more houses, and increasing urbanisation is leading to a loss of green space to help water drain away. All of this puts London's existing sewerage system under more pressure. As a result, the system quickly becomes overloaded when it rains, leading to frequent, large discharges of untreated combined sewage entering the River Thames. Without action the situation will get worse. In future, discharges may occur during dry weather conditions as the capacity of London's public sewers is exceeded.

In addition, climate change predictions indicate lower summer river flows and warmer water temperatures and these are likely to affect dissolved oxygen levels in the river. The warmer the water is, the less oxygen can dissolve and the quicker organic matter in sewage will break down and consume oxygen. This, in turn, would make aquatic life more sensitive to any pollution.

<sup>2</sup> Source: Thames Water, 2010.

<sup>3</sup> Directive 91/271/EEC.

<sup>4</sup> Directive 2000/60/EC.

CSO discharges now happen more than once a week on average and as little as 2 mm of rainfall can trigger a discharge. Without a comprehensive solution, discharges could, in the future, occur during dry weather.

## **Roles and responsibilities**

Defra (the Department for Environment, Food and Rural Affairs) is the government department responsible for the framework of policy and legislation relating to the impact of CSO discharges on the River Thames. We have a duty to make sure that a solution (such as the Thames Tunnel) meets our policy goals and EU legal obligations at a cost that is affordable and represents value for money. Therefore, we have a keen interest in ensuring that this project is delivered successfully.

Thames Water has a statutory responsibility to provide an effective and efficient public sewer in London. It is required under its licence conditions to comply with relevant legislation.

Ofwat (the economic regulator of the water and sewerage industry in England and Wales) is responsible for making sure that Thames Water complies with these conditions and meets its statutory obligations with reference to the River Thames (in a manner that is in the interests of customers and yet enables Thames Water to carry out its functions effectively and efficiently).

The Environment Agency is the environmental regulator responsible for ensuring that Thames Water is compliant with environmental law (including in respect of CSO discharges into the River Thames). The Environment Agency is also the statutory environmental adviser to government.

Although this project is of significant strategic importance to government, we will not be delivering it and it will be financed in the private sector. Thames Water, as statutory sewerage undertaker, is responsible for ensuring the success of the project.

## **The case for change in detail**

There are compelling reasons to find a solution to the challenges posed by CSO discharges.

### **Legal imperative**

As explained above, the UK is required by law to have an adequate sewage collection and treatment system. The European Commission position is that the magnitude of the discharges now occurring in London does not constitute an adequate collection system and, as a result, the UK has been referred by the Commission to the ECJ.

In July 2010, the ECJ confirmed that it had received the Commission's application covering London and one other site: Whitburn in north-east England. If the UK loses the case, the Commission can apply to the Court to seek fines against the UK. If the case proceeds to this stage, the Court can impose a lump sum and/or a periodic fine. The Court has wide discretion concerning the level of fines imposed.

The UK and the Commission have now exchanged pleadings and an oral hearing will take place on 10 November 2011, with a judgment likely to emerge in the second half of 2012.

### Public support for finding a solution

In 2006, a study took place which sought to assess people's preferences and therefore the value they place on particular benefits. (This value is expressed as 'willingness to pay' or WTP.<sup>5</sup>) The benefits to people were associated with reducing the number of fish deaths and adverse health impacts, and reducing sewage litter and odour. In all cases, the reductions tested were those consistent with complying with the UWWTD. The study suggested that people would value these benefits within a range centred on around £4.4 billion in aggregate (updated to 2011 prices).

Defra has subsequently developed this analysis<sup>6</sup> to take into account the potential impacts of population increases and different assumptions about income growth over the life of the tunnel. An estimate has also been made of the proportion of estimated benefit that might be attributed to the Thames Tunnel, as distinct from the Lee Tunnel which is also contributing to improvements in the Tideway. This analysis suggests that the total value of benefits from improvements arising from the Thames Tunnel might be in the range of £3.0 billion to £5.1 billion (present value terms, over the 100-year life of the tunnel). The fact that this is a wide range reflects the uncertainties associated with this kind of monetary analysis.

### Other benefits

There are other, unquantifiable, benefits that could result from a Thames Tunnel. These include employment and regeneration benefits, reputational issues, the protection of habitats and species, and the reduction in sewer flooding risks.

Improvements to the water quality in the River Thames through the construction of a tunnel could lead to wider, long-term benefits to London's reputation (e.g. as a tourist destination) and economy. Equally, the lack of an effective and timely solution could be damaging.

For example, the Thames Tunnel project should help to maintain the attractiveness of London for inward investment. We need to ensure that our infrastructure is maintained, and that includes ensuring that the River Thames meets adequate environmental standards comparable to other major western cities. We believe that the project itself will lead to considerable economic activity – funded in the long run by customers while in the short term it should attract inward investment and could give a boost to economic activity. This includes the creation of employment opportunities: Thames Water estimates that the project would directly employ around 4,250 people in construction and related sectors and additionally provide further secondary employment opportunities.

It is unlikely at present that businesses are put off locating in London due to the presence of raw sewage in the River Thames. However, given the predictions of increasing quantities of waste water entering the river over time, and possibly more frequent low flows in the river during the summer due to climate change, it is likely at some stage in the future that there will be a more prolonged and detectable impact. The likelihood of this will increase as competing capitals and large cities continue to put in place schemes to address their similar problems.

Aside from businesses, there may be benefits to riverside development. Without a solution, the river is predicted to deteriorate and could have an impact on the value of existing property and limit future development.

---

<sup>5</sup> *Thames Tideway – Stated Preference Survey*, Eftac, 2006.

<sup>6</sup> See 'Costs and benefits of the Thames Tunnel', [www.defra.gov.uk/environment/quality/water/sewage/overflows/](http://www.defra.gov.uk/environment/quality/water/sewage/overflows/)

While no study has been completed which would enable a monetary value of the above kinds of wider benefits to be credited to the tunnel, it should be noted for context that London's gross value added (a measure of total economic activity) is currently in the region of £250 billion to £300 billion per year.<sup>7</sup>

There are also benefits to upstream and downstream environmental assets, such as fishery nursery habitats and other designated habitats for wildlife, including a number of sensitive habitats of conservation importance. Fish populations in the estuary have improved enormously since the 1960s and are now varied. About 125 species of fish have been recorded in the Thames estuary, including freshwater, marine and migratory fish. Although many of these are occasional visitors, there are, nonetheless, a large number that are regularly found. The numbers of dace and bream have increased markedly in recent years. In addition, shad and smelt, which are species of international importance, have become increasingly abundant in the estuary. Small numbers of salmon and sea trout annually migrate to and from the River Thames and its tributaries.<sup>8</sup> However, we believe that there is great potential for increased biodiversity and greater abundance of fish, including sensitive species and species of conservation importance, such as shad, smelt, eels, and river and sea lamprey.

A specific problem relating to sewer flooding to properties in the Counters Creek area in West London is being addressed by a separate Thames Water project.<sup>9</sup> However, there may be synergies between the two projects: the Tunnel could potentially receive flows and form part of the solution to sewer flooding problems in this area and elsewhere.

An updated version of this document was published in October 2015

---

<sup>7</sup> Source: Greater London Authority Economics Unit.

<sup>8</sup> *State of the Environment in London*, Environment Agency, 2010, page 68.

<sup>9</sup> [www.thameswater.co.uk/cps/rde/xchg/corp/hs.xsl/9344.htm](http://www.thameswater.co.uk/cps/rde/xchg/corp/hs.xsl/9344.htm)

### 3. What is the economic case for change?

Placing a value on the environmental benefits resulting from the tunnel is difficult. However, as explained in section 2, willingness to pay surveys have been used to value in monetary terms some of the benefits associated with the tunnel. Using these values helps to make the economic case for finding a solution to the impacts created by CSOs discharging into the River Thames.

First, a reduction in the number of fish that are killed, reduced health impacts and a reduction in the amount of sewage litter and odour have a total combined value to UK households of between £3.0 billion and £5.1 billion over the life of the tunnel, depending on assumptions about incomes and population growth.<sup>10</sup>

Second, as mentioned above, there are wider, unquantified benefits to be borne in mind. These include:

- employment and regeneration effects;
- a reduction in the risk of sewers flooding;
- the impact of the Thames Tideway on London's reputation, as well as that of the wider UK; and
- the assurance of compliance with the UWWTD.

On the last point, any infraction fines imposed due to non-compliance would have financial implications for the UK. Putting a cost on this is difficult because of a lack of precedents but, if we lose the case, we estimate that the European Commission would try to seek fines upwards of £100 million a year.

#### Researching possible solutions

Extensive studies have taken place over many years involving the consideration of a wide range of possible solutions to address untreated waste water problems in the Thames. These considerations have included both tunnel and non-tunnel based options.

In 2000, the Thames Tideway Strategic Study<sup>11</sup> was set up to consider the environmental impact of combined sewer discharges to the tidal River Thames and to propose potential solutions that would ensure continued compliance with the UWWTD. The main report (produced in February 2005<sup>12</sup> and followed by a supplementary report in November 2005<sup>13</sup>) recommended a major tunnel under the Thames to intercept CSO discharges.

<sup>10</sup> This is an estimated economic value of the environmental benefits based on people's expressed 'willingness to pay' for them. Source: Defra, based on results from *Thames Tideway – Stated Preference Survey*, Eftec, 2006 and *Thames Tideway Cost Benefit Analysis*, NERA for Thames Water, 2007.

<sup>11</sup> Thames Water, the Environment Agency, the Greater London Authority, Defra and Ofwat (as an observer) all contributed to the study, chaired independently by engineering consultant, Professor Chris Binnie.

<sup>12</sup> *Thames Tideway Strategic Study Steering Group Report*, February 2005.

[http://files.thamestunnelconsultation.co.uk/files/thamestunnel/02%20TTSS%20Steering%20Group%20Report\\_Feb05.pdf](http://files.thamestunnelconsultation.co.uk/files/thamestunnel/02%20TTSS%20Steering%20Group%20Report_Feb05.pdf)

<sup>13</sup> *Thames Tideway Strategic Study Steering Group Report: Supplementary Report to Government*. November 2005.

[http://files.thamestunnelconsultation.co.uk/files/thamestunnel/08%20TTSS%20Supplementary%20Report%20to%20Government\\_Nov05.pdf](http://files.thamestunnelconsultation.co.uk/files/thamestunnel/08%20TTSS%20Supplementary%20Report%20to%20Government_Nov05.pdf)

This study also led to the London Tideway Improvements Scheme. The scheme identified three integrated solutions:

- The Thames Tunnel.
- The Lee Tunnel between Abbey Mills pumping station near Stratford and Beckton to pick up the large discharges at Abbey Mills CSO. (Work has already started on the Lee Tunnel.)
- Improvements to five sewage treatment works (Beckton, Crossness, Long Reach, Riverside and Mogden). This work has already begun. The improvements to Beckton involve a major extension to the works, which includes capacity to meet future dry weather flow requirements and to treat the contents of the Thames and Lee Tunnels, and to generate renewable energy from the sludge resulting from the treatment process.

In March 2007, Defra undertook a regulatory impact assessment on sewage collection and treatment for London.<sup>14</sup> The assessment considered various approaches to meeting the UWWTD requirements, mainly focusing on tunnel-based solutions but also reviewing work that had been carried out on alternative approaches (e.g. separate sewer systems and sustainable drainage systems (SuDS)<sup>15</sup>). Options were assessed in terms of their ability to meet environmental objectives, agreed as part of the Thames Tideway Strategic Study and confirmed by the Environment Agency as appropriate.

Following this assessment, Ian Pearson, the then Minister of State for Climate Change and Environment, concluded that Thames Water should proceed with a tunnel-based approach to address unsatisfactory discharges into the Thames tideway. No alternative solutions had been identified which would comply with both the environmental objectives set by the Thames Tideway Strategic Study and the requirements of the Directive. Neither would any alternative approach provide a quicker or more cost-effective solution.

At the time of these considerations, estimated discharge volumes were available but firm data on some of the CSO discharges were lacking. Therefore, it was acknowledged that further investigation into the development and design of a single tunnel approach was needed to refine further the solution and the costs. The ministerial agreement at that stage was to a tunnel-based solution on an 'in principle' basis, with a view to further work being completed and reviewed.

Since that time, detailed investigations have been carried out by Thames Water, leading to refinements in the preferred route for a Thames Tunnel and to improved knowledge of the level of discharges from CSOs into the Thames. Therefore, there is now an increased awareness of the environmental problems in the River Thames and increased evidence that the problem is more serious than previously understood.

### **Alternative options considered**

The Thames Tideway Strategic Study considered a number of approaches to the sewerage problems in London. These included, for example, screening of discharges, local storage and treatment and a shorter tunnel in West London.

---

<sup>14</sup> See [www.defra.gov.uk/environment/quality/water/sewage/overflows/](http://www.defra.gov.uk/environment/quality/water/sewage/overflows/)

<sup>15</sup> SuDS can help to reduce the volume of water that London's sewer network has to deal with. SuDS involve using permeable surfaces to allow water to infiltrate the ground where storage systems collect and store excess water in lagoons. There, evaporation and ground infiltration take place.

Department for Environment, Food and Rural Affairs

The table below summarises the main options considered, assessing each option in terms of compliance with the environmental and legal drivers for the project, along with associated costs for each option.

Option	Drivers met (pros)	Drivers not met (cons)	Estimated costs	Comments
Doing nothing, i.e. not building a tunnel but continuing with the construction of the Lee Tunnel and the upgrading of five sewage treatment works (STWs).	None.	<ul style="list-style-type: none"> <li>Does not meet the statutory requirement to protect the environment and water quality to enable us to continue to meet our obligations under the UWWTD, increasing the risk of successful infraction proceedings against the UK.</li> <li>Does not meet the need to adapt to climate change or population growth and increasing urbanisation.</li> </ul>	Construction of the Lee Tunnel and the upgrading of Beckton sewage treatment works will continue at a cost of £0.8 billion (2011 prices).	This is not a feasible option. The Lee Tunnel and Beckton sewage treatment works upgrade will help to reduce the overall volume of discharges but not by enough to meet environmental objectives. There is also a risk of successful infraction proceedings against the UK for not complying with the UWWTD.
Converting the current combined sewerage system into a new, separate drainage system (in addition to the Lee Tunnel and STW upgrades).	Would alleviate sewer flooding and would eventually comply with the UWWTD and environmental objectives.	<ul style="list-style-type: none"> <li>Extremely disruptive to businesses, residents and transportation. Does not meet the requirement to find a timely solution as it would be extremely time-consuming to implement. Increases the risk of successful infraction proceedings against the UK.</li> </ul>	More costly than tunnel option at an estimated cost of at least £13 billion (2007 prices; higher today), excluding economic costs of disruption to traffic, etc.	This option would involve creating a completely new network of sewers and every existing property would need connecting to the new system. Cost and disruption would be very high and might lead to large numbers of misconnections, which would create a legacy of problems, pollution and further work.

Option	Drivers met (pros)	Drivers not met (cons)	Estimated costs	Comments
Sustainable drainage systems (SuDS), in addition to the Lee Tunnel and STW upgrades.	In certain areas, there are realistic local opportunities to reduce 37% of impermeable areas, potentially contributing to a reduction in CSO discharges.	<ul style="list-style-type: none"> <li>Does not meet the statutory requirement to protect the environment and water quality to enable us to continue to meet our obligations under the UWWTD, increasing the risk of successful infraction proceedings against the UK. (Even in the most receptive of trial catchments it has been estimated that there would still be more than ten spills from the local CSO in a typical year.)</li> <li>Does not meet the requirement to find a timely solution as it would be extremely time-consuming to implement, i.e. up to 40 years.</li> <li>Does not meet the requirement to find a cost-effective solution.</li> </ul>	More costly than the tunnel option at an estimated cost of at least £13 billion (2007 prices; higher today).	This option would require properties to be retrofitted and space to be made available for storage, discharge routes and disposal routes. In most areas, this space does not exist. There are also limitations (in terms of cost and practicality) to implementation in existing properties.
A tunnel-based solution (in addition to the Lee Tunnel and STW upgrades). <sup>16</sup>	<ul style="list-style-type: none"> <li>Meets the statutory requirement to protect the environment and water quality to enable us to continue to</li> </ul>	<ul style="list-style-type: none"> <li>None; would meet all requirements.</li> <li>However, costs, complexity and planning issues may create difficulties in achieving target date for</li> </ul>	A 'whole life' cost of £4.1 billion (discounted present value terms, before considering financing arrangements).	Although this option comes with significant costs and disruption at certain sites, overall and in comparison with other options (excluding the do nothing option), it

<sup>16</sup> Government support to date has been for a tunnel-based solution. However, this does not necessarily rule out more sophisticated approaches to its construction, such as a phased approach. Advantages of a phased approach are that it could make it easier to attract capital to the project, it could reduce the costs of capital (by reducing risks) and it may require smaller sums of funding over a longer timescale, though the total cost would be higher. But there are also disadvantages to a phased approach to construction. The annual number of spills would still exceed 50 until the final phase of construction was complete. Also, the tunnel would be built east to west and many of the most polluting discharges occur from CSOs at the western end. Being furthest upstream, these remain in the river for longer and would not be addressed until the final phase of the tunnel was in place, so discharges would continue to be a problem for quite some time. A longer delivery timetable could also create problems of blight for property owners situated in those areas falling within the later stages of construction and also those properties near a main drive shaft which would need to be kept in use for a much longer construction timetable.

Option	Drivers met (pros)	Drivers not met (cons)	Estimated costs	Comments
	<p>meet our obligations under the UWWTD.</p> <ul style="list-style-type: none"> <li>• Meets the need to adapt to climate change or population growth and increasing urbanisation.</li> <li>• Meets the requirement to find a timely solution.</li> <li>• Meets the requirement to find a cost-effective solution.</li> </ul>	<p>completion, increasing the risk of infraction fines.</p>		<p>has the lowest costs and is the quickest option, with minimum disruption to the existing system and London.</p>

### **The Jacobs Babtie report**

Ofwat commissioned its own report to review the work and reports of the Thames Tideway Strategic Study.<sup>17</sup> This was published in February 2006 and proposed additional options for dealing with the CSO discharges at a potentially lower cost, but with lower CSO control. It proposed constructing a 9 km tunnel to intercept discharges in West London (Hammersmith to Heathwall CSOs), a screening plant to reduce sewage-derived litter and faecal matter discharged to the River Thames, and an enhanced primary treatment plant at Abbey Mills pumping station in East London. These measures were in addition to the proposed upgrades at Crossness, Morden, Beckton, Long Reach and Riverside sewage treatment works, litter skimmer boats, and oxygenation measures ('bubblers' and hydrogen peroxide dosing plants). It also suggested that SADS should be implemented over the medium term where appropriate in London's suburban fringes. However, Defra's 2007 regulatory impact assessment<sup>18</sup> concluded that the Jacobs Babtie recommendations would not meet the objectives set within the Thames Tideway Strategic Study, and so they were not accepted. This was on the grounds that the Jacobs Babtie recommendations would still leave frequent discharges from 19 CSOs between Vauxhall Bridge and the tidal barrier (which would continue to discharge around 10 million cubic metres per year) and ultimately dissolved oxygen targets for the River Thames would not be met. Also, skimmer and bubbler boats could not be considered an effective strategy under the UWWTD as they would not prevent pollution entering the river.

A more recent review by Thames Water of a twin tunnel approach has confirmed that these problems remain and, further, that a twin tunnel approach assumes a certain level of headroom within the existing sewerage network which does not exist. This would create difficulties in pumping back into the main sewerage network any volumes from within a western tunnel. Any wait for capacity within the main network would also result in sewage sitting within the western tunnel for long periods and becoming septic and odorous.

<sup>17</sup> *Independent review to assess whether there are economic partial solutions to problems caused by intermittent storm discharges to the Thames Tideway*, 2006. [www.ofwat.gov.uk/sustainability/rpt\\_gen\\_tidewaybabtie20060214](http://www.ofwat.gov.uk/sustainability/rpt_gen_tidewaybabtie20060214)

<sup>18</sup> For more information, see <http://files.thamestunnelconsultation.co.uk/files/thamestunnel/1-100-RG-PNC-0000-900008%20Appendix%20A.pdf>

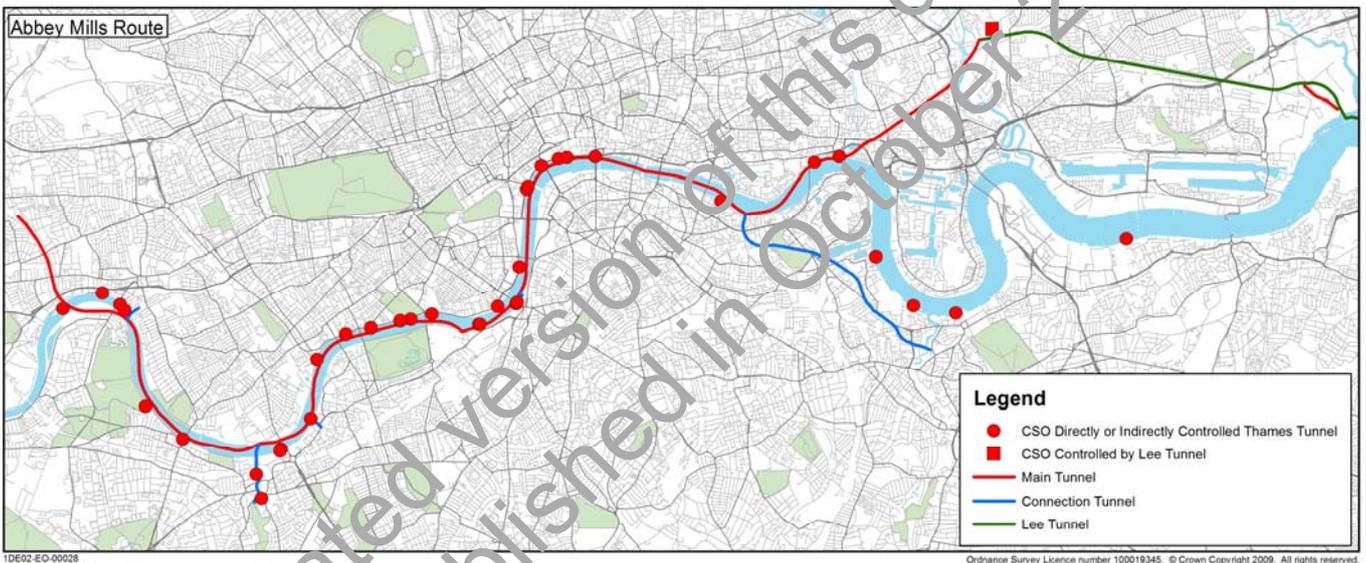
## The preferred solution

Building a tunnel remains the best option for meeting all of our objectives and our statutory obligations. It also remains the most cost-effective solution. The Government considers that detailed studies, which have been kept under review since the original decision to support a tunnel-based solution in 2007, continue to confirm the case for a Thames Tunnel.

## The plan for the Thames Tunnel

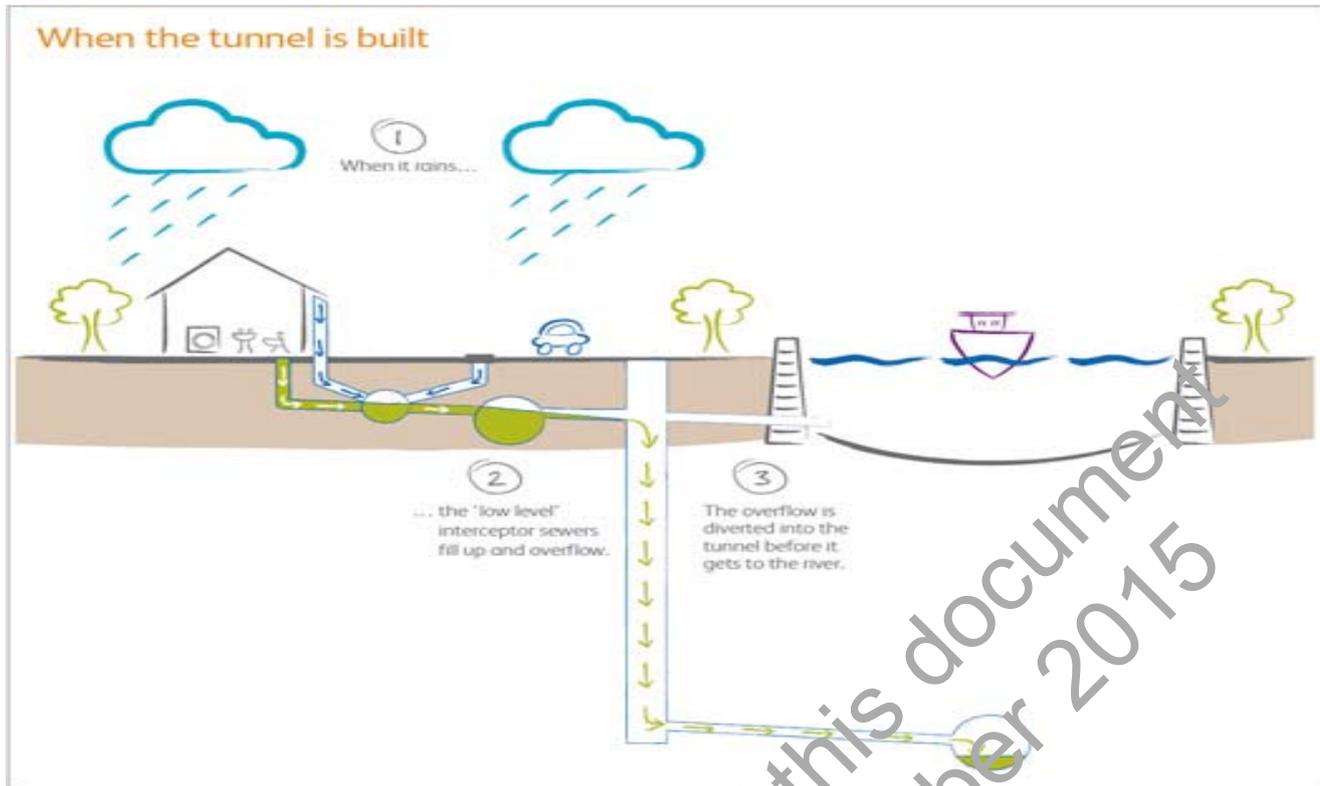
It is proposed that the Thames Tunnel will be 7.2 m in diameter and up to 67 m deep, and Thames Water's preferred route is up to 25 km (16 miles) long. A tunnel of this size is necessary to provide sufficient storage capacity within it and the depth is necessary to avoid other tunnels and to allow the sewage to flow through the tunnel by gravity.

This route generally follows the route of the River Thames so that it can be connected to the CSOs located along the riverbank. It follows the River Thames as far as Limehouse, where it will continue north-east to Abbey Mills pumping station near Stratford. Here it will be connected to the Lee Tunnel, which will transfer the sewage to Beckton Sewage Treatment Works.



## Consulting on the Thames Tunnel

Thames Water is currently carrying out extensive public consultations to refine the route for the Thames Tunnel. The first round of public consultation took place between September 2010 and January 2011. Thames Water published its analysis of responses in March 2011 and has reviewed the design and route of the tunnel. A revised design will be published for a second round of public consultation (due to start in November 2011 and last for 14 weeks), before the planning application is submitted in the latter half of 2012. Following planning consent, Thames Water expects to begin constructing the tunnel in 2016. The target date for completion of the tunnel is currently estimated to be 2022–23.



## Paying for the tunnel

Thames Water customers will pay for the tunnel and work needed to improve CSOs through their sewerage bills. This cost will be spread across Thames Water's 13.8 million sewerage customers, including those outside London.

On the basis of current estimated costs, the tunnel will result in an average maximum annual customer bill impact of £70-80 at 2011 prices. The bill estimates include an estimate of the cost of financing the project. We have given a central range rather than a single figure, as with a project of this complexity and duration unknowns such as real interest rates over several decades will have significant influence on the costs to customers. Choices we make in the coming months on the delivery and financing of the project will also have an impact.

An increase to £193-£203 will bring bills for Thames Water sewerage customers from being currently the cheapest in England (at £123 per year in 2011/12) to below the current national average of £211. Thames Water sewerage bills would still be lower than South West, Southern, Anglian and Wessex Water bills.

The evidence from recent work by Ofwat on affordability is that around 11% of households that receive sewerage services from Thames Water currently spend more than 5% of their disposable income on water and sewerage bills (around 620,000 households). This is around the average for England and Wales. Ofwat estimates that an £80 maximum increase in sewerage bills in the Thames sewerage area would see about 15% of households spending more than 5%<sup>19</sup> of their disposable income on water and sewerage bills (i.e. 820,000 households – an increase of 200,000). This would be above the current England and Wales average and would be the second highest by sewerage company, behind South West Water at

<sup>19</sup> Used as an indicator of water affordability. For more information, see [www.ofwat.gov.uk/future/customers/metering/affordability/prs\\_inf\\_afford.pdf](http://www.ofwat.gov.uk/future/customers/metering/affordability/prs_inf_afford.pdf)

16%. This analysis is based on a number of assumptions: in particular, that bills for other companies do not change between now and 2020 and that Thames Water does not have any other investment. It also does not take account of population growth (which could result in a smaller average increase).

We recognise that the costs of the project are significant and will be revised as the project progresses. Ofwat will continue to scrutinise the tunnel costs so that the final proposal (following consultation by Thames Water on the preferred route and sites for the tunnel) represents best value for money for customers.

The pros and cons of various financing mechanisms are currently being considered, including both the existing funding regime in the water industry regulated by Ofwat, and an adapted regulatory route. Decisions will be taken in due course and will take into account best value for money for Thames Water customers.

### **Uncertainties to consider**

Some uncertainties are inevitable for a project entailing long, costly and geographically complex sewers being built in a heavily urbanised area.

In addition to the uncertainties mentioned above in estimating the impact of decisions to be made regarding the financing mechanism for the project, there are also uncertainties about whether our estimate of risks is accurate and whether the project can be structured in such a way as to attract the required private capital.

An updated version of this document was published in October 2015

## 4. Conclusion

There is an environmental case for action in the Thames: the current level of discharges from CSOs into the Thames is excessive, resulting in large fish kills, adverse health impacts, sewage litter and odour-related problems. Without a solution, this situation is expected to deteriorate. The Thames Tunnel remains the cheapest solution which addresses these problems and meets the objectives set by the Thames Tideway Strategic Study for water quality improvements in the Thames.

In addition there is an economic case to support the tunnel. It will secure at least £3 billion to £5 billion worth of economic benefits (where estimable)<sup>20</sup> for a 'whole life' cost of around £4.1 billion (present value, before considering financing arrangements). There are also other regeneration and employment benefits resulting from the tunnel: for example, the tunnel is expected to directly employ around 4,250 people in the construction and related sectors. Finally, the tunnel meets our statutory requirements under the UWWTD and will reduce the risk of infraction fines against the UK.

Defra, together with Ofwat, Infrastructure UK, the Environment Agency and HM Treasury, has worked closely with Thames Water to ensure that the costs are minimised and that the project can be delivered efficiently in a way that secures value for money for customers and protects taxpayers. We will continue to do this and to ensure that there are no better value solutions that meet the need.

### Further sources of information

To find out more about this project, visit:

- [www.defra.gov.uk/environment/quality/water/sewage/overflows/](http://www.defra.gov.uk/environment/quality/water/sewage/overflows/)
- [www.thamestunnelconsultation.co.uk](http://www.thamestunnelconsultation.co.uk)

---

<sup>20</sup> See the economic case for change, page 7.