Phase two scheme development report

Part one: Main report
**Phase two consultation documentation**

### General
- Your guide to phase two consultation
- Why does London need the Thames Tunnel?
- Feedback form
- Equalities form
- Customer overview leaflet

### Technical documents
- Air management plan
- Book of plans
- Code of construction practice
  - Part A: General requirements
- Consultation strategy and statement of community consultation
- Design development report
- Draft waste strategy
- Interim engagement report
- Needs Report
- **Phase two scheme development report**
  - Preliminary environmental information report
  - Report on phase one consultation
  - Site selection background technical paper
  - Site selection methodology paper

### Project information papers
- Build
- Changes
- Consultation
- Design
- Environment
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### Site information papers
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- Albert Embankment Foreshore
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- Beckton Sewage Treatment Works
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- Earl Pumping Station
- Falconbrook Pumping Station
- Greenwich Pumping Station
- Hammersmith Pumping Station
- Heathwall Pumping Station
- Jews Row
- King Edward Memorial Park Foreshore
- King George’s Park
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- Other works
- Putney Bridge Foreshore
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# Thames Tunnel

## Phase two scheme development report

### Part one: Main report

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F. King George’s Park
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K. Chelsea Embankment Foreshore
L. Kirtling Street (formerly Tideway Walk)
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N. Albert Embankment Foreshore
P. Victoria Embankment Foreshore
Q. Blackfriars Bridge Foreshore
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S. King Edward Memorial Park Foreshore
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U. Deptford Church Street (formerly Borthwick Wharf Foreshore)
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<td>combined sewer overflow</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
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<td>IPC</td>
<td>Infrastructure Planning Commission</td>
</tr>
<tr>
<td>PS</td>
<td>pumping station</td>
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<tr>
<td>SR</td>
<td>storm relief</td>
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<td>STW</td>
<td>sewage treatment works</td>
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<td>TBM</td>
<td>tunnel boring machine</td>
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1 Executive summary

1.1 Purpose of this report

1.1.1 This report is the *Phase two scheme development report* and sets out the work we have undertaken since phase one consultation, which commenced in September 2010 and ran through until January 2011. It describes how the scheme has evolved in the intervening period and how we have used the responses we received from the phase one consultation, alongside ongoing engineering scheme design work and information on changes in circumstances, to update the proposals that we are publicising during our phase two consultation period.

1.1.2 The appendices to this report include a detailed account of the site selection process for each of the phase two consultation preferred sites.

1.2 The Thames Tunnel project in context

1.2.1 The Thames Tunnel project is a linear infrastructure scheme, of which the primary objective is to control discharges from 34 of the most unsatisfactory combined sewer overflows (CSOs) into the River Thames, in order to meet EU and UK Government legal requirements.

1.2.2 The combined sewage (which is sewage combined with rainwater) that currently flows directly into the River Thames from CSOs would be captured and stored in the main tunnel and connection tunnels. The flows would then be transported along the tunnel, from west London to Abbey Mills in east London. From Abbey Mills, the flows would continue the journey via the Lee Tunnel to Beckton Sewage Treatment Works, where they would be treated when capacity exists.

1.2.3 The preferred route of the main tunnel would be approximately 25km long and will pass under the administrative areas of 14 London local authorities in order to intercept the identified CSOs.

1.2.4 Further details of the project’s technical requirements are provided in the *Site selection background technical paper*, available on the Thames Tunnel consultation website.

1.3 Outline of the site selection process up to phase one

1.3.1 A series of sites is required in order to build and operate the Thames Tunnel project. To determine the preferred scheme, a site selection process has been undertaken, using a methodology which was adopted after consultation on the proposed methods with the relevant local authorities and pan-London stakeholders. The *Site selection methodology paper* describes this in detail and is available on the Thames Tunnel consultation website.
The methodology for site selection is based on a rigorous and transparent process, which has been developed specially for the Thames Tunnel project to help us choose the most suitable construction sites. The site selection process is essentially a sieving exercise and consists of three main stages:

- **Long list**: Creation of a ‘long list’ of potential sites.
- **Short list**: Filtering the ‘long list’ by assessing engineering, planning, environmental, community and property considerations to form a ‘draft short list’. More detailed multidisciplinary assessment is then required to form a ‘final short list’.
- **Preferred sites**: Reviewing and assessing all ‘final short list’ sites, alongside tunnelling options, to produce the preferred sites and preferred route that make up the preferred scheme.

The site selection process was carried out in parallel with the development of a tunnelling strategy. The aim was to find the most effective tunnelling strategy to connect the main tunnel sites and CSO sites. Potential main tunnel sites were grouped into zones for this purpose. While sites were initially assessed on their individual merits, ultimately they had to be judged as a package of sites that would work together to allow construction of the tunnel.

Details of the site selection methodology and its application to the Thames Tunnel project is described in Section 3.

**What we did at phase one consultation**

At phase one consultation, we presented our preferred scheme, with the aim of ensuring that all consultees had an opportunity to understand and influence our proposals at an early stage. This included presenting 22 preferred site locations, and indicating which ones were required as main tunnel drive or reception sites and which ones were required as CSO interception sites. The other shortlisted options were also presented so that our site selection process was transparent to everyone. We set out for each site the engineering, planning, environmental, community and property issues raised and considered during our site selection work. Three options for the tunnel route were also presented, and the preferred route was identified as the Abbey Mills route.

Section 4 explains our approach to consulting on our phase one preferred scheme, and the outcomes of the phase one consultation are summarised (the full details of feedback are set out in the Report on phase one consultation).

The responses were analysed to identify key issues and themes. They were presented in terms of comments relating to the issue of need, the tunnel solution and the preferred route, as well as site specific feedback.

The detailed responses for each site are also discussed in the relevant site appendices to this report.

The responses we received to phase one consultation are an important part of our continuing scheme development. The feedback people gave...
us on the scheme allowed us to further examine and test our approach to all sites, which informed how the scheme developed up until the start of phase two consultation.

### 1.5 How the scheme has been developed since phase one

1.5.1 We needed to develop the scheme following phase one consultation to take into account, where possible and appropriate, further engineering work indicating different technical requirements, new information and changes in circumstances for sites or the tunnel route, and/or the comments and suggestions we received from the consultation process. Section 5 examines these considerations and lists the outcomes for each site.

1.5.2 In terms of ongoing engineering progress, key developments include:

- only 18 of the 34 CSOs are now required to be directly intercepted by the tunnel (the remainder will be controlled by other measures) – at phase one consultation we had concluded that 21 CSOs would need to be controlled via direct interception
- river transport constraints between Putney Bridge and Hammersmith Bridge have influenced the consideration of a double drive site in this area
- drive sites in London Clay now no longer require such large site areas
- further work has found that a larger diameter tunnel than initially proposed is required at the western end to meet the flow and storage requirements of the tunnel.

1.5.3 Additional work by the engineering team which has fed into this process includes more detailed engineering studies into some scheme components: ‘System master planning’ to consider the overall sewage system operations; construction, transport and river logistics studies; and field investigations and survey work.

1.5.4 We have monitored the sites to establish whether there have been any changes in circumstances. Such changes might include the grant of planning permission, the start of redevelopment work on a site, changes in planning policy, new survey information or site acquisitions. Examples of sites where changes have occurred include Bell Lane Creek and Chambers Wharf.

1.5.5 The consultation feedback has been analysed by all disciplines (engineering, planning, environment, community and property) to evaluate how we can respond to the key issues raised. With regard to site specific issues, we considered making changes to the proposals based on phase one consultation feedback in the following ways:

- considering use of an alternative site in some cases
- investigating alternative technical solutions for some sites
- looking closely at what measures might be incorporated to address issues regarding the potential effects of the project across all sites.
1.5.6 With respect to the tunnel route, we took into account responses and concluded that the Abbey Mills option was still our preferred route.

1.5.7 Our site selection methodology includes provision for a targeted repeat of the site selection process if necessary: a process we have called back-checking. The back-check process was designed to allow us to revisit our preferred sites if necessary and examine them again in more detail to check whether or not they are still the best sites to use. In some cases where changes have occurred, this has triggered the back-check process. Back-checks have been carried out for 12 sites in total.

1.6 \textbf{Identification of the preferred scheme for phase two consultation}

1.6.1 Section 6 explains how scheme development work since phase one consultation has informed the identification of sites and the tunnelling strategy that makes up the phase two preferred scheme.

1.6.2 In order to allow decisions on the preferred scheme for phase two consultation to be made, a range of technical documents were produced and assessments were undertaken so that each site and tunnelling option could be analysed systematically in accordance with our methodology, namely:

- **Site suitability reports** – site suitability reports were completed for each new or amended site, assessing it in terms of its proposed use (e.g., as a main tunnel drive or reception site or CSO site). The site suitability reports explain the considerations taken into account by every discipline when assessing each site on its own merit.

- **Engineering options report** – an engineering options report was prepared to determine the various tunnelling drive options available to construct the main tunnel, in terms of linking one zone to the next. Long connection tunnel drive options were also considered.

1.6.3 This information was used to examine the following:

- **Main tunnel sites** – each of the sites contemplated for main tunnel drive or reception sites was considered, with the most appropriate site identified for each of the zones. Some of these sites are the same as those put forward at phase one consultation and some sites are new sites.

- **Analysis of main tunnel drive options** – tunnelling drive options were compared and evaluated to arrive at the preferred drive option and hence a set of preferred main tunnel sites.

- **CSO sites** – each CSO was examined in relation to the principal requirements for that CSO and in order to identify the preferred CSO sites. Some CSO sites are the same as those put forward at phase one consultation and some sites are new sites. Where long CSO connection tunnels are required, regard was had to the most appropriate tunnelling drive option.
1 Executive summary

- **Preferred scheme** – the outcome of this process was the identification of a preferred scheme for phase two consultation.

1.6.4 A full set of appendices is attached to this report, and each appendix details the individual considerations for each preferred site and explains how decisions were made to select sites for our phase two preferred scheme.

1.6.5 A clear comparison of what has changed between phase one consultation and phase two consultation as a consequence of scheme development is provided in Table 1.1 below. Figure 1.1 shows the phase two preferred scheme.

**Table 1.1 Principal differences between phase one preferred scheme and phase two preferred scheme**

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<th>Site type</th>
<th>Preferred site name</th>
<th>Site type</th>
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<td>Acton Storm Tanks</td>
<td>CSO site; connection tunnel reception</td>
<td>Acton Storm Tanks</td>
<td>Main tunnel single reception site; CSO site</td>
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<tr>
<td>Hammersmith Pumping Station</td>
<td>Main tunnel reception site; CSO site; connection tunnel drive</td>
<td>Hammersmith Pumping Station</td>
<td>CSO site; connection tunnel drive to main tunnel</td>
</tr>
<tr>
<td>Barn Elms</td>
<td>Sequential main tunnel double drive site; CSO site</td>
<td>Barn Elms</td>
<td>CSO site; connection tunnel drive to main tunnel</td>
</tr>
<tr>
<td>Putney Bridge Foreshore</td>
<td>CSO site; connection tunnel drive to main tunnel</td>
<td>Putney Bridge Foreshore</td>
<td>CSO site; connection tunnel drive to main tunnel</td>
</tr>
<tr>
<td>Bell Lane Creek</td>
<td>CSO site; connection tunnel drive to main tunnel; connection tunnel drive to King George's Park</td>
<td>Dormay Street</td>
<td>CSO site; connection tunnel drive to Carnwath Road Riverside; connection tunnel drive to King George's Park</td>
</tr>
<tr>
<td>King George's Park</td>
<td>CSO site; connection tunnel reception</td>
<td>King George's Park</td>
<td>CSO site; connection tunnel reception</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>Carnwath Road Riverside</td>
<td>Main tunnel single drive/single reception site; connection tunnel reception</td>
</tr>
<tr>
<td>Jews Row</td>
<td>CSO site; connection tunnel drive to main tunnel</td>
<td>-</td>
<td>Technical solutions have removed the requirement for a CSO site at this</td>
</tr>
</tbody>
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<th>Site type</th>
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<td>Bridges Court Car Park</td>
<td>CSO site; connection tunnel drive to main tunnel</td>
<td>Falconbrook Pumping Station</td>
<td>CSO site; connection tunnel drive to main tunnel</td>
</tr>
<tr>
<td>Cremorne Wharf Foreshore</td>
<td>CSO site; drop shaft on line of main tunnel</td>
<td>Cremorne Wharf Depot</td>
<td>CSO site; connection tunnel drive to main tunnel</td>
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<td>Chelsea Embankment Foreshore (west of Chelsea Bridge)</td>
<td>CSO site; connection tunnel drive to main tunnel</td>
<td>Chelsea Embankment Foreshore (opposite Bull ring Gate)</td>
<td>CSO site; connection tunnel drive to main tunnel</td>
</tr>
<tr>
<td>Tideway Walk</td>
<td>Main tunnel single drive/single reception site; CSO site (two CSO interceptions)</td>
<td>Kirtling Street</td>
<td>Main tunnel concurrent double drive site</td>
</tr>
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<td>Albert Embankment Foreshore</td>
<td>CSO site (two CSO interceptions); access along the foreshore; connection tunnel drive to main tunnel</td>
<td>Albert Embankment Foreshore</td>
<td>CSO site (two CSO interceptions); connection tunnel drive to main tunnel</td>
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<td>Victoria Embankment Foreshore</td>
<td>CSO site; connection tunnel drive to main tunnel</td>
<td>Victoria Embankment Foreshore</td>
<td>CSO site; connection tunnel drive to main tunnel</td>
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<td>CSO site; drop shaft on line of main tunnel</td>
<td>Blackfriars Bridge Foreshore</td>
<td>CSO site; drop shaft on line of main tunnel</td>
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<td>Druid Street</td>
<td>CSO site; connection tunnel reception</td>
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<td>King’s Stairs Gardens</td>
<td>Main tunnel double reception site; two connection tunnel drives</td>
<td>Chambers Wharf</td>
<td>Main tunnel single drive/single reception site; one connection tunnel reception</td>
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<td>King Edward Memorial Park Foreshore</td>
<td>CSO site; connection tunnel drive to Butcher Row; all facilities in the</td>
<td>King Edward Memorial Park Foreshore</td>
<td>CSO site; no connection tunnel drive to Butcher Row; some facilities in the park;</td>
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<tr>
<td>Butcher Row</td>
<td>foreshore; drop shaft on line of main tunnel</td>
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<td>drop shaft on line of main tunnel</td>
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<tr>
<td></td>
<td>CSO site; connection tunnel reception</td>
<td>-</td>
<td>Technical solutions have removed the requirement for a CSO site at this location</td>
</tr>
<tr>
<td>Earl Pumping Station</td>
<td>CSO site; drop shaft on line of connection tunnel</td>
<td>Earl Pumping Station</td>
<td>CSO site; drop shaft on line of connection tunnel</td>
</tr>
<tr>
<td>Borthwick Wharf Foreshore</td>
<td>CSO site; drop shaft on line of connection tunnel</td>
<td>Deptford Church Street</td>
<td>CSO site; drop shaft on line of connection tunnel</td>
</tr>
<tr>
<td>Greenwich Pumping Station</td>
<td>CSO site; connection tunnel reception</td>
<td>Greenwich Pumping Station</td>
<td>CSO site; connection tunnel drive</td>
</tr>
<tr>
<td>Abbey Mills Pumping Station</td>
<td>Main tunnel single drive site</td>
<td>Abbey Mills Pumping Station</td>
<td>Main tunnel single reception site</td>
</tr>
</tbody>
</table>
Figure 1.1 Phase two preferred scheme
1.7 Phase two consultation and the way forward

1.7.1 The preferred scheme is now the subject of our second phase of consultation with stakeholders and the public.

1.7.2 Phase two consultation forms an important part of our engagement and consultation process. It provides an opportunity for the public, landowners and pan-London consultees to consider the phase two preferred scheme and give us their comments. These comments will be used to further review and refine the Thames Tunnel proposal before we take the final scheme forward in our application for approval in 2012.
2 Introduction

2.1 Purpose of this report

2.1.1 We held our first phase of consultation on the need for the Thames Tunnel project, our preferred route and preferred sites from September 2010 to January 2011.

2.1.2 We are now undertaking our second phase of consultation and this report has been prepared to provide information on how the preferred scheme (including preferred sites) that we are now consulting on has been identified.

2.1.3 Since January 2011, we have reviewed comments from phase one consultation and feedback from ongoing engagement, undertaken further detailed engineering work and had regard to relevant changes in circumstances at specific sites. As a consequence, further work has been undertaken to ensure that the project can meet its required objectives (as described in the Needs Report), while minimising any potential adverse effects. This work has culminated in the identification of what is now referred to as the ‘phase two preferred scheme’.

2.1.4 The phase two preferred scheme contains a number of changes to the phase one preferred scheme, in terms of preferred sites and the associated tunnelling strategy. The changes are explained in full in Section 5 of this report and appendices A to W.

2.1.5 This Phase two scheme development report provides an overview of the development of the scheme up to the point of phase one consultation and an account of how the scheme has evolved since then. We are now seeking feedback on the phase two preferred scheme (as described in sections 5 and 6 of this report), including the new preferred sites. A range of information has been made available for phase two consultation, and the document entitled Your guide to phase two consultation lists each of the available documents and sources of information.

2.1.6 This report:

- summarises the site selection methodology and explains how this was applied
- summarises the outcomes of phase one consultation, explaining its relevance to the phase two preferred scheme
- explains the requirements for further scheme development work following phase one consultation
- provides details on how the phase two preferred scheme was identified, explaining the preferred sites, associated tunnel drives and main tunnel route that make up the scheme we are presenting for phase two consultation
- provides an account of how and why each of the preferred sites was chosen (refer to appendices).
2.1.7 The first part of the report explains how the phase one preferred scheme (which was the subject of our phase one consultation) was identified and consulted on. This information is included in order to provide the context for the post phase one scheme development work described in Section 5 and the identification of the phase two preferred scheme, as described in Section 6.

2.1.8 This report has been prepared in order to explain the development of the project leading up to phase two consultation. It has been prepared for both a technical and non-technical audience and, for that reason, an executive summary and series of separate site selection appendices for each individual site have been prepared as part of this report. This will allow non-technical readers to access relevant information more readily.

2.2 Background

2.2.1 London’s sewer system was designed in the 1800s to handle wastewater and runoff rainwater through a combined collecting system. Combined sewer overflows (CSOs) were incorporated into the sewer system as relief structures to prevent flooding caused by sewer overloading, especially during periods of heavy rainfall.

2.2.2 The capacities originally allowed for in the interceptor and combined sewer systems designed by Sir Joseph Bazalgette in the 1850s (and subsequently extended), have now been substantially exceeded. This results in frequent and substantial discharges into the River Thames. Currently, overflows from the sewers to the Thames Tideway (being the tidal reaches of the River Thames) occur more than 50 times per year at the most frequently overflowing CSOs.

2.2.3 There is a need to reduce these incidents in order to comply with the EU Urban Waste Water Treatment Directive (UWWTD) and the related UK Urban Waste Water Treatment Regulations (UWWTR), and for Thames Water to implement the UK Government’s request for solution.

2.2.4 The Thames Tunnel project, in conjunction with the Lee Tunnel and upgrades to London’s sewage treatment works, has been determined (by independent studies and confirmed by Thames Water) to be the best technological solution and most cost-effective means to deal with the discharges, and to meet the regulatory requirements.

2.3 The Thames Tunnel project

2.3.1 The Thames Tunnel project is a linear infrastructure scheme, of which the primary objective is to capture discharges from 34 of the most unsatisfactory CSOs discharging into the River Thames, in order to meet EU and UK Government legal requirements.

2.3.2 The combined sewage (which is sewage combined with rainwater) that currently flows directly into the River Thames from CSOs would be captured and stored in the main tunnel and connection tunnels. The flows would then be transported along the tunnel, from west London to Abbey Mills in east London. From Abbey Mills, the flows would continue the
journey via the Lee Tunnel to Beckton Sewage Treatment Works, where they would be treated when capacity exists.

2.3.3 The preferred route of the main tunnel would be approximately 25km long and will pass under the administrative areas of 14 London local authorities in order to intercept the identified CSOs.

2.3.4 To determine the preferred scheme, a site selection process has been undertaken, using a methodology which was adopted after consultation on the proposed methods with the relevant local authorities and pan-London stakeholders. The Site selection methodology paper describes this in detail and is available on the Thames Tunnel consultation website.

2.3.5 Further details of the project’s technical requirements are provided in the Site selection background technical paper, also available on the Thames Tunnel consultation website.

2.4 Report structure

2.4.1 This report is divided into the following sections:

- **Section 3: The site selection process up to phase one consultation.** This explains the principles behind the site selection process and summarises how the phase one preferred sites and route were identified.

- **Section 4: Phase one consultation.** This summarises the approach to phase one consultation and its outcomes.

- **Section 5: Scheme development following phase one consultation.** This explains how and why scheme development work has taken place since phase one consultation.

- **Section 6: Phase two preferred scheme.** This details the outcomes from scheme development work since phase one consultation which has led to the identification of our phase two preferred scheme, with reference to the tunnelling strategy and preferred sites that make up the scheme.

- **Section 7: Conclusions and way forward.** This provides a summary of the preferred scheme to be taken forward to phase two consultation and an overview of the way forward.
3 The site selection process up to phase one consultation

3.1 Introduction

3.1.1 This section outlines our approach to site selection and provides an overview of how the site selection process was applied up to phase one consultation. This information is included in order to explain the process we used to identify our preferred sites for phase one consultation, and to provide the context for the scheme development work subsequently undertaken to arrive at the phase two preferred scheme described later in this report.

3.1.2 While this section focuses on an explanation of how the phase one preferred sites were identified, the principles and approach described remain valid for further site selection work undertaken since phase one consultation, as reported in sections 5 and 6.

3.2 The site selection methodology

3.2.1 A series of sites are required in order to build and operate the Thames Tunnel project. In order to advance the project, we prepared a Site selection methodology paper to set out the methodology to identify the sites required to construct and operate the tunnel infrastructure.

3.2.2 The Site selection methodology paper was the subject of two rounds of consultation (including workshops) in October 2008 and April 2009 with the potentially directly affected London local authorities and other strategic pan-London stakeholders. The general approach and the principles behind the methodology are broadly supported by these consultees.

3.2.3 The Site selection methodology paper was first published in May 2009 and most recently published in summer 2011. It draws upon best practice and reflects the principles and requirements of relevant planning policy and sustainability guidance. A multidisciplinary approach was used, drawing upon the technical knowledge and expertise of engineering, planning, environmental, community and property specialists.

3.2.4 In summary, the Site selection methodology paper comprises three main stages, which are set out below.

Stage 1

3.2.5 This stage comprises a site identification and filtering process, carried out in three main parts:

• 1A – the creation of a long list of potential sites
• 1B – the creation of a short list of potential sites
• 1C – the creation of a preferred list of sites.

1 It was published again in summer 2011 to include reference to a second phase of consultation not originally proposed. The amendments do not have any bearing upon the principles set out in the May 2009 version of the site selection methodology, and the agreed methodology has been followed.
Stage 2

3.2.6 This stage allows for public consultation on our preferred scheme.

3.2.7 The phase one public consultation was undertaken on a preferred scheme consisting of:
- a series of preferred CSO sites and main tunnel sites
- a preferred route; alongside
- other previously considered sites and routes.

3.2.8 Phase one consultation was undertaken between 13 September 2010 and 14 January 2011. It provided an opportunity to hear the views of communities living in the vicinity of any preferred or shortlisted sites, statutory consultees and any other interested parties across all three main tunnel routes.

3.2.9 A second phase of consultation (phase two) provides a further opportunity to seek views and reflects the fact that we have made a number of changes to the project, including the possible introduction of new preferred sites. Phase two consultation, which is now under way, is intended to ensure that consultees have a further opportunity to participate while options are still being considered and when it is still possible to influence the scheme.

3.2.10 Phase two consultation is broadly following the approach used for phase one consultation, with a series of staffed exhibitions held at venues as close as possible to the preferred sites. More detailed information on how preferred sites are likely to be used, and measures to overcome potential environmental effects, will be provided (as compared to the level of information provided at phase one consultation). Further details of our approach to consultation are set out in our Community consultation strategy and Statement of community consultation.

Stage 3

3.2.11 This stage comprises the final selection of sites and will include revisions to the preferred scheme, taking into account comments received during phase two consultation and any further technical work. It will culminate in the production of a final site selection report.

3.2.12 During the site selection process, if any of the main tunnel or CSO sites are eliminated or changed for any reason, a targeted repeat (back-check) of stages 1-3 will need to be undertaken, as appropriate, in order to fill in any site gaps.

3.2.13 A targeted repeat would be caused by, for example, there being significant changes of circumstances in relation to existing sites or combinations of sites, new or replacement sites being required or found, or the engineering design developing in unexpected ways.

3.3 Creation of the long list of sites (Stage 1A)

3.3.1 Generally, we defined ‘a site’ as an area for which boundaries were readily distinguished and defined. Professional judgement was used to determine
whether a site was itself potentially large enough to accommodate either a main tunnel site or CSO site, or could be linked with another site in order to perform that function. Regard was also had to practical river linkages.

**CSO sites**

3.3.2 The long list of CSO sites was created by conducting a desktop survey of the land either side of the existing sewers for the 34 worst performing CSOs, to identify potential sites of an appropriate size. The extent of the search varied at each CSO, depending on the sewerage system.

3.3.3 While it is preferable for CSO sites to be close to the sewer overflow being intercepted (to simplify construction and ease of making a connection to the main tunnel), some flexibility was introduced in order not to restrict the number of potential sites, given the need to identify sufficient sites to find the most suitable, in accordance with the criteria identified in our methodology. In this respect, no fixed distances between the CSO site and the interception of the sewer overflow were considered; instead, judgement was used to identify sites that could potentially be ‘reasonably connected’ to the sewer.

3.3.4 This process resulted in the identification of 373 potential sites on the long list of CSO sites (at this point, three potential tunnel routes were still under consideration).

**Main tunnel sites**

3.3.5 We created the long list of main tunnel sites by conducting a desktop survey of the land within the site search area, which extended from west London to Beckton Sewage Treatment Works and 500 metres either side of the banks of the River Thames. This allowed us to identify sites that might be suitable for two categories of main tunnel sites:

- main tunnel drive sites
- main tunnel reception sites and intermediate sites (these were considered together as the size of site required is similar).

3.3.6 The site search area excluded London’s four World Heritage sites and existing housing within concentrated residential areas. This desktop exercise was conducted mainly by examining aerial photographs, Ordnance Survey maps and atlases.

3.3.7 This process resulted in 769 potential sites being identified on the long list of main tunnel sites (at this point, three potential tunnel routes were still under consideration). Sites on the long list were plotted on a geographical information system map. These sites were those that simply met physical main tunnel requirements and were not subject to any assessment of potential constraints at this stage.
3.4 Creation of the draft short list of sites (Stage 1B)

Assessment criteria

3.4.1 We assessed the potential main tunnel sites and CSO sites on the long list against the considerations and values set out in Table 2.2 of the Site selection methodology paper, under the headings of engineering, planning, environment, community and property. This allowed for a preliminary high-level assessment sufficient to determine which sites move from long list to draft short list.

3.4.2 Each criterion was gauged against broad indicative values:
- Red – negative or harmful – unlikely to be suitable
- Amber – moderate or restrictive conditions – likely to require mitigation
- Green – acceptable or positive – no significant constraints.

3.4.3 It should be noted that if a site is awarded a red value, this will not necessarily prevent a site proceeding to the next stage of assessment.

3.4.4 For the engineering considerations, we assessed the following:
- Site size
- Site features
- Availability of jetty/wharfage facilities and distance to river
- Means of access.

3.4.5 For CSO sites, we added an additional criterion to the Table 2.2 assessment entitled ‘Location (proximity to sewer to be intercepted)’ in order to take account of whether the interception was within, adjacent or remote from the CSO site.

3.4.6 For the planning and environmental considerations, we assessed the following:
- Heritage designation
- Landscape/townscape designation
- Open space
- Ecological designation.

3.4.7 For the community and property criteria, we assessed the following:
- Neighbouring land uses
- Existing or designated use of site
- Special land and Crown land
- Acquisition costs.

Results of assessment of the long list of sites

3.4.8 Following review and engineering design developments affecting site selection, we selected 109 out of 769 main tunnel sites and 152 out of 373
CSO sites for the draft short list (for the preferred scheme as presented at phase one consultation). Professional judgement was used in the application of planning, environmental, community and property considerations and emerging engineering design requirements, in order to determine whether or not a site should move from the long list to the draft short list of sites.

3.5 Creation of the short list of sites (Stage 1B)

Assessment criteria

3.5.1 The next part of the process comprised an assessment of sites on the draft short list against more detailed engineering, planning, environmental, community and property considerations, as set out in Table 2.3 of the Site selection methodology paper, using technical knowledge and professional judgment. This stage of the assessment built upon the information collected at draft short list assessment stage, focussing on more detailed considerations for each site and allowing for further refinement. This assessment was not intended to be exhaustive, and it was recognised that if further issues were identified as the project evolved, these would also be used for assessment and back-checking purposes.

3.5.2 For the engineering criteria, we assessed the following:
   - Site size
   - Distance and route to river
   - Availability of, or ability to create, jetty/wharfage facilities
   - Means of road/rail access – suitability and availability, including consideration of transport options for workers
   - Site features (ground conditions, geology, topography and other factors)
   - Site efficiency (ability to accommodate all requirements on one site and, if not, describe how facilities can be achieved via a combination of sites)
   - Tunnelling and system engineering requirements.

3.5.3 For the planning and environmental criteria, the following were assessed:
   - Planning applications/permissions relating to sites – eg, application expected, awaiting determination, unimplemented permission
   - Development plan (adopted London Plan, unitary development plan or local development framework) allocation or special policy considerations
   - Heritage designations – eg, archaeology priority areas, scheduled ancient monuments, historic parks and gardens, conservation areas, listed buildings
3 The site selection process up to phase one consultation

- Landscape/open space designations – eg, public open space, Metropolitan Open Land, other landscape/open space designations, informal/undesignated open space
- Ecological designation – eg, Sites of Special Scientific Interest, nature conservation/reserve designations, tree preservation orders
- Transport – eg, rights of way, other key transport routes
- Amenity – eg, neighbouring land uses and amenity considerations, such as sensitivity to noise, dust and other construction effects.

3.5.4 For the community criteria, we assessed the following:
- Proximity to sensitive receptors
- Social considerations
- Economic considerations
- Health considerations
- Equality considerations.

3.5.5 For the property criteria, we assessed the following:
- Ownership of site
- Tenant on site
- Estimated acquisition cost
- Crown land and special land
- Access and material transfer rights.

Results of assessment of the draft short list of sites

3.5.6 At the completion of this stage, and taking into account engineering design developments affecting site selection, we selected a total of 59 of 109 main tunnel sites and 77 of 152 CSO sites for the provisional short list of sites (for the preferred scheme as presented at phase one consultation).

3.5.7 Review of the main tunnel sites recommended for the provisional short list of sites showed that the majority of them are located on operational industrial land, which includes land occupied and in active use by warehouses and industrial wharves, followed by public open space and parkland. A much lower number were located on vacant land, construction plots or vacant industrial land. The remainder of the sites included sports grounds, playing fields, vacant wharves, riverside basins, general commercial land, foreshore, operational Thames Water sites and car parks.

3.5.8 Review of the CSO sites recommended for the provisional short list of sites showed that the majority are located on industrial land. A much lower number are located on land occupied by general commercial businesses and sites currently occupied by a pumping station. The remainder are located on parking areas, playgrounds, gardens, roads and public footpaths, hospital sites or on wooded areas.
3.5.9 The purpose of the Table 2.3 assessment was to identify those factors which would be considered likely to either prevent development from taking place or identify restrictions which would need to be addressed if a site were to be taken forward to the next stage, and to identify those sites which were least constrained and therefore most suitable for development. For example:

- In engineering terms, we considered a site to be least suitable for development as a main tunnel drive site if there was no wharfage available and access by road was severely restricted.

- In planning and environment terms, we considered a site to be least suitable for development if there were a number of designations with which the use of the site for the project would conflict and which could not be adequately resolved or mitigated.

- In property terms, a site was considered to be least suitable for development if it was in the ownership of the Crown or a public body for operational reasons, or if acquisition costs were likely to be excessive.

- In community terms, a site was considered to be least suitable for development if it was in close proximity to a number of sensitive receptors, such as residential properties and community facilities, which could be affected by development of the site.

Consultation on provisional short list of sites

3.5.10 Before finalising the short list of sites, we arranged a series of meetings with the potentially affected London local authorities and other pan-London statutory consultees to discuss the provisional short list. These were held between July and September 2009, and were undertaken to verify that no specific sites or general site location factors had been overlooked in the assessment process, and to seek confirmation, as far as possible, that the most appropriate sites had been identified for inclusion on the short list.

3.5.11 This consultation was undertaken on a confidential basis to avoid undue anxiety and potential blight within the local community. This approach accords with the Government’s 1999 Code of Practice on the Dissemination of Information.

3.5.12 Overall, there was general support from stakeholders for the implementation of the site selection methodology up to the provisional short list stage. There were areas of concern raised over the use of parks and open space for construction sites, and the impact of the proposals on regeneration opportunities and sites with planning permission. The use of foreshore areas was less well received by Port of London Authority and Environment Agency representatives, but more positively considered by the London local authorities due to the constraints of the urban environment.

3.5.13 All consultees supported the use of river transport, where feasible, for main tunnel sites. Some consultees queried why river transport could not be promoted for CSO sites in the same way as it is being for main tunnel
sites. Suggestions for the potential use of permanent works adjacent to or on the river as viewing areas were also raised by some local authorities, and this opportunity has been examined further.

3.5.14 At the majority of meetings, consultees were able to provide site specific comments for some or all of the shortlisted sites within their area. A number of consultees provided additional written comments following the meeting.

3.5.15 This local authority and stakeholder consultation process led to further refinements to the short list by removal of seven main tunnel sites and six CSO sites from the provisional short list (for the preferred scheme as presented at phase one consultation). These sites were generally removed either because they were no longer available as development had commenced (or was due to commence) on site, or because a number of stakeholders raised serious concerns about their suitability.

3.5.16 A further round of consultation on the provisional short list was also undertaken with potentially affected London local authorities and other pan-London statutory consultees between January and March 2010. The opportunity was taken to verify comments previously raised, and to update the information where appropriate. This process has further informed the selection of the preferred sites discussed in Section 6.

Results of assessment of the draft short list of sites

3.5.17 We selected 52 out of 109 main tunnel sites and 71 out of 152 CSO sites to arrive at our final short list, with an overall total of 123 sites (for the preferred scheme as presented at phase one consultation). Parallel design development activities had revised the number of CSOs requiring direct interception from 34 to 21.

3.6 Creation of the preferred list of sites (Stage 1C)

3.6.1 The preferred list of sites was created from a total of 123 shortlisted sites, which were split across 21 CSO sites and 11 main tunnel site zones (for the preferred scheme as presented at phase one consultation). This process involved the following stages, the first two of which occurred concurrently and the third of which brought together the findings of the first two stages:

- The suitability of all sites on the final short list were assessed in more detail in site suitability reports, which included inputs from planning, environment, community, property and engineering perspectives. The considerations taken into account in the site suitability reports are explained in further detail in appendices A to W.

- An engineering options report sets out tunnel drive options and CSO connection types, with regard to the availability and spacing of suitable main tunnel sites as well as to the potential for combined use of sites.

- Optioneering workshops were held to bring together the disciplines to discuss key factors from the site suitability reports and Engineering options report in order to agree which drive options and associated sites were preferred.
3.6.2 Selection of the phase one preferred sites was determined based on professional judgement, taking into account engineering, planning, environmental, community and property considerations set out in the Site selection methodology paper.

3.6.3 Comparisons between potential sites were made for each of the CSO locations to select the preferred CSO sites. These were discussed and recommendations were agreed at the optioneering workshops.

3.6.4 In tandem with the development of the preferred list of sites, we made comparisons by identifying ‘zones’ for the main tunnel sites (based on optimum tunnel drive lengths and other engineering requirements), in order to allow us to consider the most effective tunnelling drive strategy for connecting the main tunnel sites and the CSO sites. Comparisons between potential main tunnel drive sites, intermediate sites and reception sites were made to select the most suitable site within each discrete zone along the main tunnel (no drive option requires sites within all zones). Comparisons between tunnelling drive options were then made to select the preferred drive option. The sites associated with the zones of the preferred drive option were identified as the preferred main tunnel sites. These were discussed and recommendations were agreed at optioneering workshops.

3.6.5 Our approach to analysing tunnelling drive options and how it relates to the process used to identify suitable sites for the project is explained in more detail in Section 6.

3.6.6 The process described above to identify our preferred scheme for phase one consultation was reported in our Preferred scheme report and summarised in the Project Overview report published at phase one consultation.

**Main tunnel route selection**

3.6.7 The three main tunnel route alignments (River Thames route, Rotherhithe route and Abbey Mills route) considered are described in the Site selection background technical paper.

3.6.8 Three routes were consulted on at phase one consultation, with the Abbey Mills route presented as the preferred route. Analysis of the consultation feedback received concluded that the Abbey Mills route remains the preferred route. In summary, the Abbey Mills route has a number of advantages:

- It is the shortest route
- It is the least disruptive and most cost-effective option (delivering 20 per cent savings compared with the other two options), while still meeting all our environmental objectives
- It requires the least number of worksites
- It requires less tunnelling at depth through chalk in the east. This is more difficult and would bring greater health and safety issues.
The site selection process up to phase one consultation

Results of assessment of the final short list of sites

3.6.9 The phase one preferred scheme is presented in Figure 3.1 and comprised:

- Abbey Mills as our preferred route for the main tunnel.
- The selection of 21 preferred sites out of 123 shortlisted sites, made up of two main tunnel sites, three combined main tunnel and CSO sites and 17 CSO sites.

3.6.10 The route would terminate at Abbey Mills, where flows would continue via the Lee Tunnel for treatment at Beckton Sewage Treatment Works. This preferred scheme was put forward for further ongoing engagement and phase one consultation. The opportunity was also provided at phase one consultation for consultees to comment on those shortlisted sites and tunnel routes that were not selected as preferred sites and route, but were considered as potential alternatives.

The back-checking process

3.6.11 It should be noted that the Site selection methodology paper explains how the methodology allows us to revisit the site selection process and undertake a back-check if any site is eliminated for any reason, or if there is a significant change in circumstance or development in the engineering design. This process is described in further detail in Section 5, which explains how and why the back-check process was triggered.
3 The site selection process up to phase one consultation

Figure 3.1 Phase one preferred scheme
Phase one consultation on preferred route, main tunnel sites and CSO sites

4.1 Introduction

4.1.1 This section summarises the approach to and outcomes of phase one consultation. Full details of consultation are provided in the Report on phase one consultation. A summary is included here to provide the context for the scheme development work outlined in Section 5, particularly that undertaken in response to comments received during phase one consultation.

4.1.2 Prior to submitting an application for approval for the project, we wanted to understand the views of the community, landowners and technical consultees. Our phase one consultation provided the first opportunity in our multistage consultation strategy for us to hear the views of those key stakeholders. Our approach to consultation has regard to the Planning Act 2008 and reflects the good practice set out in the Department for Communities and Local Government’s Guidance on pre-application consultation (September 2009), and the Infrastructure Planning Commission guidance notes 1 (on pre-application stages) and 2 (on preparation of applications). Our Community consultation strategy and Statement of community consultation provide further details on our approach to consultation.

4.1.3 The overriding aim of phase one consultation was to ensure that all consultees had a chance to understand and influence our proposals at an early stage. This meant that:

- the local and strategic impacts and benefits of the project relating to river water quality and system capacity were explained, in order for all parties to form a clear view of the need for the Thames Tunnel project
- members of the public, across the route as a whole and in the vicinity of the preferred and shortlisted sites, were consulted in good time during the evolution of the project, enabling them to have a meaningful say and, where possible, to influence its development.

4.1.4 We launched our phase one consultation on 13 September 2010, for a period of 14 weeks, to 20 December 2010. We subsequently decided to extend this to a total of 18 weeks, and the consultation closed on 14 January 2011.

4.1.5 This section describes how we went about consulting on our preferred route, main tunnel sites and CSO sites, and how we analysed the responses we received. It sets out the main findings of the consultation process, how we have taken into account the comments we received, and the method used to feed back the results of this significant exercise to consultees in the detailed Report on phase one consultation.

4.2 Consultation activities

4.2.1 During phase one consultation, we consulted on the need for the Thames Tunnel project, the alternatives to a tunnel, our work so far to establish our
preferred scheme (including other shortlisted sites and routes considered),
engineering, planning, environmental, community and property issues
raised and considered during our site selection work, and our initial ideas
on the permanent structures after work is complete.

4.2.2 A range of preconsultation activities was undertaken to ensure that the
phase one consultation would be as effective as possible, and a variety of
activities were undertaken as a core part of our phase one consultation.
These are described in our Report on phase one consultation.

4.3 Review and analysis of consultation responses

4.3.1 Feedback was received from 2,869 unique consultees, comprising 2,815
community respondents, 30 technical consultees and 24 landowners.

4.3.2 The Report on phase one consultation includes our responses to the
issues raised by respondents during phase one consultation. As well as
explaining the process for analysing and identifying key themes arising,
we have undertaken further analysis to identify how these might influence
the development of the proposed scheme. This has involved the five
disciplines – engineering, planning, environment, community and property
– reviewing the key themes and issues, and evaluating their impact on our
proposals and how we could respond to them. The influence of
consultation responses on the phase two preferred scheme is explained
further in Section 5.

4.3.3 Our main findings in respect of need, solution and the preferred route were
that a majority of respondents consider it necessary to reduce the amount
of sewage entering the River Thames, although some were unclear or not
convinced that a tunnel is the most appropriate solution. There was
greater support for the Abbey Mills route compared to the other route
options we consulted on. We do not therefore propose to change our
preference for the Abbey Mills route.

4.3.4 With regard to site specific issues, and in response to the comments
received for our 22 preferred CSO and main tunnel sites, we identified a
need to consider making changes or improvements to some sites,
including:

- for some sites, investigating the potential to use an alternative site
- for some sites, investigating possible alternative technical solutions
- for all sites, incorporating measures to address the issues which have
  been raised concerning the potential effects of the project.

4.3.5 Detailed responses for each site are set out in the Report on phase one
consultation and are referred to as necessary in appendices A to W of this
report. The Report on phase one consultation is intended to form an
appendix to the full ‘consultation report’ as detailed in Infrastructure
Planning Commission Guidance Note 2 and required by the Planning Act
2008, which will accompany our application for approval for the Thames
Tunnel project in due course.

4.3.6 Before we make a final decision on the appropriateness of the alternative
sites or technical solutions, we want to receive feedback on our amended
proposals (our phase two preferred scheme) through our phase two consultation.
5 Scheme development following phase one consultation

5.1 Introduction

5.1.1 The primary purpose of this report is to explain how the scheme has developed since phase one consultation. This section sets out how the scheme has evolved and, in particular, how the scheme has been developed further to reflect the ongoing scheme design, new information received in relation to sites through consultation and changes in circumstances (the Phase two design development report provides further detail on how design issues have been addressed). This section also explains the back-checking exercise set out within our Site selection methodology paper and how and why this process has been used to search for new sites where scheme development work has required this.

5.1.2 Scheme development work has generally been undertaken for one of three reasons (or a combination of these reasons):

- ongoing engineering scheme design
- consultation feedback
- changes in circumstances.

5.1.3 This section explains the types of issues that arose under each of these headings and how/why the back-checking process was used to review the suitability of sites in certain instances.

5.1.4 In particular, this report focuses on the scheme development work as it relates to preferred sites, and the tunnelling drive strategy (ie, tunnelling directions and implications for how the main tunnel sites are connected to one another).

5.2 Ongoing engineering scheme design

5.2.1 Throughout the development of the project, the engineering design has continued to proceed in parallel with the site selection process. It has always been recognised (as described in the Site selection methodology paper) that there is an iterative relationship between engineering design and site selection. As part of this iterative process, regard has been had to phase one consultation feedback and, wherever possible, ongoing engineering scheme design has sought to identify improved means of implementing the project.

5.2.2 Design development activities that have taken place since phase one consultation have included:

- architectural and landscape design work for above-ground features
- engineering designs and studies of various components of the scheme (for example, means of CSO interception, site size requirements, hydraulic studies, etc)
- ‘system master planning’ to define the sewage system operation changes and facilities needed to control and limit overflows from the scheme. Work has also addressed ventilation and odour design
• other work examining construction, transportation and river navigational logistics issues
• field investigations, including ground investigations and surveys.

5.2.3 In particular, the following design development work has influenced the sites and tunnelling strategy that make up the phase two preferred scheme:

• Developments in the design have reduced the number of the 34 CSOs controlled by the Thames Tunnel project by direct interception from 21 at phase one consultation to 18 at phase two consultation (meaning that 16 CSOs will now be intercepted indirectly). The remaining CSOs are able to be controlled by other measures as described in the Site selection background technical paper. This is described in more detail in relation to particular sites in Section 6.7.

• In terms of marine transport, the operations between Putney Bridge and Hammersmith Bridge are considered to be challenging, especially when servicing the peak tunnelling rates. In the upper reaches of the river beyond Putney Bridge, the presence of recreational users, such as rowers and small boats, presents a major hazard and risk to be considered when evaluating sites. Sites along this length of the Thames could be accessed and serviced but would require careful planning to mitigate the problems associated with navigational constraints. This is discussed in relation to the suitability of sites in zones S2 (Barn Elms) and S3 (Wandsworth Bridge) in Section 6.6.

• Further investigations have determined that the minimum size for a main tunnel drive site in areas where the geology is London Clay (the western section of the scheme) can be reduced to approximately 15,000m² by constraining certain activities and facilities. At phase one consultation, it was assumed to be 18,000m².

• Further work has been undertaken to investigate the hydraulic requirements of the western end of the tunnel. This has found that a larger diameter tunnel than initially proposed is required at the western end to meet the flow and storage requirements of the tunnel.

• Use of the River Lee for barge transportation has been further studied. Considering all currently available information, it is now thought to be unlikely to provide a reliable day-in, day-out means of barging throughout a sustained main tunnel construction period at the Abbey Mills Pumping Station site.

• Further work has been undertaken to determine the method and strategy for providing for odour and air management.

• System hydraulics have been studied in relation to the storage volume in the Greenwich Connection Tunnel.

• Further studies have enabled a better understanding of fluvial impacts, currents and sensitivities of construction in the river.
5.2.4 The above list, although not exhaustive, sets out some of the engineering design factors that influenced the sites and tunnelling strategy that make up the phase two preferred scheme.

5.3 Phase one consultation feedback

5.3.1 Feedback from phase one consultation has also played an important part in terms of influencing the phase two preferred scheme. We have analysed all responses received to identify how these might influence the development of the proposed scheme. This analysis has involved the five disciplines – engineering, planning, environment, community and property – reviewing the key themes and issues raised during phase one consultation, and evaluating their impact on our proposals and how we could respond to them.

5.3.2 Taking each of the issues into account, we have looked at ways in which we can reduce the effects identified. We have carefully considered the justification for keeping any of our proposals as originally presented.

5.3.3 We have always recognised the importance of introducing measures to reduce the effects of our proposals, and the feedback received, together with the more detailed environmental information that we are collecting, has helped to guide our further work. In order to mitigate/reduce the effects of our works, we have undertaken further design development and environmental assessment work, and/or proposed amendments to the nature or extent of the works.

5.3.4 We have given careful consideration to the comments received on the preferred sites presented at phase one consultation and also comments received on other shortlisted sites. In response to new information received through consultation, we have considered making changes or improvements to some sites, including:

- for some sites, investigating the potential to use an alternative site
- for some sites, investigating possible alternative technical solutions
- for all sites, incorporating measures to address the issues which have been raised concerning the potential effects of the project.

Interim engagement between phase one and phase two consultation

5.3.5 Where further work was required to investigate the suitability of preferred sites or potential alternative sites, we sought to engage with community consultees, technical consultees and landowners on potential changes for these sites, and the feedback from engagement has been considered as part of the selection of sites for phase two consultation. It should be noted that the process of informal engagement is supplementary to the process of formal consultation.

5.3.6 For community consultees, we used a range of methods, including:

- community liaison meetings – presentations to local community groups
5.3.7 At the community liaison meetings and drop-in sessions, comment cards were made available. These provided those attending with an opportunity to express their views on the alternatives we are considering, and provide information that we should consider as we develop our proposals. This feedback has fed in to the decisions made on the suitability of sites as reported in Section 5 and appendices A to W. An Interim engagement report has been prepared and is available as part of this phase two consultation.

5.4 Changes in circumstances

5.4.1 We recognise that, during the course of the site selection and consultation processes, circumstances relating to particular sites may well change or new information on sites may become available. Our objective is to select the most suitable sites available at the time the project is to be constructed (securing them in advance, where appropriate), and we have ensured that our site selection process is flexible enough to take these changes on board.

5.4.2 The scheme development work has therefore had regard to new information and changes in circumstances since phase one consultation, where applicable. These changes have, in some cases, been the reason, or one of the reasons, for triggering the back-checking process described in Section 5.5. The types of change in circumstance that we have taken into account can generally be grouped under the following headings:

- Engineering – new information that has arisen through the ongoing engineering work described in Section 5.2
- Planning – granting of planning permissions for alternative schemes, lapsing of planning permissions on potential sites, site commencements, changes to planning policies and designations
- Environment – new survey information, new information obtained for the environmental impact assessment process, changes in designated sites.
- Community – any change in the community uses on or surrounding a site
- Property – commencement of development, new information as a result of land acquisition investigations on availability of sites.

5.4.3 Particular examples are as follows:

- Land adjoining Hammersmith Pumping Station – submission of a new planning application for the residential development on the site and changing the designation from employment zone to residential in the London Borough of Hammersmith and Fulham emerging Local Development Framework.
5. Scheme development following phase one consultation

- Availability of a new, previously unconsidered site (which had not previously been included on our long list) potentially suitable for interception of Frogmore Storm Relief – Bell Lane Creek CSO.
- Availability of Chambers Wharf as a potential alternative main tunnel site to King’s Stairs Gardens. This site was previously discounted as construction appeared to have commenced. However, the owner demolished the existing buildings, stopped work, then later put the site on the market.

5.5 Back-checking

5.5.1 In some (but not all) instances, scheme development work has resulted in a need for us to reconsider the suitability of particular sites identified as preferred sites for phase one consultation.

5.5.2 The Site selection methodology paper explains how the methodology allows us to revisit the site selection process and undertake a back-check if any site is eliminated for any reason, or if there is significant change in circumstance or development in the engineering design.

5.5.3 The site selection process prior to back-checking and the steps in the back-check process are outlined in Figure 5.1.

Figure 5.1 Overview of the back-check process

5.5.4 The process can be summarised as follows.

- Step one requires a decision to be made on whether there is a need to trigger the back-check process (which could be for any of the reasons set out in sections 5.2 to 5.4 above, or a combination of those
reasons). This process has to be undertaken for each of the sites identified at phase one consultation.

- Step two requires the back-check process to be scoped (ie, availability of potential sites to be determined) and at the end of step two, the project group will need to agree if there is sufficient scope (sites) and, if so, which ‘pool’, or group of sites, is to be reassessed in step three.

- Step three requires the five discipline teams to reassess the site under consideration by following stage 1 of the *Site selection methodology paper*. The findings of the reassessment will be discussed at an optioneering workshop and the teams will make recommendations on any new replacement sites and any necessary changes to the scheme, including any alterations to the main tunnel and connection tunnel strategy. The recommendations from step three will be fed into step four.

- In step four, the workshop recommendations will be considered and approved by the Thames Tunnel management team. Any agreed changes to the preferred sites and scheme will then require the Thames Tunnel project team to update relevant site selection documents and to consider if any further targeted consultations may be needed with relevant stakeholders (also refer to paragraphs 5.3.5 – 5.3.7).

5.5.5 We have used the back-check process in relation to the following phase one preferred sites:

- Acton Storm Tanks
- Hammersmith Pumping Station
- Barn Elms
- Bell Lane Creek
- Bridges Court Car Park
- Cremorne Wharf Foreshore
- Chelsea Embankment Foreshore
- Tideway Walk
- King’s Stairs Gardens
- King Edward Memorial Park Foreshore
- Borthwick Wharf Foreshore
- Greenwich Pumping Station.

5.5.6 The conclusions of the back-check process are presented and explained in Section 6 and appendices A to W.

5.6 **Summary**

5.6.1 Table 5.1 below summarises the implications of our scheme development work, as described in this section, for each of our phase one consultation
preferred sites. It should be noted that for each site we considered whether or not there was any additional information that would potentially trigger a back-check and we checked whether a site was also still in accordance with our design development for the scheme. Where there was no substantive new information or design changes to take into account we did not proceed any further with a back check.

5.6.2 The final recommendations for each site, following further site selection work and consideration of drive options, are presented in Section 6.

**Table 5.1 Phase one preferred sites: Implications of scheme development work**

<table>
<thead>
<tr>
<th>Site</th>
<th>Implications for the phase one preferred site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acton Storm Tanks</td>
<td><strong>Back-check required.</strong> We identified a need to consider whether the main tunnel should be extended to Acton Storm Tanks and whether this site is suitable as a main tunnel reception site. However it should be noted we still believe this is the most appropriate site to intercept the local CSO, which would be connected to the main tunnel by the use of the most suitable back-checked main tunnel site near to this site.</td>
</tr>
<tr>
<td>Hammersmith Pumping Station</td>
<td><strong>Back-check required.</strong> We still believe this is the most appropriate site to connect the local CSO to the main tunnel. However, instead of the main tunnel ending at Hammersmith Pumping Station, we identified a need to look at whether the main tunnel should be extended to Acton Storm Tanks. This would mean that a smaller CSO site would be required at Hammersmith Pumping Station for a shorter period of time (approximately three years), with potentially fewer effects and fewer permanent structures.</td>
</tr>
<tr>
<td>Barn Elms</td>
<td><strong>Back-check required.</strong> We still believe this is the most appropriate site to connect the local CSO to the main tunnel. We identified a need to review alternative sites from Hammersmith Bridge to Albert Bridge that could be used to construct the main tunnel. One site we decided to explore further was the Carnwath Road Riverside area. This would mean that a smaller CSO site would be required at Barn Elms for a shorter period of time (approximately two and half years), with potentially fewer effects and fewer permanent structures.</td>
</tr>
<tr>
<td>Putney Bridge Foreshore</td>
<td>We reviewed whether there was a need to undertake a back-check for this site and concluded that the back-check process should not be triggered. We still believe this is the most appropriate site to</td>
</tr>
<tr>
<td>Site</td>
<td>Implications for the phase one preferred site</td>
</tr>
<tr>
<td>-------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Bell Lane Creek</td>
<td><strong>Back-check required.</strong> A site in close proximity to the existing local CSO was put up for sale and could be used to intercept this CSO. Further work was identified as required in order to understand whether this site would be an appropriate alternative to our preferred site at phase one consultation.</td>
</tr>
<tr>
<td>King George's Park</td>
<td>We reviewed whether there was a need to undertake a back-check for this site and concluded that the back-check process should not be triggered. We still believe this is the most appropriate site to connect the local CSO to the main tunnel.</td>
</tr>
<tr>
<td>Jews Row</td>
<td>We have looked at alternatives to control flows that would remove the requirement for a CSO site to intercept flows at this location.</td>
</tr>
<tr>
<td>Bridges Court Car Park</td>
<td><strong>Back-check required.</strong> We identified a need to look at alternative sites for CSO interception, including Falconbrook Pumping Station, which is owned by Thames Water.</td>
</tr>
<tr>
<td>Cremorne Wharf Foreshore</td>
<td><strong>Back-check required.</strong> We identified a need for further work to investigate the potential to locate the access to our proposed works through the waste transfer facility rather than Cremorne Gardens, or to use an alternative site.</td>
</tr>
<tr>
<td>Chelsea Embankment Foreshore</td>
<td><strong>Back-check required.</strong> We identified a need to undertake further work to investigate the potential to use a land-based rather than foreshore site to intercept the existing local CSO and connect the northern Low Level Sewer No.1 to the main tunnel.</td>
</tr>
<tr>
<td>Tideway Walk</td>
<td><strong>Back-check required.</strong> We still believe that the Battersea area is the most appropriate for connecting the local CSOs to the main tunnel. Since we are exploring splitting the CSO and main tunnel site, the CSO site could be smaller, with fewer permanent structures. We still require a main tunnel site in the Tideway Walk area and identified a need to explore alternative options for this site.</td>
</tr>
<tr>
<td>Albert Embankment Foreshore</td>
<td>We reviewed whether there was a need to undertake a back-check for this site and concluded that the back-check process should not be triggered. We still believe this is the most appropriate site to connect the existing local CSOs to the main tunnel. We explored whether an alternative access via Lacks Dock would be possible.</td>
</tr>
<tr>
<td>Site</td>
<td>Implications for the phase one preferred site</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Victoria Embankment Foreshore</td>
<td>We reviewed whether there was a need to undertake a back-check for this site and concluded that the back-check process should not be triggered. We still believe this is the most appropriate site to intercept the existing local CSO and connect the northern Low Level Sewer No.1 to the main tunnel.</td>
</tr>
<tr>
<td>Blackfriars Bridge Foreshore</td>
<td>We reviewed whether there was a need to undertake a back-check for this site and concluded that the back-check process should not be triggered. We still believe this is the most appropriate site to intercept the existing local CSO and connect the northern Low Level Sewer No.1 to the main tunnel.</td>
</tr>
<tr>
<td>Druid Street</td>
<td>We have looked at alternatives to control flows that would remove the requirement for a CSO site to intercept flows at this location.</td>
</tr>
<tr>
<td>King’s Stairs Gardens</td>
<td><strong>Back-check required.</strong> We still believe we need a site in this general area. We identified a need to review whether there is an alternative site which could be used to construct the main tunnel. An opportunity arose for us to purchase Chambers Wharf, a previously shortlisted site, which we have done in conjunction with the property developers, St James Group Limited,</td>
</tr>
<tr>
<td>King Edward Memorial Park Foreshore</td>
<td><strong>Back-check required.</strong> We considered that there was a need to review the site layout, access arrangements and investigate potential options to connect the CSO to the main tunnel.</td>
</tr>
<tr>
<td>Butcher Row</td>
<td>We have looked at alternatives to control flows that would remove the requirement for a CSO site to intercept flows at this location.</td>
</tr>
<tr>
<td>Abbey Mills Pumping Station</td>
<td>We reviewed whether there was a need to undertake a back-check for this site and concluded that the back-check process should not be triggered. We still believe this is the most appropriate site as it is located within an existing Thames Water operational site.</td>
</tr>
<tr>
<td>Earl Pumping Station</td>
<td>We reviewed whether there was a need to undertake a back-check for this site and concluded that the back-check process should not be triggered. We still believe this is the most appropriate site to connect the existing local CSO to the main tunnel.</td>
</tr>
<tr>
<td>Borthwick Wharf Foreshore</td>
<td><strong>Back-check required.</strong> We identified a need to look at alternative sites for CSO interception and we investigated alternative sites for CSO interception.</td>
</tr>
</tbody>
</table>
5 Scheme development following phase one consultation

<table>
<thead>
<tr>
<th>Site</th>
<th>Implications for the phase one preferred site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greenwich Pumping Station</td>
<td><strong>Back-check required.</strong> We still believe this is the most appropriate site to connect the local CSO to the main tunnel. We are also considering ways in which the connection tunnel is constructed and have identified that a larger construction site may be required at this location.</td>
</tr>
</tbody>
</table>

5.6.3 Section 6 and the site selection appendices A to W set out the conclusions reached in respect of each of the above sites following scheme development work.
6 The preferred scheme (following phase one consultation and scheme development)

6.1 Introduction

6.1.1 The purpose of this section is to explain how, as a consequence of the scheme development work that has taken place since phase one consultation, we have arrived at the phase two preferred scheme. In particular, it sets out how our preferred sites, and the tunnel drive strategy that links those sites, have been identified.

6.1.2 Prior to phase one consultation, the Preferred scheme report was produced. Its purpose was to recommend, for phase one consultation, the preferred sites, associated tunnel drives and main tunnel route for the Thames Tunnel project. This section fulfils a similar purpose and sets out the preferred sites and tunnel drive option identified as a consequence of scheme development since phase one consultation. (NB. A ‘drive option’ sets out the way main tunnel sites along the route can be linked for the purposes of the tunnel boring machines that will construct the tunnel).

6.1.3 It should be noted that scheme development has not affected the preferred main tunnel route. This remains the Abbey Mills route.

6.1.4 In order to explain how the preferred scheme, as put forward for phase two consultation, has been identified, the remainder of this section is split into the following sections:

- **Review and assessment of long list, draft short list and short list of sites** (Section 6.2). This summarises how individual sites were assessed in order to arrive at a short list.

- **Main tunnel site zones** (Section 6.3). This section sets out which zone each shortlisted site was assigned to.

- **Tunnel drive options** (Section 6.4). This details the various drive options available to construct the tunnel by linking a combination of available main tunnel zones to create a scheme that meets the project’s objectives.

- **Main tunnel sites** (Section 6.5). This identifies the main tunnel sites put forward as most suitable for each identified zone and summarises the rationale for their selection. Full details of the sites are provided in appendices A to W.

- **Analysis of main tunnel drive options** (Section 6.6). This describes how the various tunnelling drive options were evaluated, in terms of comparing suitability of sites used by different drive options in order to arrive at the preferred drive option and hence the preferred main tunnel sites.

- **CSO sites** (Section 6.7) This summarises the assessment of the sites identified as preferred for connection of each CSO to the main tunnel. Full details of the sites are provided in appendices A to W.
6 The preferred scheme

- **Analysis of CSO connection tunnel drive options** (Section 6.8). This explains the considerations taken into account for drive options associated with long CSO connection tunnels.

- **Phase two preferred scheme** (Section 6.9). This describes the sites, tunnelling drive option and route that make up the preferred scheme for phase two consultation.

6.1.5 Further information about the background and engineering requirements of the Thames Tunnel project can be found in the *Site selection background technical paper*.

6.2 **Review and assessment of long list, draft short list and short list of sites**

6.2.1 As explained in Section 4, we have revisited the site selection process and reassessed sites in certain areas through our back-check process. This involves repeating the relevant stages of the site selection process described in Section 3.

6.2.2 In order to be able to undertake a back-check for a specific site, it was necessary to revisit both the previous long list assessments (Table 2.2 of the *Site selection methodology paper*) and the previous draft short list assessments (Table 2.3 of the *Site selection methodology paper*). In addition to revisiting the previous assessments and verifying the findings against any new information received, any new sites not previously considered were assessed in accordance with the considerations set out in Tables 2.2 and 2.3.

6.2.3 Sites were included on the post phase one consultation long list and these were assessed to provide a post phase one consultation draft short list.

6.2.4 A short list of potential sites was then confirmed for each of the back-check sites.

6.2.5 For each shortlisted site, a site suitability report was prepared, as described in Section 3, and the recommendations within the reports were considered at a series of workshops alongside the drive options set out in the *Engineering options report – Abbey Mills route*.

6.2.6 Following the back-check process the number of sites on the various lists were:

- long list: 770 main tunnel sites and 367 CSO sites
- draft short: 120 list main tunnel sites and 148 CSO sites
- final short list: 53 main tunnel sites and 57 CSO sites.

6.3 **Main tunnel site zones**

6.3.1 Prior to phase one consultation, an engineering options report was prepared in accordance with the *Site selection methodology paper*. It considered how sites work in combination, and options for main tunnel alignment and CSO connections.
6.3.2 The Abbey Mills route was identified as the preferred route in the *Preferred scheme report*, prepared prior to phase one consultation and, following phase one consultation, remains the preferred route.

6.3.3 A second engineering options report, *Engineering options report – Abbey Mills route*, has been prepared, as part of the process of scheme development following phase one consultation, to consider the engineering drive options available to construct the main tunnel on the Abbey Mills route in the light of potential changes to main tunnel sites.

6.3.4 These ‘drive options’ were considered, taking account of the shortlisted sites available following the back-checking process.

6.3.5 The *Engineering options report – Abbey Mills route* is set out in two main parts, which consider:

- Part one: System design and engineering requirements
- Part two: Main tunnel and connection tunnel drive options.

6.3.6 The *Engineering options report – Abbey Mills route* describes the control and interception of CSO flows, tunnel hydraulic requirements and system functional and operational requirements. It describes the geology along the route and the implications this has for construction of the tunnel, and the tunnel engineering and construction requirements and methods. Of particular importance, it makes clear that the spacing of main tunnel sites, and therefore number of main tunnel sites required, is influenced by:

- the tunnel boring machine types must be appropriate to the geological conditions expected
- the need to deliver the project efficiently and on time
- the risk of tunnel boring machine breakdowns/servicing requirements, and their severity and frequency, increases with the length of the drive
- the emergency egress of the construction workforce will become more difficult the longer the length of the drive.

6.3.7 As a result of these considerations, a number of concurrent main tunnel drives were identified as required to construct the main tunnel. The final decision on the number of tunnel boring machines, and hence the number of main tunnel sites, has been based on a balance between the type of tunnel boring machine appropriate to the ground, the available locations of main tunnel sites, geology, programme, environment, amenity, health and safety, risk, cost and procurement considerations.

6.3.8 The 53 main tunnel sites on the short list fell principally into two types of sites required to construct the main tunnel:

- main tunnel reception / intermediate sites only
- main tunnel drive sites (also suitable as reception / intermediate sites).

6.3.9 The characteristics of these site types are described in the *Site selection background technical paper*. Furthermore, each shortlisted site is described in detail, and its suitability for the proposed usage has been assessed and documented in its respective site suitability report.
6.3.10 To assess the total number of combinations of tunnel drive options, the shortlisted sites were grouped into a number of zones (as was done prior to phase one consultation and reported in the previous Engineering options report). This was based on the geographical proximity of sites. Figure 6.1 shows the main tunnel site zones identified (it should be noted that zones S8, S9 and S10 are not relevant to the Abbey Mills route, as they applied to the other two alternative routes previously under consideration and are not discussed further in this report).

![Diagram of main tunnel site zones]

**Figure 6.1 Main tunnel site zones**

6.3.11 Table 6.1 below identifies the shortlisted main tunnel sites within each zone and identifies the type of use for which they were assessed as being suitable. For each of these sites, the specific site suitability report contains a more detailed assessment.

**Table 6.1 Grouping of shortlisted main tunnel sites for the Abbey Mills route**

<table>
<thead>
<tr>
<th>Site zone</th>
<th>Site ID</th>
<th>Site name</th>
<th>Local authority</th>
<th>Site usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>S0</td>
<td>S01EG</td>
<td>Acton Storm Tanks</td>
<td>Ealing</td>
<td>reception</td>
</tr>
<tr>
<td></td>
<td>S02EG</td>
<td>Commercial units, Stanley Gardens</td>
<td>Ealing</td>
<td>reception</td>
</tr>
<tr>
<td></td>
<td>S03EG</td>
<td>Acton Park Industrial Estate</td>
<td>Ealing</td>
<td>reception</td>
</tr>
<tr>
<td></td>
<td>S04EG</td>
<td>Industrial units, Allied Way</td>
<td>Ealing</td>
<td>reception</td>
</tr>
<tr>
<td>S1</td>
<td>No shortlisted sites</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Site zone | Site ID | Site name | Local authority | Site usage
---|---|---|---|---
S2 | S17RD | Barn Elms | Richmond | • double drive  
• single drive  
• reception/intermediate
S3 | S18WH | Feathers Wharf | Wandsworth | • reception/intermediate
| S72HF | Fulham Depot, next to Wandsworth Bridge | Hammersmith and Fulham | • reception/intermediate
| S87HF | Carnwath Road Riverside | Hammersmith and Fulham | • single drive  
• reception/intermediate
S4 | No shortlisted sites | | | |
S5 | S61WH | Battersea Park | Wandsworth | • double drive with S92WH  
• single drive  
• reception/intermediate
| S68WH | Battersea Power Station | Wandsworth | • double drive  
• single drive  
• reception/intermediate
| S72WH | Kirtling Street with Cringle Street | Wandsworth | • spilt double drive with S93WH  
• spilt single drive with S93WH  
• spilt reception/intermediate with S93WH  
• reception/intermediate
S6 | S86WH | Post Office | Wandsworth | • spilt double drive with S80WH  
• spilt single drive with S80WH  
• reception/intermediate
| S92WH | Part of Battersea Power Station | Wandsworth | • double drive  
• single drive  
• reception/intermediate
| S93WH | Kirtling Street | Wandsworth | • double drive  
• single drive  
• reception/intermediate
| S94WH | Post Office Way | Wandsworth | • spilt single drive with S80WH  
• reception/intermediate
6.4 Tunnel drive options

6.4.1 This section of the report outlines the drive options identified as available, based on the use of zones as described above.

6.4.2 Section 6.5 (main tunnel sites) takes into account the suitability of potential sites within each drive option, in order to evaluate the relative merits of each potential drive option to arrive at a preferred scheme. The sequence of decisions to be made to arrive at a preferred scheme is as follows:

- Nine zones have been identified along the length of the Abbey Mills route.
- A series of potential drive options (as set out in this section) are identified based on these nine zones (drive options need to have regard to zones where a main tunnel site is an absolute requirement; for example, at the start –Zone S0 Acton – and end –Zone S11 Abbey Mills).
- The most suitable site within each zone is identified for main tunnel drive and reception sites. There may be zones where no suitable sites
are identified. This may be acceptable if having a site in that zone is not an absolute requirement.

- The drive options are evaluated using a series of comparisons, taking into account the relative suitability of one site compared to that within a neighbouring or alternative zone.
- The preferred drive option, and thus preferred sites, are identified.

### Main tunnel drive options

6.4.3 All the feasible drive options have been identified based on the potential number of tunnel boring machines required and the sites that they could be driven from and to. Based on the site zone grouping and the maximum and minimum drive lengths defined below, and for the reasons explained at paragraphs 6.3.10 and 6.3.11 above, either three or four tunnel boring machines would be needed to construct the main tunnel.

6.4.4 The list of feasible drive options was developed based on the following considerations (which are similar to those which were used to determine the drive options for the phase one preferred scheme):

- A construction period of six years.
- Theoretically, the maximum practical drive length has been estimated to be 12km.
- The minimum economic drive length is 3km because of the time and effort required to install and remove the tunnel boring machine.
- The types of site available in each zone (ie, whether they were suitable for a drive or reception site).
- The length of tunnel drives through different geological strata.
- It takes longer to construct the very deep shafts required in the Lambeth Group, Thanet Sand Formation or Chalk ground conditions, when compared to those in London Clay found in the western section of the tunnel. A diaphragm wall shaft is required in these areas (zones S5 Battersea to S11 Abbey Mills). London Clay is found in zones S0 Acton to S4 Lots Road.
- Distance between access points for operation and maintenance of the permanent works.
- Tunnel vertical alignment and gradient constraints.

6.4.5 The list of main tunnel drive options was considered in a series of preferred scheme optioneering workshops, which brought together representatives of the engineering, planning, environment, community and property teams to consider the merits and demerits of potential options. These workshops were based on those drive options established in the Engineering options report – Abbey Mills route. The list of potential main tunnel drive options presented to the optioneering workshops is included as

6.4.6 Table 6.2 below.
6.4.7 In order to interpret the various drive options set out in

6.4.8 Table 6.2, it may be helpful to consider the following description of the final option above, W3/E6:

- A site in Zone S0 Acton would be used to receive a tunnel boring machine from a site in Zone S3 Wandsworth Bridge.
- A site in Zone S3 Wandsworth Bridge would be used to drive a tunnel boring machine to a site in Zone S0 Acton.
- The same site at S3 Wandsworth Bridge would also be used to receive a tunnel boring machine from the other direction, from a drive site in Zone S5 Battersea.

---

**Table 6.2 Main tunnel summary of drive options**

<table>
<thead>
<tr>
<th>Drive option</th>
<th>Zone</th>
<th>Acton</th>
<th>Barn Elms</th>
<th>Wandsworth Bridge</th>
<th>Battersea</th>
<th>Shad</th>
<th>Limehouse</th>
<th>Abbey Mills</th>
<th>Number of drive sites</th>
<th>Number of intermediate sites</th>
<th>Number of reception sites</th>
<th>Number of TBMs</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1/E1</td>
<td></td>
<td>r</td>
<td>d-r</td>
<td>-</td>
<td>d</td>
<td>d</td>
<td>r-r</td>
<td>d</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>W1/E2</td>
<td></td>
<td>r</td>
<td>d-r</td>
<td>-</td>
<td>d</td>
<td>d</td>
<td>r-d</td>
<td>r</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>W1/E3</td>
<td></td>
<td>r</td>
<td>d-r</td>
<td>-</td>
<td>d</td>
<td>d</td>
<td>r-r</td>
<td>-</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>W1/E4</td>
<td></td>
<td>r</td>
<td>d-r</td>
<td>-</td>
<td>d</td>
<td>d</td>
<td>r-d</td>
<td>-</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>W1/E5</td>
<td></td>
<td>r</td>
<td>d-r</td>
<td>-</td>
<td>r</td>
<td>d</td>
<td>r-r</td>
<td>-</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>W1/E6</td>
<td></td>
<td>r</td>
<td>d-r</td>
<td>-</td>
<td>d</td>
<td>r</td>
<td>d-r</td>
<td>-</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>W2/E1</td>
<td></td>
<td>r</td>
<td>d-d</td>
<td>-</td>
<td>r</td>
<td>d</td>
<td>r-r</td>
<td>-</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>W2/E2</td>
<td></td>
<td>r</td>
<td>d-d</td>
<td>-</td>
<td>r</td>
<td>d</td>
<td>r-d</td>
<td>-</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>W2/E3</td>
<td></td>
<td>r</td>
<td>d-d</td>
<td>-</td>
<td>r</td>
<td>d</td>
<td>r-d</td>
<td>-</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>W2/E4</td>
<td></td>
<td>r</td>
<td>d-d</td>
<td>-</td>
<td>r</td>
<td>d</td>
<td>r-d</td>
<td>-</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>W2/E5</td>
<td></td>
<td>r</td>
<td>d-d</td>
<td>-</td>
<td>r</td>
<td>r</td>
<td>d-r</td>
<td>-</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>W2/E6</td>
<td></td>
<td>r</td>
<td>d-d</td>
<td>-</td>
<td>r</td>
<td>r</td>
<td>d-r</td>
<td>-</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>W3/E1</td>
<td></td>
<td>r</td>
<td>-</td>
<td>d-r</td>
<td>d</td>
<td>d</td>
<td>r-r</td>
<td>-</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>W3/E2</td>
<td></td>
<td>r</td>
<td>-</td>
<td>d-r</td>
<td>d</td>
<td>d</td>
<td>r-r</td>
<td>-</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>W3/E3</td>
<td></td>
<td>r</td>
<td>-</td>
<td>d-r</td>
<td>d</td>
<td>d</td>
<td>r-r</td>
<td>-</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>W3/E4</td>
<td></td>
<td>r</td>
<td>-</td>
<td>d-r</td>
<td>d</td>
<td>d</td>
<td>r-r</td>
<td>-</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>W3/E5</td>
<td></td>
<td>r</td>
<td>-</td>
<td>d-r</td>
<td>d</td>
<td>d</td>
<td>r-r</td>
<td>-</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>W3/E6</td>
<td></td>
<td>r</td>
<td>-</td>
<td>d-r</td>
<td>d</td>
<td>d</td>
<td>r-r</td>
<td>-</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

**Legend:** The following nomenclature/legend is used in the table to define the types of site required in the defined zones. Where 'd' denotes drive site, 'r' denotes reception site and 'i' denotes intermediate site. The tunnel is driven from a 'd' drive location to a 'r' reception location and through an 'i' intermediate location.

**Table:**

<table>
<thead>
<tr>
<th>No site required</th>
<th>Single Reception</th>
<th>Double Reception</th>
<th>Intermediate</th>
<th>Drive and Reception</th>
<th>Single Drive</th>
<th>Double Drive</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>r</td>
<td>r-r</td>
<td>i</td>
<td>r-d</td>
<td>d</td>
<td>d-d</td>
</tr>
</tbody>
</table>
6. The preferred scheme

- A site in Zone S5 Battersea would be used to drive a tunnel boring machine to Zone S3 Wandsworth Bridge.
- The same site in Zone S5 Battersea would also be used to receive a tunnel boring machine from the other direction, from a drive site at Zone S7 Limehouse.
- A site in Zone S7 Limehouse would be used to drive a tunnel boring machine to a site in Zone S5 Battersea.
- The same site in Zone S7 Limehouse would also be used to receive a tunnel boring machine from the other direction, from a drive site in Zone S11 Abbey Mills.
- A site in Zone S11 Abbey Mills would be used to drive a tunnel boring machine to a site in Zone S7 Limehouse.

6.4.9 Table 6.2 lists the 18 potentially feasible drive options and shows that:
- all 18 options use four tunnel boring machines
- four options use four drive sites and one reception site, while 14 options use three drive sites and two reception sites
- all options require a main tunnel site in Zone S0 Acton, Zone S5 Battersea and Zone S11 Abbey Mills
- all options require a main tunnel site in either Zone S2 Barn Elms or Zone S3 Wandsworth Bridge
- all options require a main tunnel site in either Zone S6 Shad or Zone S7 Limehouse.

6.4.10 The potential requirement for a drive site or reception site in each zone is linked to the direction in which each section of the tunnel is to be constructed, i.e., the direction in which the tunnel boring machine will ‘drive’ the tunnel from one site (a drive site) to another (a reception site) and the maximum lengths of tunnel drive that can be achieved.

**CSO connection types and connection tunnel drive options**

6.4.11 Some CSO drop shafts are proposed to be directly on the line of the main tunnel and therefore do not require a connection tunnel. All other CSOs will require a connection tunnel to make the connection to the main tunnel. (Table 6.3 identifies which CSOs are online and which require a connection tunnel, and sets out the CSO connection type.) In most instances, these connection tunnels are relatively short and are proposed to be driven from the CSO site. In a few instances, there are drive options associated with connection tunnels, as set out below.

6.4.12 *The Engineering options report – Abbey Mills route* discusses five possible different connection types which have been identified for connecting the existing CSO sewers to the main tunnel. In practice, four connection types were considered. In summary, these are as follows:
• **Type A CSO connection type**: Used where a connection tunnel is required to connect to the main tunnel via a shaft on the main tunnel.

• **Type B CSO connection type**: Used where a connection tunnel is required between the CSO interception point and the main tunnel, and where the main tunnel is located in competent ground, such as London Clay, so that a direct tunnel-to-tunnel connection can be made.

• **Type C CSO connection type**: Used where two or more CSOs are intercepted and brought together before being connected to the main tunnel, either directly or at a main tunnel shaft.

• **Type E CSO connection type**: Used where the CSO interception point can be connected directly to a shaft located on the line of the main tunnel.

### Table 6.3 CSO sites and connection types

<table>
<thead>
<tr>
<th>CSO ref</th>
<th>CSO name</th>
<th>CSO site name</th>
<th>Connection type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS01X</td>
<td>Acton SR</td>
<td>Acton Storm Tanks</td>
<td>E</td>
<td>Connection culvert to main tunnel shaft</td>
</tr>
<tr>
<td>CS04X</td>
<td>Hammersmith PS</td>
<td>Hammersmith Pumping Station</td>
<td>B</td>
<td>Connection tunnel to main tunnel</td>
</tr>
<tr>
<td>CS05X</td>
<td>West Putney SR</td>
<td>Barn Elms</td>
<td>B</td>
<td>Connection tunnel to main tunnel</td>
</tr>
<tr>
<td>CS06X</td>
<td>Putney Bridge</td>
<td>Putney Bridge Foreshore</td>
<td>B</td>
<td>Connection tunnel to main tunnel</td>
</tr>
<tr>
<td>CS07A</td>
<td>Frogmore SR - Bell Lane Creek</td>
<td>Dormay Street</td>
<td>C</td>
<td>Connection tunnel drive options, see Table 6.4</td>
</tr>
<tr>
<td>CS07B</td>
<td>Frogmore SR - Buckhold Rd</td>
<td>King George’s Park</td>
<td>C</td>
<td>Connection tunnel drive options, see Table 6.4</td>
</tr>
<tr>
<td>CS09X</td>
<td>Falconbrook PS</td>
<td>Falconbrook Pumping Station</td>
<td>B</td>
<td>Connection tunnel to main tunnel</td>
</tr>
<tr>
<td>CS10X</td>
<td>Lots Road PS</td>
<td>Cremorne Wharf Depot</td>
<td>B</td>
<td>Connection tunnel to main tunnel</td>
</tr>
<tr>
<td>CS14X</td>
<td>Ranelagh</td>
<td>Chelsea Embankment Foreshore (opposite Bull Ring Gate)</td>
<td>B</td>
<td>Connection tunnel to main tunnel</td>
</tr>
<tr>
<td>CS16X</td>
<td>Heathwall PS</td>
<td>Heathwall Pumping Station</td>
<td>B</td>
<td>Connection tunnel to main tunnel</td>
</tr>
<tr>
<td>CS17X</td>
<td>South West SR</td>
<td>Heathwall Pumping Station</td>
<td>B</td>
<td>Connection tunnel to main tunnel</td>
</tr>
<tr>
<td>CS19X &amp; CS20X</td>
<td>Clapham SR &amp; Brixton SR</td>
<td>Albert Embankment Foreshore</td>
<td>B</td>
<td>Connection tunnel to main tunnel</td>
</tr>
<tr>
<td>CS22X</td>
<td>Regent St</td>
<td>Victoria Embankment Foreshore</td>
<td>B</td>
<td>Connection tunnel to main tunnel</td>
</tr>
</tbody>
</table>
6. The preferred scheme

<table>
<thead>
<tr>
<th>CSO ref</th>
<th>CSO name</th>
<th>CSO site name</th>
<th>Connection type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS27X</td>
<td>Fleet Main</td>
<td>Blackfriars Bridge Foreshore</td>
<td>E</td>
<td>Main tunnel driven through CSO drop shaft</td>
</tr>
<tr>
<td>CS29X</td>
<td>North East SR</td>
<td>King Edward Memorial Park Foreshore</td>
<td>A or E</td>
<td>Connection options, see Table 6.4</td>
</tr>
<tr>
<td>CS31X</td>
<td>Earl PS</td>
<td>Earl Pumping Station</td>
<td>C</td>
<td>On line of Greenwich Connection Tunnel</td>
</tr>
<tr>
<td>CS32X</td>
<td>Deptford SR</td>
<td>Deptford Church Street</td>
<td>C</td>
<td>On line of Greenwich Connection Tunnel</td>
</tr>
<tr>
<td>CS33X</td>
<td>Greenwich PS</td>
<td>Greenwich Pumping Station</td>
<td>C</td>
<td>Connection tunnel drive options, see Table 6.5</td>
</tr>
</tbody>
</table>

NB. Details of the various connection types A-E are provided in the Engineering options report – Abbey Mills route

6.4.13 In addition to the main tunnel drive options, it was necessary to consider some connection tunnel drive options as follows:

- A connection tunnel associated with a Type C connection bringing together flows from the Frogmore Storm Relief – Bell Lane Creek (CSO7A) CSO and Frogmore Storm Relief – Buckhold Road (CSO7B) CSO before connection to the main tunnel.
- A connection tunnel associated with a Type C connection bringing together flows from the Greenwich Pumping Station (CS33X) CSO, Deptford Storm Relief (CS32X) CSO and Earl Pumping Station (CS31X) CSO before connection to the main tunnel.
- Type A or Type E connection options for the North East Storm Relief CSO interception.

6.4.14 The drive options for the above connection tunnels are presented below.

**Frogmore Connection Tunnel**

6.4.15 Table 6.4 presents the list of Frogmore Connection Tunnel drive options to be taken forward to the next stage of the site selection process for multidisciplinary consideration.
Table 6.4 Frogmore Connection tunnel – drive options

<table>
<thead>
<tr>
<th>Connected directly to the main tunnel</th>
<th>CSO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frogmore SR - Buckhold Road</td>
</tr>
<tr>
<td>Connection tunnel drive option</td>
<td></td>
</tr>
<tr>
<td>FA</td>
<td>d</td>
</tr>
<tr>
<td>FB</td>
<td>r</td>
</tr>
<tr>
<td>FC</td>
<td>d</td>
</tr>
<tr>
<td>FD</td>
<td>r</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Connected to the Zone S3 main tunnel shaft</th>
<th>CSO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frogmore SR - Buckhold Road</td>
</tr>
<tr>
<td>Connection tunnel drive option</td>
<td></td>
</tr>
<tr>
<td>FE</td>
<td>d</td>
</tr>
<tr>
<td>FF</td>
<td>d</td>
</tr>
<tr>
<td>FG</td>
<td>d</td>
</tr>
<tr>
<td>FH</td>
<td>r</td>
</tr>
<tr>
<td>FI</td>
<td>r</td>
</tr>
<tr>
<td>FJ</td>
<td>r</td>
</tr>
</tbody>
</table>

**Legend:** The following nomenclature/legend is used in the table to define the types of site required. Where 'd' denotes drive site, 'r' denotes reception site and 'through' denotes the tunnel drives through a CSO drop shaft (ie, similar to 'i' an intermediate site).

<table>
<thead>
<tr>
<th>Single reception</th>
<th>Single drive</th>
<th>Intermediate</th>
<th>Sequential double drive</th>
</tr>
</thead>
<tbody>
<tr>
<td>r</td>
<td>d</td>
<td>i</td>
<td>d then d</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Double reception</th>
<th>Drive and reception</th>
<th>Tunnel drive through CSO drop</th>
<th>Consecutive double drive</th>
</tr>
</thead>
<tbody>
<tr>
<td>r-r</td>
<td>r-d</td>
<td>through</td>
<td>d-d</td>
</tr>
</tbody>
</table>

**Greenwich Connection Tunnel**

6.4.16 The potentially feasible drive options for the Greenwich Connection Tunnel are presented in Table 6.5 below. All of the Greenwich Connection Tunnel drive options connect to the main tunnel via a main tunnel shaft in Zone S6 Shad.

6.4.17 Table 6.5 also shows which main tunnel drive options each of the connection tunnel drive options is associated with, as they must be able to work in combination (these are explained in more detail in appendix V).
6.4.18 The site selection back-checking associated with North East Storm Relief CSO sites identified two feasible CSO connection types as follows:

- The King Edward Memorial Park Foreshore (C29XA) and King Edward Memorial Park (C29XB) shortlisted sites could be connected to the main tunnel via a CSO drop shaft constructed on the line of the main tunnel. This would be a Type E CSO connection and no connection tunnel would be required.

- The King Edward Memorial Park Foreshore (C29XA) and King Edward Memorial Park (C29XB) shortlisted sites could be connected to the main tunnel via a connection tunnel and an intermediate shaft located on one of the main tunnel site zone S7 Limehouse shortlisted sites. This would be a Type A CSO connection.

6.4.19 Table 6.6 presents the two NESR Connection Tunnel drive options associated with the Type A CSO connection to be taken forward to the next stage of the site selection process for multidisciplinary consideration.

### Table 6.6 North East Storm Relief Type A CSO connection tunnel – drive options

<table>
<thead>
<tr>
<th>CSO site/Zone</th>
<th>Main tunnel site zone: S7 Limehouse</th>
</tr>
</thead>
<tbody>
<tr>
<td>KEMP (C29XB)/KEMP Foreshore (C29XA)</td>
<td></td>
</tr>
<tr>
<td>Connection tunnel drive option</td>
<td></td>
</tr>
<tr>
<td>NA</td>
<td>d</td>
</tr>
<tr>
<td>NB</td>
<td>r</td>
</tr>
</tbody>
</table>
Summary

6.4.20 This section has summarised the main tunnel and connection tunnel drive options as presented in the Engineering options report – Abbey Mills route. The evaluation of these drive options is reported in sections 6.6 and 6.8. This involves considering the advantages and disadvantages of the individual sites identified as the most suitable for each zone under consideration. The next sections therefore focus on the suitability of potential main tunnel sites and CSO sites within each zone.

6.5 Main tunnel sites

6.5.1 Section 6.4 explains why it is necessary to consider how the potential main tunnel sites link together to form possible drive options for construction of the main tunnel. It describes how shortlisted main tunnel sites are assigned to particular zones, and that various combinations of zones and types of main tunnel site (drive or reception) can be identified as possible drive options, taking into account the system design and engineering requirements for the scheme. The most suitable site within each zone has been identified and this process is summarised in this section, and described in more detail in appendices A to W.

6.5.2 However, it should be noted that the scheme does not require sites within all nine zones. It requires a site within certain zones, some of which are fixed (ie, the zones at the beginning and end) and some of which can be compared against neighbouring zones, in order to choose the most suitable site within that broad location.

6.5.3 Each subsection below outlines the most suitable site within each of the different site zones. It should be noted that these do not represent the final preferred sites selected for phase two consultation, simply the most suitable site within that zone for the purpose of comparing drive options. In order to identify the most favourable means of constructing the main tunnel, the starting point is to choose a site within each zone so drive options based on these zones can be compared, in order to choose a workable and affordable scheme (drive option) with the least impact on the community and environment, and thus least conflict with planning policy.

6.5.4 Preferred sites can only be identified once the drive options have been evaluated in the context of available sites, as described in Section 6.6 below.

Zone S0 Acton

6.5.5 At phase one consultation, there was no Zone S0 Acton and so no preferred main tunnel site in this zone. At phase one consultation, we proposed a CSO site at Acton Storm Tanks which would have been connected to the main tunnel via a connection tunnel driven from the Hammersmith Pumping Station site. During scheme development work, we identified that the Hammersmith Pumping Station site was no longer available (refer also to Zone S1 Hammersmith below). For this reason, and those explained in Appendix A, the tunnelling strategy for the western end of the tunnel has been reviewed leading to a need to consider potential main tunnel sites at the western end of the tunnel.
6.5.6 C01YC remained our preferred site to intercept the Acton Storm Tanks CSO.

6.5.7 In order to identify a potential main tunnel site we defined a 500m area around the CSO site in order to create the new main tunnel Zone S0 Acton, ensuring that any potential site would be close enough to our preferred CSO site. We then commenced the back-check process for Zone S0 to determine whether there were any potential sites and, if so, their suitability. Based on currently available information no shortlisted main tunnel drive sites were identified.

6.5.8 We shortlisted four main tunnel reception/intermediate sites: S01EG/C01YC Acton Storm Tanks (an extension of our preferred CSO site), S02EG/C01YC Commercial units, Stanley Gardens, S03EG/C01YC Acton Park Industrial Estate and S04EG/C01YC Industrial units, Allied Way.

6.5.9 S01EG/C01YC Acton Storm Tanks was identified as the most suitable main tunnel reception site within Zone S0 Acton because it is a brownfield site, and it is already used and owned by Thames Water to temporarily store storm water flows in tanks when there is not enough capacity in the sewerage system. The site is large enough to intercept the CSO and receive the main tunnel from Carnwath Road Riverside.

6.5.10 Appendix A provides full details of the identification of the Acton sites.

**Zone S1 Hammersmith**

6.5.11 At phase one consultation, we identified S33HF Hammersmith Pumping Station and surrounding land as our preferred site for a main tunnel reception site in Zone S1 Hammersmith. This site was also proposed to be used to connect the local CSO to the main tunnel and drive a connection tunnel to Acton Storm Tanks.

6.5.12 However, during scheme development work, we identified that most of the area around the Hammersmith Pumping Station site was no longer available, due to the submission of a new planning application for residential development on the site and the reallocation of the site from employment use to residential use in the London Borough of Hammersmith and Fulham emerging *Local Development Framework*. It is understood that residential development is expected to proceed in the near future, meaning that this site should be excluded in accordance with the approach set out in our site selection methodology, which excludes residential areas.

6.5.13 We held discussions with the landowner of the site which concluded that the only viable option would be to use part of the site for CSO connection only, and not as a main tunnel reception site or drive site for the connection tunnel to Acton Storm Tanks.

6.5.14 The possibility of the main tunnel extending to Acton Storm Tanks (see Zone S0 Acton above) opened up the option of using this site only to intercept the local Hammersmith Pumping Station CSO.
6.5.15 As a result of the new planning application and change to the site allocation policy, we began a back-check to review the availability of a main tunnel drive site that could be used to drive the tunnel to Acton Storm Tanks from a location further east. Further engineering work determined that the size of a main tunnel drive site in areas of clay geology could be reduced from 18,000m² to 15,000m² by constraining certain activities and facilities. This allowed sites that had previously been dismissed as slightly too small to be reconsidered.

6.5.16 It was concluded that there was no site available to be used as a main tunnel site (drive or reception) in Zone S1 Hammersmith.

**Zone S2 Barn Elms**

6.5.17 At phase one consultation, S17RD Barn Elms was identified as the most suitable site in this zone (it was the only shortlisted site in this zone) and subsequently identified as a preferred site once the phase one drive options had been evaluated.

6.5.18 S17RD Barn Elms remains the most suitable site for this zone for the same reasons as identified previously. These include the opportunity to combine the main tunnel worksite with the CSO connection worksite, river access for transportation of materials, distance from residential properties and vehicular access to the local road network.

6.5.19 Further technical work meant that the tunnelling strategy for the western end of the tunnel had to be reviewed. This led to a need to reconsider potential main tunnel sites in Zones S1 Hammersmith to S4 Lots Road and to trigger the back-check process. Further engineering work also determined that the size of a main tunnel drive site in areas of clay geology could be reduced from 18,000m² to 15,000m² by constraining certain activities and facilities. This allowed sites that had previously been dismissed as slightly too small to be reconsidered.

6.5.20 The suitability of drive options reliant on this site is discussed further in Section 6.6. Not all drive options utilise a site in Zone S2 Barn Elms.

6.5.21 Appendix G provides full details of the identification of the Barn Elms site (alongside other potential sites within Zones S1 Hammersmith – S4 Lots Road).

**Zone S3 Wandsworth Bridge**

6.5.22 At phase one consultation, there were no sites identified as being suitable for use as a main tunnel drive site in Zone S3 Wandsworth Bridge. We identified two sites which would be suitable as main tunnel reception sites, but the phase one preferred tunnelling strategy meant this type of site was not required in this locality.

6.5.23 Further technical work meant that the tunnelling strategy for the western end of the tunnel had to be reviewed. This led to a need to reconsider potential main tunnel sites in Zones 1 Hammersmith to S4 Lots Road and to trigger the back-check process. Further engineering work also determined that the size of a main tunnel drive site in areas of clay geology could be reduced from 18,000m² to 15,000m² by constraining
certain activities and facilities. This allowed sites that had previously been dismissed as slightly too small to be reconsidered.

6.5.24 Through the back-check process, three sites were shortlisted: two main tunnel reception sites and one single main tunnel drive site within this zone. (The single main tunnel drive was previously two intermediate/reception sites that were combined to form one larger site.)

6.5.25 The shortlisted sites were S87HF Carnwath Road Riverside (which combines previous sites S69HF Trinidad Wharf and Industrial site, Carnwath Road and S70HF Industrial site, Carnwath Road), which was assessed as a potential main tunnel drive or reception site, S18WH Feathers Wharf which was assessed as a potential main tunnel reception site and S72HF Fulham Depot, which was also assessed as a potential main tunnel reception site.

6.5.26 S18WH Feathers Wharf was identified as the most suitable main tunnel reception site within Zone S3 Wandsworth Bridge. In summary, this was because it is a brownfield site within an industrial area.

6.5.27 S18WH Feathers Wharf is not, however, large enough to be a main tunnel drive site so S87HF Carnwath Road Riverside was identified as the most suitable main tunnel drive site within Zone S3 Wandsworth Bridge. In summary, this is because it is a brownfield site with river access and is a safeguarded wharf.

6.5.28 The suitability of drive options reliant on these sites is discussed further in Section 6.6. Not all drive options utilise a site in this Zone S3 Wandsworth Bridge.

6.5.29 Appendix G provides full details of the identification of the Carnwath Road Riverside site (alongside other potential sites within Zones S1 Hammersmith – S4 Lots Road).

**Zone S4 Lots Road**

6.5.30 At phase one consultation, there were no sites identified as being suitable for use as a main tunnel drive site in Zone S4 Lots Road. We identified two main tunnel reception/intermediate sites, but the phase one preferred tunnelling strategy meant that a main tunnel site was not needed in this locality.

6.5.31 Further technical work meant that the tunnelling strategy for the western end of the tunnel had to be reviewed. This led to a need to reconsider potential main tunnel sites in Zones S1 Hammersmith to S4 Lots Road and to trigger the back-check process. Further engineering work also determined that the size of a main tunnel drive site in areas of clay geology could be reduced from 18,000m² to 15,000m² by constraining certain activities and facilities. This allowed sites that had previously been dismissed as slightly too small to be reconsidered.

6.5.32 Through the back-check process, no sites were shortlisted in Zone S4 Lots Road. Therefore, there were no suitable sites for further consideration identified within this zone. For this reason, none of the drive options utilise a site within this zone.
Zone S5 Battersea

6.5.33 At phase one consultation, the most suitable site within this zone was S79WH/S80WH Tideway Walk and this was taken forward to consultation as a preferred site. This site was also to be used to connect two local CSOs to the main tunnel.

6.5.34 A main tunnel site is required in this zone to suit all of the drive options identified in Section 6.4. The distance between potential sites in this zone and the next set of potential sites to the east (Zone S6 Shad) is such that a main tunnel site in this zone is required to ensure maximum recommended tunnelling distances are not exceeded.

6.5.35 At phase one consultation, further information on the preferred site (S79WH/S80WH) was obtained. In particular, we were informed that planning permission for housing on the site had been granted and that work has commenced on the site, so it would not be available to the project.

6.5.36 The back-check process for this zone was triggered on the basis that the site was no longer available, and assessed seven potential main tunnel drive (single and/or double) sites plus three potential reception only sites. All of these sites progressed from long list to short list. Of these sites, S72WH/S93WH Kirtling Street was identified as the most suitable site within this zone. In summary, this is because it is a brownfield site in an industrial area with direct river access and good road access, and was suitable for use as a double drive site if required.

6.5.37 The suitability of drive options reliant on this site is discussed further in Section 6.6. All drive options utilise a site in Zone S5 Battersea.

6.5.38 Appendix L provides full details of the identification of the Kirtling Street site (alongside other potential sites within Zone 5 Battersea).

Zone S6 Shad

6.5.39 At phase one consultation, the most suitable site within this zone (the only shortlisted site in this zone) was S54SK King’s Stairs Gardens and this was taken forward to consultation as a preferred main tunnel reception site. This site was also preferred as a site to drive two connection tunnels to connect four surrounding CSOs to the main tunnel.

6.5.40 A main tunnel drive or reception site is required in this zone to suit some, but not all, of the drive options identified in Section 6.4. There are risks associated with tunnelling through different types of geology. There is a change in geology from the Lambeth Group and Thanet Sand Formation (Zone S5 Battersea) to Chalk (Zone S6 Shad – approximately 500m to the east of Tower Bridge) so based on engineering risks, drive options from zones S5 (Battersea) to S7 (Limehouse) are less desirable.

6.5.41 S76SK Chambers Wharf site had been on our draft short list but had not proceeded to the final short list. We were aware that a developer had secured planning approval for housing on this site and appeared to have started work on this permission (demolition and site clearance had commenced). Since then, the site has been put up for sale and, in
conjunction with the property developers St James Group Limited (part of the Berkley Group), we have purchased the site as a possible alternative to King’s Stairs Gardens.

6.5.42 This new information relating to the availability of Chambers Wharf, the feedback received during phase one consultation in relation to our proposed use of King’s Stairs Gardens, and engineering design developments combined to trigger the back-check process.

6.5.43 Potential sites within this zone were therefore reconsidered through the back-check assessment process. While a number of sites were included on the long list and draft short list, the only sites included on the short list within this zone and assessed in further detail were S76SK Chambers Wharf (for a drive or reception site) and S54SK King’s Stairs Gardens (for a drive or reception site).

6.5.44 The assessment led to the conclusion that S76SK Chambers Wharf should be identified as the most suitable site within this zone. In summary, this is because it is a brownfield site, has river access and can provide sufficient space to allow use as either a main tunnel drive or reception site.

6.5.45 The suitability of drive options reliant on this site is discussed further in Section 6.6. Not all drive options utilise a site in this Zone S6 Shad.

6.5.46 Appendix R provides full details of the identification of the Chambers Wharf site (alongside other potential sites within zones S6 Shad and S7 Limehouse).

**Zone S7 Limehouse**

6.5.47 A main tunnel drive or reception site from this zone would be required for one or more of the drive options identified in Section 6.4.

6.5.48 At phase one, the most suitable drive or reception site within this zone was S021T King Edward Memorial Park. However, following comparison of available drive options, it was not identified as a preferred drive or reception site, although the adjoining foreshore site was identified as a preferred site for CSO connection.

6.5.49 As described in relation to Zone S6 above, a back-check was triggered in respect of the S54SK King’s Stairs Gardens. This also required reconsideration of potential sites (and related drive options) in Zone S7 Limehouse as sites within this zone could be used as a potential alternative to a site in Zone S6 Shad.

6.5.50 For the reasons discussed in Appendix P (Chambers Wharf), S021T King Edward Memorial Park remained the most suitable site within Zone S7 Limehouse. In summary, this is because when compared to other sites in this zone, it was less constrained and offered the opportunity to combine a main tunnel site with the CSO site, and would allow river access.

6.5.51 The suitability of drive options reliant on this site is discussed further in Section 6.6. Not all drive options utilise a site in Zone S7 Limehouse.
Appendix R provides full details of consideration of this site as an alternative to S54SK King’s Stairs Gardens (alongside other potential sites within zones S6 Shad and S7 Limehouse).

**Zone S8 Deptford, Zone S9 Charlton and Zone S10 Beckton**

At phase one, we identified the most suitable drive and/or reception site in each of these zones. Drive options for the River Thames route and Rotherhithe route utilised the sites within these zones.

However, since phase one consultation, we have decided to proceed with the Abbey Mills tunnel route as our preferred route, and the two alternative routes are no longer under consideration. The Abbey Mills route directly connects Zone S7 Limehouse to Zone S11 Abbey Mills and does not require sites within zones S8 Deptford, S9 Charlton or S10 Beckton. Sites within these zones are not therefore considered further within this report as main tunnel sites. Sites within Zone S8 Deptford have, however, been considered further in relation to the Greenwich Connection Tunnel, as described in Appendix V. It should be noted that the Lee Tunnel will transfer flows from Abbey Mills to Beckton STW for treatment.

**Zone S11 Abbey Mills**

A main tunnel drive or reception site is required within this zone for all of the drive options identified in Section 6.4.

The most suitable site within this zone at phase one was identified as S84NM Abbey Mills Pumping Station. Scheme development work since phase one consultation has confirmed that this site remains the most suitable site. The suitability of drive options reliant on this site is discussed further in Section 6.6.

Appendix W provides full details of the identification of this site.

**Summary of main tunnel sites by zone**

The table below summarises the conclusions of our assessment of the most appropriate sites within each main tunnel zone for the phase two scheme. In some instances, these remain the same sites as identified in our phase one consultation and, in other instances, these sites were not previously identified as the most suitable site for that zone. Full details are provided in appendices A to W.

**Table 6.7 Summary of main tunnel sites within each zone**

<table>
<thead>
<tr>
<th>Zone</th>
<th>Zone name</th>
<th>Single drive site</th>
<th>Double drive site</th>
<th>Reception site</th>
</tr>
</thead>
<tbody>
<tr>
<td>S0</td>
<td>Acton</td>
<td>No shortlisted sites</td>
<td>Not required</td>
<td>S01EG Acton Storm Tanks</td>
</tr>
<tr>
<td>S1</td>
<td>Hammersmith</td>
<td>No shortlisted sites</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6.6 Analysis of main tunnel drive options

6.6.1 This section explains how the available drive options and most suitable sites identified for each zone, as described in sections 6.4 and 6.5 above, have been considered alongside one another, compared and evaluated in order to arrive at the phase two preferred scheme. The evaluation has taken into account engineering, planning, environment, community and property considerations. Decisions were made on the basis of the balance of merits and demerits, and were taken as collective decisions by representatives of all five disciplines.

6.6.2 As explained previously, we need to identify a series of sites that can work together to enable construction of the Thames Tunnel project. The drive options do not rely on a drive or reception site being available within every single zone (and, as detailed above, some zones have now been excluded altogether). The choices between drive options therefore tended to reflect the suitability of the identified site within one zone, as compared to the identified sites within its neighbouring zones.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Zone name</th>
<th>Single drive site</th>
<th>Double drive site</th>
<th>Reception site</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2</td>
<td>Barn Elms</td>
<td>S17RD Barn Elms</td>
<td>S17RD Barn Elms (one shaft, to be used sequentially for two drives)</td>
<td>S17RD Barn Elms</td>
</tr>
<tr>
<td>S3</td>
<td>Wandsworth</td>
<td>S87HF Carnwath Road Riverside</td>
<td>No shortlisted sites</td>
<td>S18WH Feathers Wharf</td>
</tr>
<tr>
<td>S4</td>
<td>Lots Road</td>
<td></td>
<td>No shortlisted sites</td>
<td></td>
</tr>
<tr>
<td>S5</td>
<td>Battersea</td>
<td>S72WH/S93WH Kirtling Street with Cringle Street</td>
<td>S72WH/S93WH Kirtling Street with Cringle Street</td>
<td>S72WH/S93WH Kirtling Street with Cringle Street</td>
</tr>
<tr>
<td>S6</td>
<td>Shad</td>
<td>S76SK Chambers Wharf</td>
<td>No shortlisted sites</td>
<td>S76SK Chambers Wharf</td>
</tr>
<tr>
<td>S7</td>
<td>Limehouse</td>
<td>S021T King Edward Memorial Park</td>
<td>No shortlisted sites</td>
<td>S021T King Edward Memorial Park</td>
</tr>
<tr>
<td>S8</td>
<td>Deptford</td>
<td>Not required for Abbey Mills route</td>
<td>Not required for Abbey Mills route</td>
<td>Not required for Abbey Mills route</td>
</tr>
<tr>
<td>S9</td>
<td>Charlton</td>
<td>Not required for Abbey Mills route</td>
<td>Not required for Abbey Mills route</td>
<td>Not required for Abbey Mills route</td>
</tr>
<tr>
<td>S10</td>
<td>Beckton</td>
<td>Not required for Abbey Mills route</td>
<td>NB. Flows to reach Beckton STW from Abbey Mills Pumping Station via the Lee Tunnel for the Abbey Mills route.</td>
<td></td>
</tr>
<tr>
<td>S11</td>
<td>Abbey Mills</td>
<td>S84NM Abbey Mills Pumping Station</td>
<td>Not required</td>
<td>S84NM Abbey Mills Pumping Station</td>
</tr>
</tbody>
</table>
6.6.3 Sites within certain zones are essential to completion of the scheme, either because they are at the start or end of the route, or because maximum tunnel drive lengths or a change in geology necessitate a shaft in that location. For these zones, choices tended to reflect whether the site was more or less suitable for a drive shaft (which generally has greater impact than a reception shaft) when compared with other potential options. It should also be noted that all options also required a double drive, double reception or combined drive and reception site at Zone S5 Battersea.

**Preferred main tunnel drive options**

6.6.4 In order to assess the suitability of the identified main tunnel drive options, having regard to the comparative advantages and disadvantages of the most appropriate site identified for each zone, we used a series of comparisons to make choices between drive options. Having regard to the possible options outlined in Table 6.2 these comparisons were identified as the key differences between options and the only comparisons that needed to be taken into account in order to choose between options.

6.6.5 With each comparison made, it was possible to eliminate a number of drive options until the list was finally reduced to one: the preferred tunnel drive option. The comparisons that had to be made to arrive at a preferred option included:

- Comparison 1: Comparing the use of Chambers Wharf (the most suitable site in Zone S6, Shad) with the use of King Edward Memorial Park (the most suitable site in Zone S7, Limehouse) for a main tunnel site.

- Comparison 2: Comparing the use of Barn Elms (the most suitable site in Zone S2, Barn Elms) with the use of Carnwath Road Riverside (the most suitable site in Zone S3, Wandsworth) for a main tunnel drive site.

- Comparison 3: Comparing the use of Abbey Mills Pumping Station (the most suitable site in Zone S11, Abbey Mills) as main tunnel drive site or main tunnel reception site (and associated implications for a connection tunnel at Chambers Wharf, Zone S6 Shad).

6.6.6 Each of these comparisons – and the conclusions reached at the preferred scheme workshops by engineering, planning, environment, community and property disciplines – are discussed in turn below. It should be noted that, in many instances, the advantages and disadvantages of options are finely balanced, and that a collective view was taken by discipline representatives in order to identify the preferred options.

**Comparison 1: Comparing the use of Chambers Wharf (Zone S6, Shad) with the use of King Edward Memorial Park (Zone S7, Limehouse) for a main tunnel site (drive or reception)**

6.6.7 This choice compares options that include a main tunnel site in Zone S6 Shad with those that rely on a main tunnel site in Zone S7 Limehouse.
There are no options that require a main tunnel site in both zones. By making this site comparison, the nine drive options that include a main tunnel site in Zone S6 Shad were compared with the nine drive options that include a main tunnel site in Zone S7 Limehouse.

**Figure 6.2 Comparison 1 - option with a main tunnel site in Zone S6 Shad**

6.6.8 Key considerations taken into account when assessing this option, as shown in Figure 6.2, included the following:

- It is important to select the least risk and most predictable tunnel boring machine for the expected geological conditions. The increased length of the tunnel drive between Zone S5 Battersea and King Edward Memorial Park would increase the risks associated with tunnelling due to the longer tunnel drive and the change in ground conditions just east of Tower Bridge. A tunnel drive between Zone S5 Battersea and Chambers Wharf would be shorter and present less risk.

- Chambers Wharf is a brownfield site and subject to fewer policy restrictions than King Edward Memorial Park, which is a designated public open space in an area with an identified deficiency of open space.

- Overall, environmental impacts are likely to be less at Chambers Wharf. Mitigation measures would, however, be required for Chambers Wharf and it is acknowledged that both sites are within proximity of residential properties.

- There is no acquisition risk for Chambers Wharf as it is owned by Thames Water (having been acquired by Thames Water to ensure the opportunity to consider this site can be taken). Discretionary purchase costs are likely.
6.6.9 Key considerations taken into account when assessing this option, as shown in Figure 6.3, included:

- King Edward Memorial Park is large enough to contain the full temporary construction area required without the extension onto the foreshore that would be needed at Chambers Wharf.

- A main tunnel site at King Edward Memorial Park could be combined with the site required for interception of the CSO at this location, and would avoid the need for an additional site.

- In planning and community terms no specific advantages of using King Edward Memorial Park were identified, as compared to Chambers Wharf. It was recognised that King Edward Memorial Park, which is a designated public open space, is in an area with an identified deficiency of open space. The park is also within a conservation area.

- The use of King Edward Memorial Park would introduce acquisition risks due to the possible need for a special parliamentary procedure.

- Acquisition costs are likely to be lower than the value of the Chambers Wharf site (although Chambers Wharf is owned by Thames Water, if it is not needed as a Thames Tunnel worksite, it could be sold for a sum that is likely to be not less than its acquisition cost, thereby avoiding a significant loss to the project). Discretionary purchase costs are likely.

6.6.10 Based on the above considerations, on balance, the preference is to use Chambers Wharf as a main tunnel drive site, eliminating options that use King Edward Memorial Park for this purpose. In summary, Chambers Wharf is preferred as it is a brownfield site, the length of the tunnel drive is shorter and presents less risk, and environmental impacts and conflict with planning policy are likely to be less at Chambers Wharf.
6.6.11 As a result of this comparison, the nine options that use a main tunnel drive site in King Edward Memorial Park (Zone S7 Limehouse) were eliminated.

**Comparison 2: Comparing the use of Barn Elms (Zone S2, Barn Elms) with the use of Carnwath Road Riverside (Zone S3, Wandsworth Bridge) for a main tunnel drive site**

6.6.12 This choice compares options that include a main tunnel drive site in Zone S2 Barn Elms with those that rely on a main tunnel drive site in Zone S3 Wandsworth Bridge. There are no options that require a main tunnel drive site in both zones. This site comparison allows us to compare the nine remaining drive options, six of which include a main tunnel site in Zone S2 Barn Elms and three of which include a main tunnel site in Zone S3 Wandsworth Bridge.

**Figure 6.4 Comparison 2 - option with a main tunnel site in Zone S3 Wandsworth Bridge**

6.6.13 Key considerations taken into account when assessing this option, as shown in Figure 6.4, included the following:

- Carnwath Road Riverside includes a safeguarded wharf and has much better river access for transportation of construction materials, using significantly larger barges than can reach Barn Elms. The need for new jetty and wharf facilities would be reduced compared to Barn Elms.
• Health and safety issues associated with using the river and, in particular, the dangers of interfacing with pleasure boat users are reduced at Carnwath Road Riverside, as are interfaces with people using the Thames Path.

• Carnwath Road Riverside would require relocation of existing retail/warehouse businesses

• Carnwath Road Riverside is a brownfield site which is partly vacant, while Barn Elms is a greenfield site. Use of Carnwath Road Riverside is supported in policy terms by its brownfield and safeguarded wharf status, although the area of Carnwath Road Riverside and beyond is currently proposed for regeneration within the draft South Fulham Riverside Supplementary Planning Document.

• The Thames Path at Carnwath Road Riverside is already diverted around part of the proposed site, and further diversion is considered more acceptable than at Barn Elms on the basis that it is less well used and, at Barn Elms, a diversion island around the worksite would be too long and not considered as feasible.

• In environmental terms, the use of a brownfield site will have fewer environmental impacts than use of a greenfield site at Barn Elms. However, mitigation measures would still be required at Carnwath Road Riverside.

• Use of Carnwath Road Riverside avoids potential impact on users of Barn Elms sports fields and the loss of two to three sports pitches, and possible relocation of the scout hut and boathouse.

• Acquisition of Carnwath Road Riverside would not require use of a special parliamentary procedure. Discretionary purchase costs are however to be expected.
6.6.14 Key considerations taken into account when assessing this option, as shown in Figure 6.5, included the following:

- Barn Elms is a large open area with potential for construction operations to take sufficient space. No major building demolition would be required and the site could be combined with the West Putney CSO interception site, thereby avoiding the need to acquire an extra site.

- Health and safety issues associated with using the river and, in particular, the dangers of interfacing with pleasure boat users are greater at Barn Elms, as are interfaces with people using the Thames Path.

- Barn Elms is subject to policy constraints, including Metropolitan Open Land and public open space.

- In environmental terms the use of Barn Elms may impact on nearby ecological sites, including the London Wetland Centre Site of Special Scientific Interest and River Thames and Beverley Brook Sites of Nature Conservation Importance.

- Potential impact on users of Barn Elms sports fields and the loss of two to three sports pitches, and possible relocation of the scout hut and boathouse.

- There are potentially less residential properties in the nearby area and thus less impact on community in the immediate vicinity (however, the impact of construction works may be more difficult to mitigate on this more tranquil site).
6.6.15 Based on the above considerations, on balance, the preference is to use Carnwath Road Riverside as a main tunnel drive site, eliminating options that use Barn Elms for this purpose. In summary, this is because Carnwath Road Riverside is a brownfield site and will avoid the loss of designated public open space. It is also an existing safeguarded wharf and has much better river access, enabling the use of significantly larger barges and reduces the dangers of interfacing with pleasure boat users.

6.6.16 As a result of this comparison, the six options that use a main tunnel site in Zone S2 Barn Elms were eliminated.

Comparison 3: Comparing the use of Abbey Mills Pumping Station (Zone S11 Abbey Mills) and Chambers Wharf (Zone S6 Shad) as main tunnel drive site or main tunnel reception site

6.6.17 The final comparisons between the three remaining drive options involved making choices between the use of Abbey Mills Pumping Station or Chambers Wharf as a main tunnel drive site or reception site (with associated implications for the connection tunnel to Greenwich Pumping Station, which are described further in paragraphs 6.8.11 to 6.8.15). The three options included:

- Option A (Option W3/E3 in Table 6.2): Abbey Mills would be used as a drive site to drive the tunnel to Chambers Wharf. Chambers Wharf would be used a reception site to receive the tunnel boring machine from Abbey Mills and to receive the tunnel boring machine from the drive site in Zone S5 Battersea. Chambers Wharf would also be used to either drive (Option A1) or receive (Option A2) the connection tunnel to/from Greenwich Pumping Station (identified in Figure 6.6 and 6.7 as sub-options A1 and A2).

- Option B (Option W3/E5 in Table 6.2): Abbey Mills would be used as a drive site to drive the tunnel to Chambers Wharf. Chambers Wharf would be used to receive the tunnel boring machine from Abbey Mills. Chambers Wharf would also be used as a drive site to drive the main tunnel to Zone S5 Battersea and to receive the connection tunnel from Greenwich Pumping Station. It is not possible to drive the connection tunnel from Chambers Wharf since the site is not big enough to support concurrent drive operations and because there is insufficient time to build one tunnel and then the other.

- Option C (Option W3/E4 in Table 6.2): Abbey Mills Pumping Station would be used as a reception site to receive the tunnel boring machine from Chambers
Wharf. Chambers Wharf would be used as a drive site to drive the tunnel to Abbey Mills. Chambers Wharf would also be used to receive the tunnel boring machine from Zone S5 Battersea and to receive the connection tunnel from Greenwich Pumping Station. It is not possible to drive the connection tunnel from Chambers Wharf since the site is not big enough to support concurrent drive operations and because there is insufficient time to build one tunnel and then the other.

6.6.18 The three options are illustrated and discussed in the following paragraphs.

**Option A (A1 and A2)**

**Figure 6.6 Comparison 3 - Option A1 (Greenwich Connection Tunnel driven from Zone S6 Shad)**
6.6.19 Key considerations taken into account when assessing Option A1/A2, as shown in Figure 6.6 and Figure 6.7, included the following:

- Using Chambers Wharf to receive the main tunnel boring machines avoids the need for temporary river reclamation and demolition of the existing jetty to form the site (it would be possible to drive or receive the Greenwich Connection Tunnel from Chambers Wharf on a smaller site without demolishing the jetty).

- There would be less impact on residential amenity at Chambers Wharf and this option would avoid temporary additional encroachment into the river (a strategic policy area) at the site.

- There would potentially be a significant increase in the amount of material required to be transported from Abbey Mills by road (assuming transport by barge is limited), with a consequent increase in impact on residential amenity there.

- This option has greater impact on residents at Abbey Mills but it reduces the impact on those at Chambers Wharf as, although the site could still be used to drive the smaller connection tunnel (Option A1), it would not be required for one of the main tunnel drives.

- Use of Abbey Mills as a drive site would reduce potential for discretionary purchase costs at Chambers Wharf (likely to be significantly higher than Abbey Mills drive site discretionary purchase costs). This option avoids partial construction in the foreshore and associated acquisition risks. Sub-option A1 reduces the need for
additional land to be temporarily acquired at Greenwich to drive the connection tunnel.

6.6.20 Drive options for the Greenwich Connection Tunnel are evaluated in section 6.8 below.

Option B

Figure 6.8 Comparison 3 - Option B

6.6.21 Key considerations taken into account when assessing Option B, as shown in Figure 6.8, included the following:

- This option would result in reduced construction risks associated with the concentrated tunnelling operations otherwise required at the double drive site in Zone S5 Battersea. However, Chambers Wharf could not be used as both a main tunnel drive site and for a connection tunnel drive to Greenwich Pumping Station.

- In environmental terms Abbey Mills Pumping Station is, on balance, slightly preferred as a drive site to Chambers Wharf if material could be transported by barge. However, if this is not feasible, it becomes preferable to drive from Chambers Wharf, where the river could be reliably used to remove excavated materials, thus resulting in less road vehicles having to travel past sensitive residential receptors near Abbey Mills.

- From a planning, property and community perspective no particular advantages of this option were identified.
6.6.22 Key considerations taken into account when assessing Option C, as shown in Figure 6.9, included the following:

- There would be significantly better river access for removal of excavated materials at Chambers Wharf than Abbey Mills. Further technical studies have shown that transporting material to or from the Abbey Mills site by the River Lee is highly undesirable when material needs to be reliably transported daily over a two- to three-year period. This level of barge movements would be required if Abbey Mills Pumping Station was used as a main tunnel drive site, given the volume of excavated material that would be produced.

- As this option offers a potential reduction in the amount of material required to be transported from Abbey Mills by road (assuming transport by barge is limited), there would be a consequent reduction in impact on amenity and communities in the vicinity of Abbey Mills.

- This option would avoid the need for works to create significant wharfage in the Channelsea River or potential impact on the road network at Abbey Mills in the event that barges from Abbey Mills are limited and therefore avoids related environmental impacts.

- The potential for discretionary purchase costs at Abbey Mills will be minimised if it is used as a reception site rather than a drive site.

6.6.23 Based on the above considerations, on balance, it was concluded that ‘Option C (drive option W3/E4)’, ie, driving the main tunnel from Chambers
Wharf to Abbey Mills (and using Chambers Wharf to receive the tunnel boring machine from Zone S5), should be selected. One of the main factors that influenced this decision was that further technical studies have shown that restrictions in the size of barge, reliance on high tides to be able to move barges to and from the site and other navigational risks and constraints have shown that transporting material reliably, over a sustained period of several years, to service a main tunnel drive site from the Abbey Mills site using the River Lee will be very difficult to achieve. It is also highly undesirable in terms of delivering the project in a timely and efficient manner. Therefore, the use of Chambers Wharf as a main tunnel drive site, with the ability to transport material by barge, was considered more acceptable than the use of Abbey Mills as a drive site with reliance on road transport to remove material.

Preferred drive options

6.6.24 In summary, nine zones were identified along the length of the Abbey Mills route. A series of potential drive options were identified, using the most suitable site within each zone. All drive options required a main tunnel site in Zone S0 Acton, Zone S5 Battersea and Zone S11 Abbey Mills. All options also required a double drive, double reception or combined drive and reception site at Zone S5 Battersea. No suitable main tunnel sites were available within Zone S1 Hammersmith or Zone S4 Lots Road.

6.6.25 This meant that the series of comparisons outlined above were based around using a site either in Zone S2 Barn Elms or Zone S3 Wandsworth Bridge and a site either in Zone S6 Shad or Zone S7 Limehouse (in each case, there was no requirement for a site in both pairs of zones as they are too close together), and deciding whether each of the required main tunnel sites should be a drive site or reception site.

6.6.26 Based on the above comparisons and conclusions reached by all disciplines at the preferred scheme workshops, the preferred drive option for connecting the main tunnel sites was identified as Option W3/E4, as shown in Table 6.2 above and illustrated at Paragraph 6.9.2 below.

6.7 CSO sites – preferred site selection

Introduction

6.7.1 This section provides an overview of each CSO and the identification of the preferred CSO site. A detailed account of the site selection process for each CSO site is included in the appendices to this document and should be referred to if further information is required.

6.7.2 Each site was considered on its own merits and the fact that a site is identified as a preferred site does not necessarily mean that it is free from constraints, rather that it is considered the most suitable, or least constrained, site in a required location.
6.7.3 Three sites were shortlisted for interception of this CSO, although one (Chiswick Maternity Hospital) was later discounted as development on site meant it was no longer available.

6.7.4 At phase one consultation, C01YC Acton Storm Tanks was our preferred site for CSO interception and it remains our preferred site at phase two consultation. In summary, this site was selected as it is an existing Thames Water site and would have fewer impacts on residential amenity than the other potential site (Welstead Way car park).

6.7.5 At phase two consultation, it is also proposed that the main tunnel is extended to Acton Storm Tanks. This site will therefore intercept the Acton Storm Relief CSO and also be a main tunnel reception site. The position of the shaft has been moved to the northern part of the site to minimise potential impact on residents of Warple Way. At phase one consultation, it was proposed that a connection tunnel would transfer flows from Acton to the main tunnel in the Hammersmith area. (Section 6.5, which discusses requirements for a main tunnel site at Zone S0 Acton, should also be referred to.)

6.7.6 Full details of the selection of this site (including the requirement to use this site as a main tunnel site as well as for CSO interception) are provided in Appendix A.

Hammersmith Pumping Station

6.7.7 At phase one consultation, Hammersmith Pumping Station was a preferred main tunnel reception site and was also the preferred site for CSO interception.

6.7.8 At phase two consultation, this is no longer a main tunnel reception site, but it is still necessary to intercept the CSO in this location.

6.7.9 Five sites were shortlisted for the interception of this CSO.

6.7.10 At phase one consultation, C04XJ Hammersmith Pumping Station (off Chancellors Road) was selected as the preferred site and was to be used as part of the preferred main tunnel site (S33HF Vacant Industrial land by Hammersmith Pumping Station) for construction purposes. In summary, C04XJ was selected due to its proximity to the existing pumping station, potential to combine work with main tunnel shaft works, and reduced impact on the local community.

6.7.11 Scheme development work and the submission of a new planning application for the land adjacent to the pumping station since phase one consultation (and indications that this development will commence shortly) have eliminated the possibility of the use of this site (S33HF Vacant Industrial land by Hammersmith Pumping Station) being used as a main tunnel reception site (the site is to be developed and is no longer available for this use). The smaller, adjacent site C04XN Hammersmith Pumping Station (off Distillery Road) (which is still part of S33HF, but in a slightly different location within the north-eastern corner) is the preferred site for CSO interception for phase two consultation as this can be utilised in
conjunction with the development of the surrounding site (the remainder of S33HF). The site is also located in close proximity to our existing pumping station. The drop shaft is located further away from existing residential dwellings than the other shortlisted sites, which means that construction effects can be more effectively managed. The site is also brownfield land and has good access.

6.7.12 Full details of selection of this site are provided in Appendix B.

**West Putney Storm Relief**

6.7.13 At phase one consultation, this site (S17RD Barn Elms) was a preferred main tunnel drive site and was also the preferred site for CSO interception.

6.7.14 At phase two consultation, this is no longer a main tunnel site, but it is still necessary to intercept the CSO in this location.

6.7.15 Four sites were shortlisted for interception of the West Putney Storm Relief CSO.

6.7.16 At phase one consultation, C05XQ, the southeast corner of Barn Elms sports fields, was our preferred site for CSO interception (and was sited alongside the main tunnel site S17RD Barn Elms). In summary, this site was chosen for CSO interception as it would allow a combination of works with a main tunnel site and efficient working, has good access and would require fewer enabling works than other options.

6.7.17 As a result of scheme development work, S87HF Carnwath Road Riverside is now preferred to S17RD Barn Elms for use as a main tunnel drive site. C05XQ remains, however, the preferred site for CSO interception for phase two consultation. This is because it would avoid the need to relocate an existing business and community facilities, avoids the ecological impact of working in the foreshore and would have less impact on the local community than other shortlisted sites.

6.7.18 Full details of selection of this site are provided in Appendix C.

**Putney Bridge**

6.7.19 The existing sewerage system is configured so that two large sewers join together beneath the main road junction at the southern end of Putney Bridge, just upstream of the CSO discharge point. Both branches of the sewerage network need to be intercepted. Consequently, the only viable location to intercept all flows for the Putney Bridge CSO is below the point where the two sewers meet. Therefore, all shortlisted sites are located in the foreshore.

6.7.20 Four CSO sites were shortlisted for interception of this CSO. All four were located in the foreshore, two to the west (upstream) and two to the east (downstream) of Putney Bridge. It should be noted that foreshore sites can be flexible, so the choice in effect was either to the west or east of Putney Bridge.

6.7.21 At phase one consultation, the preferred site was identified as the foreshore west of Putney Bridge. In summary, this site was identified as it was considered that, when compared to alternatives, use of this site would
minimise adverse construction effects on the multiple sensitive receptors located on the eastern side of the bridge.

6.7.22 At phase two consultation, the preferred site remains the foreshore west of Putney Bridge. The layout has been further developed in response to local engagement, which resulted in the inclusion of a temporary replacement slipway and the construction site moving slightly west. This will help to reduce the impact on Putney Bridge and to ensure that recreational and commercial river users are not adversely affected during construction.

6.7.23 Full details of selection of this site are provided in Appendix D.

Frogmore Storm Relief – Bell Lane Creek

6.7.24 Two sites were originally shortlisted for interception of this CSO. At phase one consultation, C07AF Small Business, Bell Lane Creek, was our preferred site for CSO interception.

6.7.25 Following phase one consultation, new information was received on the availability of a new alternative site, C07AR Dormay Street, to the north of the preferred site. This alternative site – a vacant site – is the preferred site for phase two consultation as its use would avoid the loss of an existing business (Panorama Antennas) and is considered suitable in all other respects.

6.7.26 Full details of selection of this site are provided in Appendix E.

Frogmore Storm Relief – Buckhold Road

6.7.27 Two sites were shortlisted for interception of this CSO. At phase one consultation, C07BF King George’s Park was our preferred site at phase one consultation and it remains our preferred site at phase two consultation. In summary, this site is preferred as it would allow efficient working and would result in fewer impacts on residential amenity than the alternative shortlisted site.

6.7.28 Full details of selection of this site are provided in Appendix F.

Jews Row – Wandle Valley Storm Relief and Falconbrook Storm Relief

6.7.29 At phase one consultation, we identified C08AC/BD, a concrete batching plant, as our preferred site to intercept these CSOs.

6.7.30 However, further scheme development work undertaken since phase one consultation has concluded that it is no longer necessary to identify a site for interception of these two CSOs. This is because modifications that have been recently made within the sewer system sufficiently reduce the number of spills to the river without the need to carry out any further works.

Falconbrook Pumping Station

6.7.31 Four sites were originally shortlisted for interception of this CSO. At phase one consultation, our preferred site was C09XC Bridges Court Car Park.
6.7.32 Scheme development work took into account consultation feedback received at phase one consultation and further engineering design work that had been undertaken. As a consequence, a new site, C09XH Falconbrook Pumping Station, has been identified as our preferred site for phase two consultation. In summary, this site is considered most suitable as it is a Thames Water owned site and appears likely to have less impact on residential amenity than alternative sites. Dedicated access to the site from York Road is being developed in consultation with Transport for London.

6.7.33 Full details of selection of this site are provided in Appendix H.

**Lots Road Pumping Station**

6.7.34 Only one site was originally shortlisted for interception of this CSO. At phase one consultation, this site, C10XA Cremorne Wharf Foreshore, was our preferred site.

6.7.35 Scheme development work took into account new information on the availability of the Cremorne Wharf Depot site, phase one consultation feedback and further engineering design work that had been undertaken. As a consequence, a new site, C10XB Cremorne Wharf Depot, has been identified as our preferred site for phase two consultation. In summary, this site is considered more suitable as it is on brownfield land, will not result in disruption to the foreshore and has less impact on residential amenity compared to the alternatives.

6.7.36 Full details of selection of this site are provided in Appendix J.

**Ranelagh**

6.7.37 Only one site was originally shortlisted for interception of this CSO and connection to the northern Low Level Sewer No.1.

6.7.38 At phase one consultation, our preferred site was therefore C14XA Chelsea Embankment Foreshore (west of Chelsea Bridge). At phase two consultation, our preferred site remains Chelsea Embankment foreshore, however its location within the foreshore has been moved slightly to a new site, C14XJ Chelsea Embankment Foreshore (opposite Bull Ring Gate). Although the decision was finely balanced, this site has been chosen because it is considered to give rise to fewer effects overall.

6.7.39 Full details of selection of this site are provided in Appendix K.

**Heathwall Pumping Station and South West Storm Relief**

6.7.40 At phase one consultation, we identified Tideway Walk (S79WH/S80WH/C17XB) as our preferred site for the interception of these CSOs. It was also the preferred main tunnel drive site in this location. The site comprised Heathwall Pumping Station and land adjacent to Tideway Walk Industrial site.

6.7.41 At phase two consultation, Tideway Walk is no longer a main tunnel drive site, but it is still necessary to intercept both CSOs in this location.
6.7.42 Three sites were originally shortlisted: one for Heathwall Pumping Station outfall and two for the South West Storm Relief. The sites adjoined, or were part of the main tunnel site at Tideway Walk.

6.7.43 Following scheme development work, the main tunnel site has changed for phase two consultation to S72WH/S93WH Kirtling Street, which is located to the west of Tideway Walk. Therefore, the main tunnel site and CSO site can no longer be combined.

6.7.44 Scheme development work reconsidered the most appropriate site for CSO interception and, for phase two consultation, the CSO interception site would be C16XB Heathwall Pumping Station as it comprises existing Thames Water operational land.

6.7.45 Full details of selection of the sites are provided in Appendix M.

**Clapham Storm Relief and Brixton Storm Relief**

6.7.46 In total, four sites were shortlisted for consideration. At phase one consultation, our preferred site for interception of both CSOs was C20XS Albert Embankment Foreshore. This remains our preferred site at phase two consultation. In summary, this site is preferred because, compared to the alternatives, it would have least impact on residential amenity, allows access and minimises impact on the flow of the river.

6.7.47 Full details of selection of the site are provided in Appendix N.

**Regent Street**

6.7.48 A site is needed to intercept the Regent Street CSO and connect to the northern Low Level Sewer No.1 to the main tunnel.

6.7.49 Two sites were shortlisted for this CSO. At phase one consultation, C22XA Victoria Embankment Foreshore was our preferred site and it remains our preferred site at phase two consultation. In summary, this site is preferred as it is considered less likely to give rise to conflict with planning policy, particularly that relating to heritage and open space designations, compared to the other shortlisted site. It also reduces the risk of working alongside the District and Circle line underground tunnels.

6.7.50 Full details of selection of the site are provided in Appendix P.

**Fleet Main**

6.7.51 A site is needed to intercept the Fleet Main CSO and to connect the northern Low Level Sewer No.1 to the main tunnel.

6.7.52 Only one site was shortlisted for the Fleet Main CSO and northern Low Level Sewer No.1. This site, C27XA Blackfriars Bridge Foreshore, was our phase one consultation preferred site and remains our preferred site at phase two consultation. While the site will require careful mitigation, it is the only potentially suitable site.

6.7.53 Full details of selection of the site are provided in Appendix Q.
Shad Thames Pumping Station

6.7.54 At phase one consultation, C28XE Druid Street was identified as our preferred site for interception of this CSO. However, scheme development work undertaken since phase one consultation has identified that, by carrying out modifications and upgrades within the Shad Thames Pumping Station, we do not need to intercept the storm relief sewer and connect it to the tunnel. As a consequence, there is no requirement for a site at Druid Street.

6.7.55 The works at Shad Thames Pumping Station include modifications to the pumps and internal pipework, demolition of the existing superintendent’s building behind the existing pumping station, construction of a new, slightly larger annex to house new electrical equipment, and some modifications to the existing sewers outside the pumping station. There is no CSO drop shaft construction at the site and no connection to the tunnel.

North East Storm Relief

6.7.56 Two sites were originally shortlisted for interception of this CSO. At phase one consultation, our preferred site was C29XA King Edward Memorial Park Foreshore. A modified version of this site, which includes an area of the park allowing the area in the foreshore to be reduced, remains our preferred site at phase two consultation. Further work to test the suitability of this site was undertaken in response to specific queries raised by phase one consultation.

6.7.57 The further work included consideration of a CSO site in C29XB King Edward Memorial Park connected by a connection tunnel to a deep intermediate main shaft in one of the Zone S7 Limehouse main tunnel sites (options set out in Table 6.6). This option would involve using two sites to connect the CSO to the tunnel. In summary, it is considered that, compared to the alternatives, C29XA King Edward Memorial Park Foreshore will have the least cumulative impact on the local community and local businesses and avoid concurrent work at two sites in close proximity putting more construction traffic onto the local roads. Consideration was also given to potential impacts from aligning the tunnel under buildings in reaching this conclusion.

6.7.58 Full details of selection of the site are provided in Appendix S.

Holloway Storm Relief

6.7.59 At phase one consultation, C30XG Butcher Row was identified as our preferred site for interception of this CSO. However, scheme development work undertaken since phase one consultation has identified that, by carrying out modifications to the existing sewer, we do not need to intercept the storm relief sewer and connect it to the tunnel. As a consequence, there is no requirement for a site at Butcher Row, but instead there are works that need to be carried out on the existing sewer in Bekesbourne Street.
6.7.60 The works in Bekesbourne Street include construction of a chamber around the existing sewer, and installation of a new penstock and flap valve. There is no connection of these works to the main tunnel.

**Earl Pumping Station**

6.7.61 Six sites were shortlisted for interception of this CSO. At phase one consultation, our preferred site was C31XY/C31XZ Earl Pumping Station (and adjoining industrial premises). This remains our preferred site for phase two consultation. In summary, these sites were selected primarily to make use of a Thames Water site and allow all new CSO assets to be within an extended Thames Water operational site.

6.7.62 Full details of selection of the site are provided in Appendix T.

**Deptford Storm Relief**

6.7.63 Three sites were originally shortlisted for this CSO and, at phase one consultation, our preferred site was C32XA Borthwick Wharf Foreshore.

6.7.64 Since phase one consultation, scheme development work has been undertaken to address matters raised at phase one consultation and engineering concerns regarding CSO interception and construction access. As a consequence of this work, at phase two consultation, our preferred site is C32XZ Deptford Church Street. In summary, this site is preferred as it is more accessible than Borthwick Wharf Foreshore, it is not as close to dense residential development and it does not encroach into the River Thames.

6.7.65 Full details of selection of the site are provided in Appendix U.

**Greenwich Pumping Station**

6.7.66 Three sites were shortlisted for interception of this CSO and, at phase one consultation, our preferred site was C33XU Greenwich Pumping Station. Greenwich Pumping Station remains our preferred site at phase two. However, an amended version of the site in terms of size and layout – C33XV – has been identified. This site incorporates land at Phoenix Wharf (CL005) in order to allow the site to be used for a long CSO connection tunnel drive site as well as a CSO interception. In summary, it was judged the most suitable site as it predominantly makes use of an existing Thames Water site, with consequent operational efficiencies and a controlled environment.

6.7.67 Full details of selection of the site are provided in Appendix V.

6.8 **Analysis of CSO connection tunnel drive options**

6.8.1 This section explains how the available drive options described in Section 6.4 above have been considered alongside the related CSO sites described in Section 6.7, in order to arrive at a preferred drive option for each of the two long connection tunnels:

- The Frogmore Connection Tunnel.
- The Greenwich Connection Tunnel.
6.8.2 The Frogmore Connection Tunnel would bring together flows from the Frogmore Storm Relief – Bell Lane Creek (CS07A) CSO and Frogmore Storm Relief – Buckhold Road (CS07B) CSO before connecting to the main tunnel.

6.8.3 To meet the hydraulic flow requirements and maintain suitable access for operation and maintenance, a 2.2m internal diameter connection tunnel would be required. The horizontal and vertical alignment of the connection tunnel would be selected to avoid the existing power supply cable tunnels and the foundations of existing and proposed buildings. The tunnel would also need to pass under the River Thames with sufficient ground cover. The ground conditions in this area are London Clay.

6.8.4 The first four options for Frogmore Connection Tunnel (these are explained in Table 6.4, references FA–FD) could be to drive or receive the connection tunnel from King George’s Park or Dormay Street, and then connect to the main tunnel. These four options were discounted because a direct connection into the main tunnel would be unnecessarily complex and would create greater health and safety risks.

6.8.5 The next six options for Frogmore Connection Tunnel (Table 6.4, references FE–FJ) could be either driven or receive the connection from either King George’s Park or Dormay Street, and then connect to the main tunnel site at Carnwath Road Riverside (main tunnel site Zone S3).

6.8.6 There were three options (Table 6.4, references FE, FF and FG) that would have driven a tunnel boring machine from King George’s Park but, as it was considered a valuable public open space and these options would create more disruption, they were discounted.

6.8.7 The three remaining options, which were assessed in more detail, can be summarised as follows:

Option FH:
Drive the tunnel boring machine from Dormay Street to King George’s Park, then dismantle the tunnel boring machine and bring it back to Dormay Street so it could be driven under the River Thames to Carnwath Road Riverside, or use a second machine (if ground condition dictate that a different type of machine should be used) for the drive from Dormay Street to Carnwath Road Riverside. All construction materials would enter and leave the tunnel at Dormay Street for this option. Refer to Figure 6.10.
**Option FI:**

Drive the tunnel boring machine from Carnwath Road Riverside to Dormay Street, then drive the tunnel boring machine (or use a second machine if ground condition dictate that a different type of machine should be used) from Dormay Street to King George’s Park. Construction materials would enter and leave the tunnel at both Carnwath Road Riverside and Dormay Street for this option. Refer to Figure 6.11.
Option FJ:

Drive the tunnel boring machine from Carnwath Road Riverside through to Dormay Street and onto King George’s Park, or use a second machine (if ground condition dictate that a different type of machine should be used) from Dormay Street to Carnwath Road Riverside with service provided from Carnwath Road. All construction materials would enter and leave the tunnel at Carnwath Road Riverside for this option. Refer to Figure 6.12.

Figure 6.12 Option FJ

6.8.8 The main considerations in comparing the three options were as follows:

- The tunnel alignment between King George’s Park and Dormay Street must avoid a cable tunnel, and the tunnel between Dormay Street and Carnwath Road Riverside must pass safely under the river. To achieve these requirements, the tunnel must follow a tighter horizontal radius in one part and be deeper in the other when crossing the river, and this means that different tunnelling machines are preferred for each reach. This also means that there would be a tunnel level change at Dormay Street. Therefore to minimise the need to duplicate construction facilities, and minimise health and safety risks and possible delay risks to the main tunnelling works at Carnwath Road Riverside, the engineering preference is Option FG.

- Use of King George’s Park should be kept to the minimum, given that it is designated as open space. Dormay Street and Carnwath Road Riverside are more suitable as drive sites, given their brownfield status.

- By using King George’s Park as a reception site, this reduces the environmental effects, particularly in respect of townscape and ecology.
It would be preferable to minimise disruption within King George’s Park by using this as a reception site only, and to drive from either Dormay Street or Carnwath Road Riverside as both are brownfield sites.

King George’s Park is not suitable as a drive site as it is green space, with associated special parliamentary procedure acquisition risks. In property terms, there is little difference between Dormay Street and Carnwath Road Riverside as connection tunnel drive sites.

The five discipline teams considered the suitability of each option in the light of the key issues set out above. It was concluded that Option FG, which involves a connection tunnel sequential double drive site at Dormay Street and connection tunnel reception sites at King George’s Park and Carnwath Road Riverside, was the preferred option as it minimised the impact on King George’s Park, made best use of available space at Dormay Street and reduced programme risk.

Option FG was therefore identified as the preferred drive option for the Frogmore Connection Tunnel.

Greenwich Connection Tunnel

The Greenwich Connection Tunnel would connect CSOs at Greenwich Pumping Station (CS33X), Deptford Storm Relief (CS32X) and Earl Pumping Station (CS31X) to the main tunnel. The possible options for the associated tunnelling strategy are set out in Table 6.5 above. These options are linked to the wider main tunnel drive options reported on in paragraphs 6.6.21 to 6.6.26 above and the preferred option was identified as Option C, as set out in Paragraph 6.6.23. Option C precludes Greenwich Connection Tunnel options GA, GB, GC and GD.

A back-check exercise was undertaken to determine acceptability of Greenwich Pumping Station as a connection tunnel drive site and this is reported in Appendix V. It was concluded that, by combining Greenwich Pumping Station with adjoining land at Phoenix Wharf, the site was suitable for use as a connection tunnel drive site. It was also decided that Chambers Wharf was not sufficiently large or suitable to accommodate both a drive site for the main tunnel to Abbey Mills and a connection tunnel drive site to Greenwich Pumping Station. Given the requirement to drive the main tunnel to Abbey Mills from Chambers Wharf, this therefore means that the Greenwich connection tunnel drive strategy GF(con) must be discounted, leaving three options GH, GI and GJ using drive sites in zones G1, G2 or G3. Zone G1 includes the Boat yard, Calypso Way (S74SK), Zone G2 includes Convoys Wharf (S01LM) and Zone G3 includes two scenarios: Greenwich Pumping Station (C33XV) as a CSO and connection tunnel reception tunnel site, and Greenwich Pumping Station plus Phoenix Wharf (C33XV + CL005) as a CSO and long connection tunnel drive site.
6.8.13 These three options, which were assessed in more detail, can be summarised as follows:

**Option GH:**

This would require the tunnel boring machine to be driven north from the Boatyard, Calypso Way to Chambers Wharf through Earl Pumping Station. The tunnel boring machine would then be dismantled and brought back to the Boatyard, Calypso Way so it could be driven to Greenwich Pumping Station through Deptford Church Street. Alternatively, a second machine could be used (if ground conditions dictate that a different type of machine should be used) for the drive from the Boatyard, Calypso Way to Greenwich Pumping Station. All construction materials would enter and leave the tunnel at the Boatyard, Calypso Way for this option. Refer to Figure 6.13.

![Figure 6.13 Option GH](image)

**Option GI:**

This option would require the tunnel boring machine to be driven north from Convoys Wharf to Chambers Wharf through Earl Pumping Station. The tunnel boring machine would then be dismantled and brought back to Convoys Wharf so it could be driven to Greenwich Pumping Station through Deptford Church Street. Alternatively, a second machine could be used (if ground conditions dictate that a different type of machine should be used) for the drive from Convoys Wharf to Greenwich Pumping Station. All construction materials would enter and leave the tunnel at Convoys Wharf for this option. Refer to Figure 6.14.
Option GJ:

This option would require the tunnel boring machine to be driven north from the Greenwich Pumping Station to Chambers Wharf through Earl Pumping Station and Deptford Church Street. All construction materials would enter and leave the tunnel at Greenwich Pumping Station for this option. Refer to Figure 6.15.

6.8.14 The five discipline teams considered the suitability of each tunnel strategy in the light of the key issues set out above. The main considerations for
each discipline in comparing the three options were that Options GI and GJ involve setting up an additional site and sinking a temporary shaft with associated increased cost and health and safety risk considerations.

6.8.15 It was concluded that Option GH, which involves a connection tunnel driven from Greenwich Pumping Station and received at Chambers Wharf was the preferred option because it avoids the need to obtain an additional site and build an additional temporary shaft.

6.9 **Phase two preferred scheme**

6.9.1 The preceding sections explain how the potential drive options were considered alongside potential main tunnel sites and CSO sites to arrive at a preferred scheme.

6.9.2 To summarise, the phase two preferred scheme is therefore drive option W3/E4 and includes the preferred sites listed in Table 6.8. For completeness Table 6.8 shows the phase one preferred scheme and associated sites alongside the phase two preferred scheme and associated sites.

**Table 6.8 Summary of preferred sites**

<table>
<thead>
<tr>
<th>Phase one preferred scheme</th>
<th>Phase two preferred scheme</th>
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</thead>
<tbody>
<tr>
<td><strong>Preferred site name</strong></td>
<td><strong>Site type</strong></td>
</tr>
<tr>
<td>Acton Storm Tanks</td>
<td>CSO site; connection tunnel reception</td>
</tr>
<tr>
<td>Hammersmith Pumping Station</td>
<td>Main tunnel reception site; CSO site; connection tunnel drive</td>
</tr>
<tr>
<td>Barn Elms</td>
<td>Sequential main tunnel double drive site; CSO site</td>
</tr>
<tr>
<td>Putney Bridge Foreshore</td>
<td>CSO site; connection tunnel drive to main tunnel</td>
</tr>
<tr>
<td>Bell Lane Creek</td>
<td>CSO site; connection tunnel drive to main tunnel; connection tunnel drive to King George's Park</td>
</tr>
<tr>
<td>King George’s Park</td>
<td>CSO site; connection tunnel reception</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
### Phase one preferred scheme

<table>
<thead>
<tr>
<th>Preferred site name</th>
<th>Site type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jews Row</td>
<td>CSO site; connection tunnel drive to main tunnel</td>
</tr>
<tr>
<td>Bridges Court Car Park</td>
<td>CSO site; connection tunnel drive to main tunnel</td>
</tr>
<tr>
<td>Cremorne Wharf Foreshore</td>
<td>CSO site; drop shaft on line of main tunnel</td>
</tr>
<tr>
<td>Chelsea Embankment Foreshore (west of Chelsea Bridge)</td>
<td>CSO site; connection tunnel drive to main tunnel</td>
</tr>
<tr>
<td>Tideway Walk</td>
<td>Main tunnel single drive/single reception site; CSO site (two CSO interceptions)</td>
</tr>
<tr>
<td>Albert Embankment Foreshore</td>
<td>CSO site (two CSO interceptions); access along the foreshore; connection tunnel drive to main tunnel</td>
</tr>
<tr>
<td>Victoria Embankment Foreshore</td>
<td>CSO site; connection tunnel drive to main tunnel</td>
</tr>
<tr>
<td>Blackfriars Bridge Foreshore</td>
<td>CSO site; drop shaft on line of main tunnel</td>
</tr>
<tr>
<td>Druid Street</td>
<td>CSO site; connection tunnel reception</td>
</tr>
<tr>
<td>King's Stairs Gardens</td>
<td>Main tunnel double reception site; two connection tunnel drives</td>
</tr>
</tbody>
</table>

### Phase two preferred scheme

<table>
<thead>
<tr>
<th>Preferred site name</th>
<th>Site type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jews Row</td>
<td>connection tunnel reception</td>
</tr>
<tr>
<td>Bridges Court Car Park</td>
<td>Technical solutions have removed the requirement for a CSO site at this location</td>
</tr>
<tr>
<td>Cremorne Wharf Foreshore</td>
<td>CSO site; connection tunnel drive to main tunnel</td>
</tr>
<tr>
<td>Chelsea Embankment Foreshore (west of Chelsea Bridge)</td>
<td>CSO site; connection tunnel drive to main tunnel</td>
</tr>
<tr>
<td>Tideway Walk</td>
<td>Kirtling Street</td>
</tr>
<tr>
<td>Albert Embankment Foreshore</td>
<td>Heathwall Pumping Station</td>
</tr>
<tr>
<td>Victoria Embankment Foreshore</td>
<td>Albert Embankment Foreshore</td>
</tr>
<tr>
<td>Blackfriars Bridge Foreshore</td>
<td>Blackfriars Bridge Foreshore</td>
</tr>
<tr>
<td>Druid Street</td>
<td>-</td>
</tr>
<tr>
<td>King's Stairs Gardens</td>
<td>Chambers Wharf</td>
</tr>
</tbody>
</table>

Technical solutions have removed the requirement for a CSO site at this location.
<table>
<thead>
<tr>
<th>Preferred site name</th>
<th>Site type</th>
<th>Preferred site name</th>
<th>Site type</th>
</tr>
</thead>
<tbody>
<tr>
<td>King Edward Memorial Park Foreshore</td>
<td>CSO site; connection tunnel drive to Butcher Row; all facilities in the foreshore; drop shaft on line of main tunnel</td>
<td>King Edward Memorial Park Foreshore</td>
<td>CSO site; no connection tunnel drive to Butcher Row; some facilities in the park; drop shaft on line of main tunnel</td>
</tr>
<tr>
<td>Butcher Row</td>
<td>CSO site; connection tunnel reception</td>
<td>-</td>
<td>Technical solutions have removed the requirement for a CSO site at this location</td>
</tr>
<tr>
<td>Earl Pumping Station</td>
<td>CSO site; drop shaft on line of connection tunnel</td>
<td>Earl Pumping Station</td>
<td>CSO site; drop shaft on line of connection tunnel</td>
</tr>
<tr>
<td>Borthwick Wharf Foreshore</td>
<td>CSO site; drop shaft on line of connection tunnel</td>
<td>Deptford Church Street</td>
<td>CSO site; drop shaft on line of connection tunnel</td>
</tr>
<tr>
<td>Greenwich Pumping Station</td>
<td>CSO site; connection tunnel reception</td>
<td>Greenwich Pumping Station</td>
<td>CSO site; connection tunnel drive</td>
</tr>
<tr>
<td>Abbey Mills Pumping Station</td>
<td>Main tunnel single drive site</td>
<td>Abbey Mills Pumping Station</td>
<td>Main tunnel single reception site</td>
</tr>
</tbody>
</table>
7 Conclusions and way forward

7.1 Preferred scheme
7.1.1 This report has summarised the work undertaken since our phase one consultation and presents the phase two preferred scheme that is the consequence of that work.

7.1.2 It has explained how ongoing engineering scheme design, phase one consultation feedback and changes in circumstances have been taken into consideration and, where necessary, have resulted in some changes to our preferred sites and associated tunnelling strategy for construction of the Thames Tunnel project.

7.2 Preferred route
7.2.1 At phase one consultation, the Abbey Mills route was our preferred route and this remains our preferred – and only – route at phase two consultation. It is shown in Figure 7.1 below.

Figure 7.1 Abbey Mills route

7.3 Preferred tunnelling drive strategy
7.3.1 The phase two preferred drive option is W3/E4 and illustrated in Figure 7.2 below.
Figure 7.2 Preferred drive option W3/E4

7.4 Preferred sites

7.4.1 This report explains how the preferred sites for phase two consultation have been identified. To summarise, the phase two preferred sites are set out in Table 6.8 above and, in summary, include:

- 16 sites identified for CSO interception (plus connection tunnel drive for some sites)
- two main tunnel reception sites (Acton Storm Tanks and Abbey Mills Pumping Station)
- three main tunnel drive sites (Carnwath Road Riverside, Kirtling Street and Chambers Wharf).

7.4.2 The locations of the preferred sites and their proposed uses are illustrated in Figure 7.3 below.
Figure 7.3 Preferred sites and proposed uses

- Acton Storm Tanks
- Hammersmith Pumping Station
- Barn Elms
- Putney Bridge Foreshore
- Durnsford Street
- King George's Park
- Carwath Road Riverside
- Falconbrook Pumping Station
- Cremona Wharf Depot
- Chelsea Embankment Foreshore
- Kirtling Street
- Heathrow Pumping Station
- Albert Embankment Foreshore
- Victoria Embankment Foreshore
- Blackfriars Bridge Foreshore
- Shad Thames Pumping Station
- Chambers Wharf
- Earl Pumping Station
- Deptford Church Street
- Greenwich Pumping Station
- King Edward Memorial Park Foreshore
- Beleymour Street
- Abbey Mills Pumping Station
- Beckton Sewage Treatment Works

Site types:
- Main tunnel
- Connection tunnels
- Lee Tunnel (under construction)
- Main tunnel drive site
- Main tunnel reception site
- CSO site
- Short connection tunnel drive site
- Long connection tunnel drive site
- System modification site
7.5 Phase two consultation and the way forward

7.5.1 Phase two consultation is now underway.

7.5.2 The aim of this second phase of consultation is to ensure that all statutory consultees, including local authorities, members of the public and those with an interest in the land directly affected by our proposed project, have the opportunity to review and comment on:

- the need for the project, including whether a tunnel is the most appropriate solution
- our preferred tunnel route, including detailed alignment of the tunnel
- our preferred construction sites
- the detailed proposals for our preferred sites, which take into account the results of our phase one consultation and further, more detailed, technical work undertaken
- the preliminary environmental information we have compiled.

7.5.3 We will have regard to all feedback received in response to the phase two consultation and will publish our responses in the form of a consultation report.

7.5.4 We intend to undertake further scheme publicity in 2012 before submitting an application for a development consent order. This is referred to as Section 48 publicity, and we will publicise our proposed application in accordance with the requirements of the Planning Act 2008 and the Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009.
### Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>combined sewer overflow (CSO)</td>
<td>A structure, or series of structures, designed to allow spillage of excess wastewater from a combined sewer under increased rainfall conditions. Flows may discharge by gravity or by pumping.</td>
</tr>
<tr>
<td>connection culvert</td>
<td>A covered channel structure which connects an interception chamber to a drop shaft.</td>
</tr>
<tr>
<td>connection tunnel</td>
<td>A tunnel which connects a drop shaft to the main tunnel.</td>
</tr>
<tr>
<td>CSO site</td>
<td>A site that contains the CSO interception chambers, connection culverts and the drop shaft from which the connection tunnel is built. Each site needs to provide enough space for all the construction related activities, which vary depending on the diameter of the shafts and the method of tunnel construction.</td>
</tr>
<tr>
<td>drive site</td>
<td>A main tunnel site containing the shaft from where the tunnel boring machine is ‘driven’ forward, ie, starts from. Excavated material is removed from and segments are fed into the tunnel via the shaft at the drive site.</td>
</tr>
<tr>
<td>drop shaft</td>
<td>A vertical, circular structure which connects a connection culvert to a connection tunnel. This is used to drop flow down to the main tunnel level.</td>
</tr>
<tr>
<td>intermediate site</td>
<td>A site that contains the intermediate shafts from which the construction of the main tunnel is supported by activities such as secondary lining. Each site needs to provide enough space for all the construction related activities, which vary depending on whether the concrete for the secondary lining will be made on the site or made elsewhere and delivered to the site by lorries.</td>
</tr>
<tr>
<td>Lee Tunnel</td>
<td>The Lee Tunnel comprises a storage and transfer tunnel from Abbey Mills Pumping Station (PS) to Beckton STW and the interception of the Abbey Mills CSO.</td>
</tr>
<tr>
<td>main tunnel</td>
<td>The tunnel from Abbey Mills to Acton Storm Tanks.</td>
</tr>
<tr>
<td>main tunnel site</td>
<td>A site from where the main tunnel is built. Each site needs to provide enough space for all the construction related activities, which vary depending on the type of tunnel boring machine used and whether the site is a drive site, a double drive site or a reception site.</td>
</tr>
<tr>
<td>mitigation measures</td>
<td>Actions proposed to moderate adverse impacts and to enhance beneficial impacts arising from the whole or specific elements of the development.</td>
</tr>
<tr>
<td>Term</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>pumping station</td>
<td>A vertical, circular structure, with pumps located at the bottom. This is used to lift storm water flows up to the sewage treatment works.</td>
</tr>
<tr>
<td>receptors</td>
<td>People (both individually and communally) and the socio economic systems they support.</td>
</tr>
<tr>
<td>reception site</td>
<td>A main tunnel site containing the shaft from where the tunnel boring machine is ‘received’, ie, ends up. The tunnel boring machine is removed from the tunnel via the shaft at this reception site.</td>
</tr>
<tr>
<td>sewage or wastewater</td>
<td>Waterborne wastes from domestic uses of water, derived from households, trade and industry.</td>
</tr>
<tr>
<td>sewerage</td>
<td>A system of pipes for the collection and transportation of domestic and industrial wastewater.</td>
</tr>
<tr>
<td>shaft</td>
<td>Duct/pipe/vertical tunnel.</td>
</tr>
<tr>
<td>storm water</td>
<td>Rainwater which funnels into sewers to be mixed with sewage and is either treated at sewage works or overflows into rivers.</td>
</tr>
</tbody>
</table>
| Thames Tunnel project       | The Thames Tunnel project will comprise a main tunnel, running from west to east London, integrated with the existing sewerage system via connection tunnels, to control 34 of the most polluting CSOs. These tunnels will then store and transfer the intercepted flows to Beckton Sewage Treatment Works. The project consists of two main elements:  
  - Works to design, construct and maintain the main tunnel, which would provide the majority of the storage capacity and enable transfer of combined sewage to Beckton STW in east London.  
  - Works to control and intercept combined sewage overflows from the worst polluting CSOs and transfer them into the main tunnel. This would include connection tunnels to link intercepted CSOs to the main tunnel. |
| Tideway                     | The tidal area of the River Thames (ie, from Teddington to the Thames Estuary).                                                                 |
| tunnel alignment            | The horizontal and vertical route of the proposed tunnels, including connection tunnels and main tunnel sites.                                    |
| tunnel boring machine       | A machine used to excavate tunnels with a circular cross-section through a variety of ground conditions.                                         |
Appendices

A. Acton Storm Tanks
B. Hammersmith Pumping Station
C. Barn Elms
D. Putney Bridge Foreshore
E. Dormay Street (formerly Bell Lane Creek)
F. King George’s Park
G. Carnwath Road Riverside
H. Falconbrook Pumping Station (formerly Bridge’s Court Car Park)
J. Cremorne Wharf Depot (formerly Cremorne Wharf Foreshore)
K. Chelsea Embankment Foreshore
L. Kirtling Street (formerly Tideway Walk)
M. Heathwall Pumping Station (formerly Tideway Walk)
N. Albert Embankment Foreshore
P. Victoria Embankment Foreshore
Q. Blackfriars Bridge Foreshore
R. Chambers Wharf (formerly King’s Stairs Gardens)
S. King Edward Memorial Park Foreshore
T. Earl Pumping Station
U. Deptford Church Street (formerly Borthwick Wharf Foreshore)
V. Greenwich Pumping Station
W. Abbey Mills Pumping Station
Phase two consultation (Autumn 2011)

For further information see our website: www.thamestunnelconsultation.co.uk
or call us on 0800 0721 086