Thames Tideway Tunnel
Thames Water Utilities Limited

Thames Water

Application for Development Consent

Application Reference Number: WWO10001

Examining Authority's Second Written Round of Questions and Requests for Information

Response from Thames Water

Water Quality and Resources

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Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Responses to second written questions
Q36 Water Quality and Resources

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Abbreviations

CSO	combined sewer overflow
DCO	development consent order
EA	Environment Agency
UWWTD	Urban Waste Water Treatment Directive
DO	Dissolved Oxygen
TTSS	Thames Tideway Strategic Study
STW	Sewage Treatment Works

1 Question: 36.1

In the light of the response given earlier (Q24.3), how would the Applicant ensure compliance with the UWWTD during the 10 yearly maintenance operation?

1.1 Our response

1.1.1 Our response to second written question 24.3 provides details on the planned ten-yearly inspections

1.1.2 The infrequent occurrence and short duration of the maintenance periods, in conjunction with the some of the factors described below, are consistent with the concept of 'limitation of pollution' and the allowance for exceptional discharges under Annex 1 to the Urban Waste Water Treatment Directive.

1.1.3 Compliance with the directive during such periods would be maintained even if discharges do occur due to the contingency nature of the work. Such contingencies are defined in the London Tideway Tunnels Operating Techniques (Section 7) (Appendix C of our *Statement of Common Ground* with the Environment Agency submitted on 4 November 2013) and referenced in the environmental permits.

1.1.4 Discharges, however, would only occur during rainfall and therefore forecasting of weather conditions would be part of the inspection programme. Inspections would be planned to take place during dry weather. As the inspections would take ten to fifteen days, predictions of rainfall would be reasonably accurate.

1.1.5 The inspections would also be coordinated with sewage treatment works operators to ensure that the full treatment capacity at the Beckton and Crossness treatment works is available.

2 Question: 36.2

Can the EA advise what would be the likely effect on river ecology and habitats if CSOs discharge to the Thames and Channelsea River during extended tunnel maintenance? What mitigation would be necessary to minimise any impacts? What period of time would it take for the ecology, habitats and river quality to return to compliance after the tunnel is put back into service?

2.1 Response

2.1.1 The Environment Agency is responsible for responding to this question. We may need to comment on the response.

3 Question: 36.3

What controls should the EA have with regard to the seasonal timing of the planned 10 yearly maintenance operation and any other operation which requires that the tunnel be taken out of service? How would these controls be secured?

3.1 Our response

3.1.1 The Environment Agency and Thames Water have agreed operating techniques for the London Tideway Tunnels (see Appendix C of our *Statement of Common Ground* with the Environment Agency submitted on 4 November 2013). This tunnel system comprises the combined Lee Tunnel and Thames Tideway Tunnel. The system would be operated in conjunction with the Beckton and Crossness sewage treatment works. The operating techniques define how the system would operate to control CSOs and the conditions under which CSO discharges would occur.

3.1.2 Section 7 of the operating techniques states that there are operational contingencies that would change how the system operates. Such contingencies include periods when inspections of the tunnel system are being carried out or failures within the catchment sewerage system that result in the tunnel system capturing dry weather flows that would otherwise discharge to the tidal Thames.

3.1.3 Section 7a regarding the operating contingency for tunnel inspections states: *"a) Isolation of the London Tideway Tunnels to facilitate access for planned inspections. Where possible, planned inspections will be carried out during a period of reduced environmental risk, typically during winter."*

3.1.4 Inspections during the winter months would limit the impact of any CSO discharges because the river water temperatures would be lowest in the year. Furthermore, the winter months of February to April have, on average, the lowest rainfall of the year.

3.1.5 As stated in our response to first written question 24.03, the expected duration of closure of the tunnel system for inspection purposes is ten to 15 days; therefore it would be practical to close the system for inspections during the winter months.

3.1.6 The operating techniques specifically call for close coordination between the Environment Agency and Thames Water when contingency operations are planned or required. The formal reporting requirements associated with contingency operations would be defined in the relevant environmental permits. The environmental permits for each CSO would reference the operating techniques and are expected to be issued during the commissioning of the tunnel system.

4 Question: 36.4

Can the EA and the Applicant explain how the reduction in flows of 28% at Shad Thames CSO would affect aesthetics, and what would be the fall back proposal in the event of the problems continuing?

4.1 Our response

4.1.1 As discussed in our response to question 18.6, the aesthetic impact of CSO discharges is primarily driven by their frequency and duration, rather than the volume of discharge. Therefore, although there is only a 28 per cent volume reduction, in the case of Shad Thames Pumping Station CSO, the proposed solution will reduce frequency by approximately 73 per cent from 15 to four events and duration by approximately 80 per cent from a total of 69 hours to 14 hours in the typical year, significantly reducing the sewage derived litter associated with discharges, and therefore improve the aesthetics in the area.

4.1.2 Because of the tidal nature of the river, it is also important to consider the environmental impacts as a whole rather than at an individual CSO. This is because discharges from adjacent CSOs can affect the aesthetics of the tidal reach of Shad Thames Pumping Station as upstream or downstream litter from adjacent CSO discharges move with the ebb and flood tides. The following paragraphs consider the CSOs in the tidal reach of Shad Thames Pumping Station CSO, and illustrate how the tunnel system can benefit the aesthetics improvement in this tidal reach as a whole.

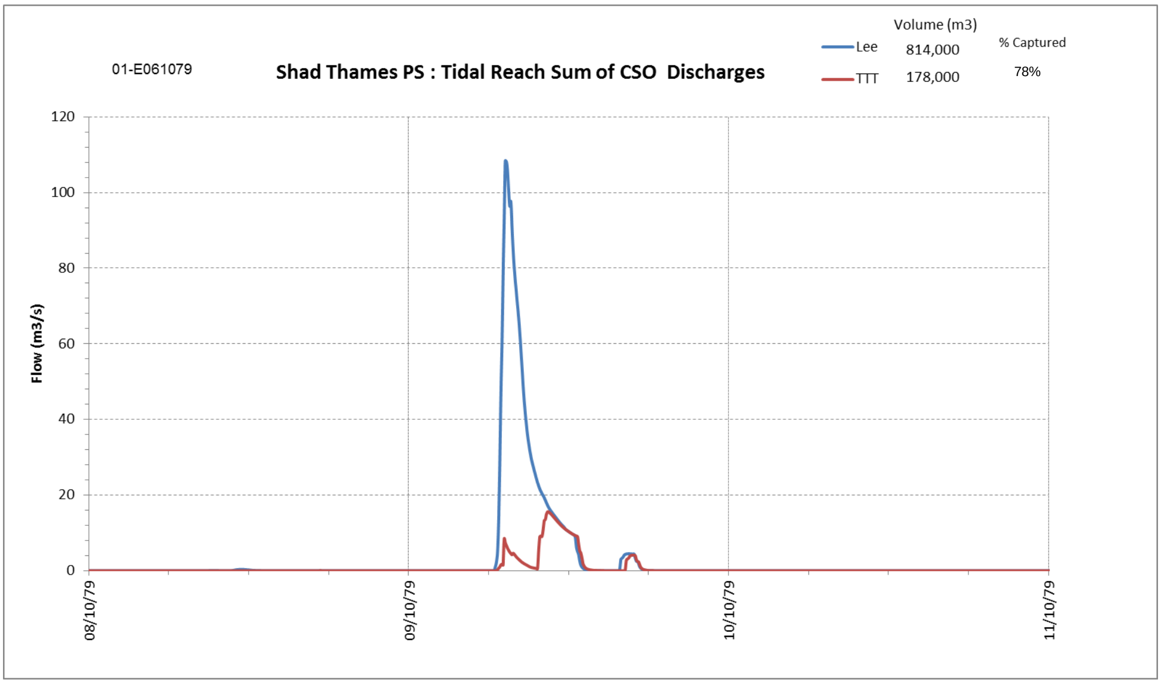
4.1.3 The Shad Thames Pumping Station CSO tidal reach can be affected by discharges from the Heathwall Pumping Station, South West Storm Relief, Clapham, Brixton and Fleet Main CSOs to the west during the ebb tide and by the North East Storm Relief, Earl Pumping Station, Deptford Storm Relief and Greenwich Pumping Station CSOs to the east during the flood tide.

4.1.4 When completed, the Thames Tideway Tunnel system would capture discharges from the CSOs subsequently reducing the volume, frequency and duration of CSO discharges within the Shad Thames tidal reach from as far west as Blackfriars Bridge to the east at Greenwich Pier.

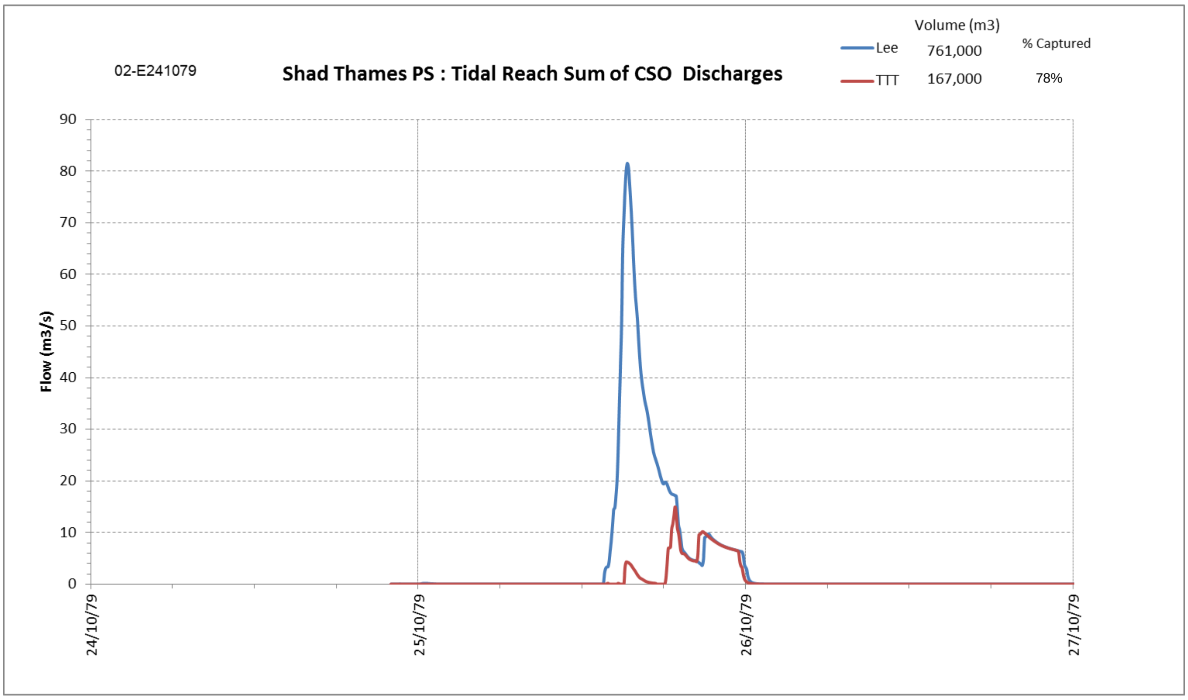
4.1.5 Figure 4.1 shows how the tunnel system captures these CSO discharges influencing the Shad Thames tidal reach for the four residual CSO events in the typical year (ie, the discharges that would occur because the tunnel system is full). Whereas Table 4.1 shows the discharge volume captured by the main tunnel for all CSO events within the Shad Thames tidal reach.

Figure 4.1 Comparison of CSO discharges in the Shad Thames tidal reach for the four residual CSO events

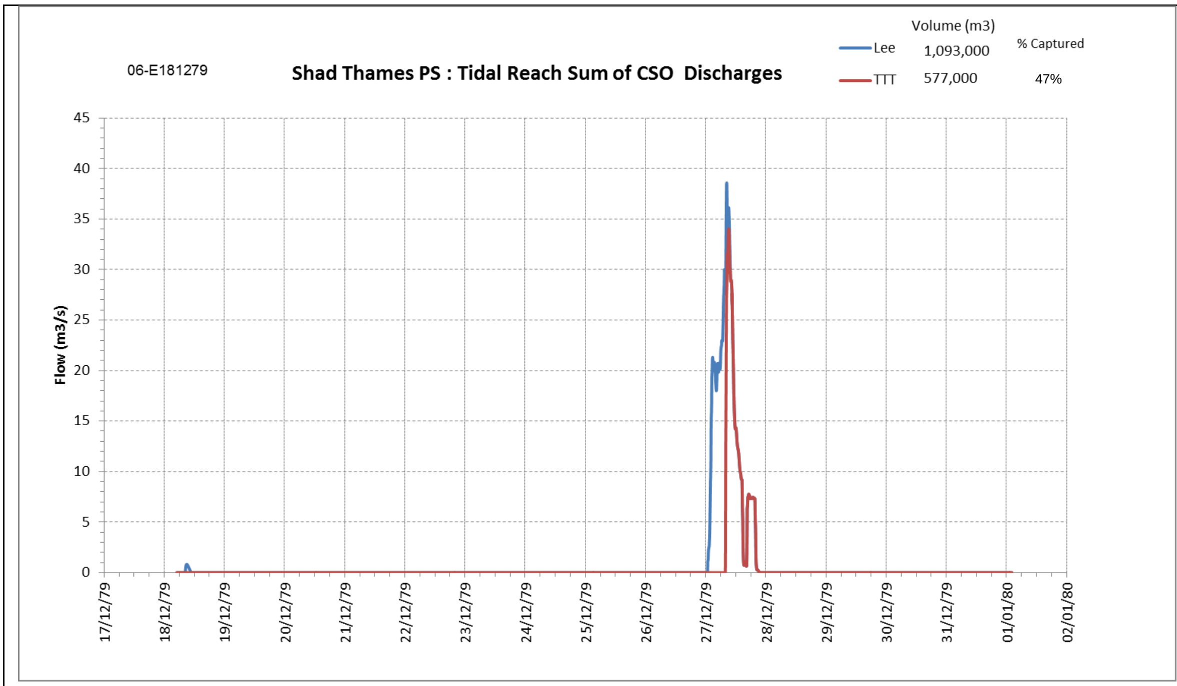
Event on 06/10/1979



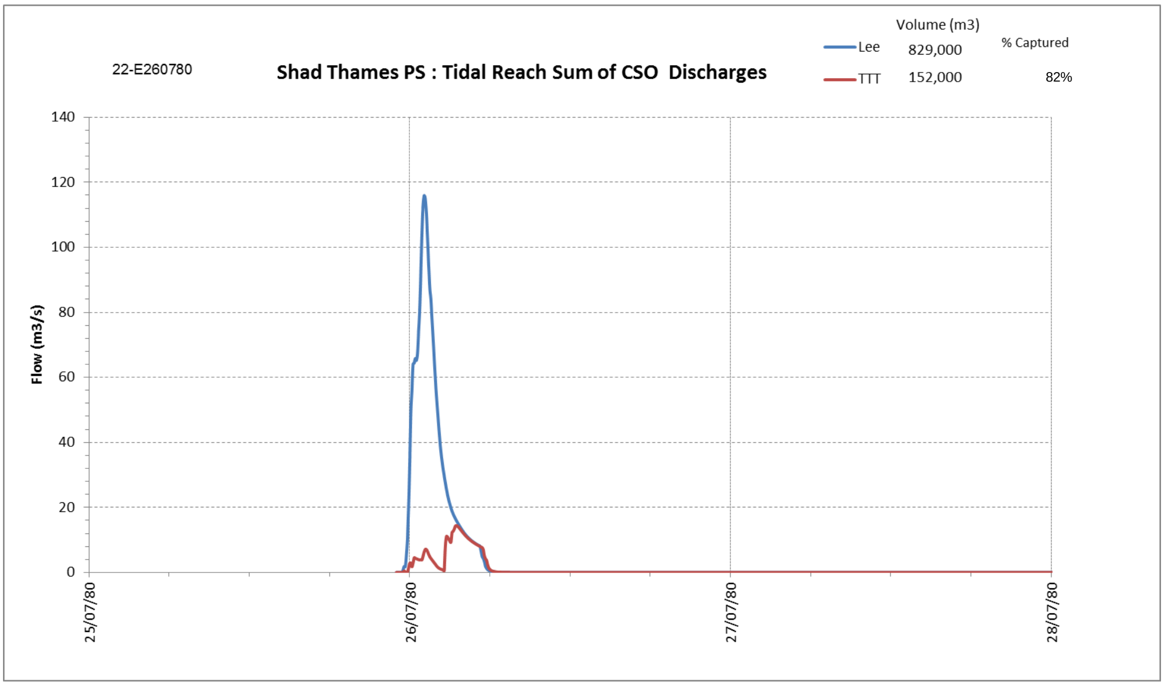
Event on 24/10/1979



Event on 18/12/1979



Event on 26/07/1980



4.1.6 From Table 4.1, it can be seen that when the project is completed, 89 per cent of CSO volume discharges into this reach would be captured by the tunnel system in the typical year when considered as a whole tidal reach rather than 28 per cent for Shad Thames Pumping Station alone. This volume captured can be directly related to the volume of litter and other material adversely affecting the aesthetic of the river.

4.1.7 Because only four discharges would occur at the unsatisfactory CSOs with the tunnel system, a high degree of aesthetic improvement is expected in this tidal reach compared to the base case, which can be affected by up to 39 discharge events from the larger adjacent CSOs. Even during the four residual events, the main tunnel would capture a significant portion of the first flush of pollutants, as illustrated in Figure 4.1 by capturing CSO flow at the beginning of the storm event.

Table 4.1 Comparison of CSO discharges in the Shad Thames tidal reach for the all typical year event

	STW Improvements and Lee Tunnel 2020s	STW Improvements, Lee Tunnel and Thames Tideway Tunnel 2020s	
CSO Event Dates	Total CSO Discharges from the Shad Thames PS tidal reach CSOs	Total CSO Discharges from the Shad Thames PS tidal reach CSOs	% Captured by the Thames Tideway Tunnel
06/10/1979	1,500		100%
08/10/1979	813,000	180,000	78%
24/10/1979	761,000	170,000	78%
01/11/1979	4,400		100%
05/11/1979	15,000		100%
07/11/1979	11,000		100%
11/11/1979	111,000		100%
26/11/1979	350,000		100%
05/12/1979	5,600		100%
08/12/1979	148,000		100%
12/12/1979	216,000		100%
14/12/1979	70		100%
18/12/1979	4,210		100%
27/12/1979	1,090,000	580,000	47%
03/01/1980	299,000		100%
20/01/1980	185,000		100%
03/02/1980	276,000		100%
22/02/1980	110,000		100%
06/03/1980	258,000		100%
12/03/1980	14,000		100%
17/03/1980	423,000		100%
24/03/1980	5,400		100%
26/03/1980	5,600		100%
28/03/1980	68,000		100%
31/03/1980	361,000		100%
01/04/1980	600		100%
30/05/1980	392,000		100%
31/05/1980	3,000		100%
10/06/1980	1,000		100%
12/06/1980	378,000	366	99.9%
16/06/1980	15		100%
17/06/1980	124,000		100%
22/06/1980	346,000		100%
24/06/1980	120,000		100%
26/06/1980	14,700		100%
30/06/1980	355,000		100%
03/07/1980	71,200		100%
06/07/1980	262,000	122	99.95%
13/07/1980	104,000		100%
26/07/1980	829,000	150,000	82%
12/08/1980	262,000		100%
14/08/1980	415,000	160	99.96%
29/08/1980	13,600		100%
16/09/1980	134,000		100%
21/09/1980	86,800		100%
Total Volume (m3)	9,450,000	1,080,000	
Total Capture in Shad Thames PS Tidal Reach		89%	

4.1.8 Within this tidal reach, the frequency and duration of discharges would reduce from 39 events over 342 hours to six events over 36 hours (see Table 6.1 in our response to question 18.6). The residual discharge of six events is from the London Bridge CSO, which is not one of the CSOs to be controlled by the project because it was assessed as having no adverse environmental impact (see Tables 3.1 and 3.2 in our response to question 18.3).

4.1.9 This significant reduction in spill frequency and duration and overall large capture of the first flush of discharges would have a beneficial impact on the aesthetics of this part of the tidal reach. Overall the tunnel system (with the sewage treatment works improvements and the Lee Tunnel) would capture approximately 98 per cent[1] of litter entering the tidal Thames.

4.1.10 It is not possible to eliminate the direct discharges from Shad Thames Pumping Station CSO because the Southwark and Bermondsey Storm Relief Sewer, which drains to the pumping station, is an important flood relief sewer. It therefore discharges during large storm events to prevent flooding at connected properties and streets in the upstream existing sewerage system. As discussed, even if this CSO discharge could be eliminated, the very nature of the tidal river would cause litter from the residual discharges from the tunnel system to impact on mooring lines.

4.1.11 We considered implementing fine screenings at Shad Thames Pumping Station; however, this is not possible due to the limitations and constraints at the pumping station site and the risk that such facilities would block during critical times when the full capacity of the pumping station is required to avoid flooding. In addition, there are issues associated with screening facilities and potential odour impacts on the local area during the removal of screenings.

4.1.12 We acknowledge that capture of all CSO discharge volumes is not a viable or cost-effective option for the Shad Thames Pumping Station CSO or for the other unsatisfactory CSOs.

4.1.13 If complaints were to arise, one mitigation option as a fall back proposal would be to install a floating barge similar to those already placed along the river to capture local litter from adjacent CSOs during the tidal excursion, as shown in Figure 4.2. A local boom could also be installed at the outlet of Shad Thames Pumping Station CSO under the boardwalk where the discharge occurs to capture discharges, if accessible.

[1] Based on 80 per cent of the litter in the first flush captured by the tunnel system.

Figure 4.2 Litter collection barge at London City Hall just west of Shad Thames Pumping Station CSO

5 Question: 36.5

As the design flows in the Engineering Design Statement (Doc 7.18, Table 3.2) give the flow of Holloway Storm Relief CSO as 8,500m³ per year (10 overflows) and the backing up into the nLLS1 may have consequential impact on the upstream sewerage system; can the Applicant provide a revised Table 3.2 giving the correct CSO performance for all CSOs and design flows, when the impact of the temporary weir has been removed from the model?

5.1 Our response

5.1.1 Table 5.1 provides a revised version of *Engineering Design Statement* (Doc ref: 7.18) Table 3.2 with the temporary weir diversion at Holloway Storm Relief CSO removed for the existing system and the base case condition (sewage treatment works improvements and Lee Tunnel). This is the condition at the site today.

5.1.2 The design flow for the interception works was based on no temporary diversion so remains unchanged. The design flow at the Fleet Main CSO drop shaft was lower due to the change in shaft diameter from 24m to 22m. The design flow for the interception and discharge at Fleet Main CSO remains unchanged.

Table 5.1 Typical year CSO performance and design flow rates with the Holloway Storm Relief temporary diversion removed

			Existing system		Base condition		Project operational		
CSO ref	CSO name	Site name	Total volume (m^3)	No. of spills	Total volume (m^3)	No. of spills	Total volume (m^3)	No. of spills	Design flow rate (m^3/s)
CS01X	Acton Storm Relief	Acton Storm Tanks	310,000	29	178,000	17	0	0	10
CS02X	Stamford Brook Storm Relief	No site required	500	2	300	2	400[a]	2	n/a
CS03X	North West Storm Relief	No site required	2,800	1	3,900	1	600	1	n/a
CS04X	Hammersmith Pumping Station	Hammersmith Pumping Station	2,200,000	51	2,350,000	54	104,000	1-3[b]	42
CS05X	West Putney Storm Relief	Barn Elms	35,000	30	37,000	31	1,500	1	2
CS06X	Putney Bridge	Putney Embankment Foreshore	68,000	33	71,000	33	1,600	1	5
CS07A	Frogmore Storm Relief – Bell Lane Creek	Dormay Street	18,000	32	19,000	32	500	1	3
CS07B	Frogmore Storm Relief – Buckhold Road	King George's Park	86,000	21	89,000	21	1,500	1	9
CS08A	Jews Row – Wandle Valley Storm Relief	No site required	2,600	1	3,000	2	0	0	n/a
CS08B	Jews Row –Falconbrook Storm Relief	No site required	7,400	2	7,500	2	7,600	2	n/a
CS09X	Falconbrook Pumping Station	Falconbrook Pumping Station	706,000	42	780,000	42	45,000	4	22
CS10X	Lots Road Pumping Station	Cremorne Wharf Depot	1,130,000	38	1,260,000	42	92,000	4	18
CS11X	Church Street	No site required	0	0	0	0	0	0	n/a
CS12X	Queen Street	No site required	0	0	0	0	0	0	n/a
CS13A	Smith Street – Main Line	No site required	1,400	4	1,500	4	1,500	4	n/a
CS13B	Smith Street – Storm Relief	No site required	0	0	0	0	0	0	n/a
CS14X	Ranelagh	Chelsea Embankment Foreshore	283,000	26	306,000	29	19,000	2	20
	Northern Low Level Sewer No.1 connection near Ranelagh CSO	Chelsea Embankment Foreshore	n/a	n/a	n/a	n/a	n/a	n/a	17
CS15X	Western Pumping Station	No site required	2,040,000	37	2,320,000	41	246,000	4	n/a
CS16X	Heathwall Pumping Station	Heathwall Pumping Station	655,000	34	748,000	39	63,000	4	12
CS17X	South West Storm Relief		230,000	13	239,000	13	3,900	1	31
CS18X	King Scholars Pond	No site required	1,400	3	1,800	3	500	2	n/a
CS19X	Clapham Storm Relief	Albert Embankment Foreshore	13,000	6	14,000	6	7,900	1	10
CS20X	Brixton Storm Relief		265,000	29	279,000	31	5,700	1	12
CS21X	Grosvenor Ditch	No site required	2,600	3	3,000	4	600	2	n/a
CS22X	Regent Street	Victoria Embankment Foreshore	22,000	5	25,000	10	0	0	18
CS23X	Northumberland Street	No site required	69,000	13	85,000	14	300	1	n/a
CS24X	Savoy Street	No site required	8,500	20	8,600	20	800	4	n/a
CS25X	Norfolk Street	No site required	0	0	0	0	0	0	n/a
CS26X	Essex Street	No site required	2,100	3	2,300	3	0	0	n/a
CS27X	Fleet Main	Blackfriars Bridge Foreshore	513,000	21	562,000	23	37,000	4	46 / 30[c]
	Northern Low Level Sewer No.1 connection near Fleet Main CSO	Chelsea Embankment Foreshore	n/a	n/a	n/a	n/a	n/a	n/a	15
CS28X	Shad Thames Pumping Station	Shad Thames Pumping Station	92,000	15	100,000	15	72,000	4	n/a
CS29X	North East Storm Relief	King Edward Memorial Park Foreshore	782,000	31	848,000	32	85,000	4	30
CS30X	Holloway Storm Relief	Bekesbourne Street	556,000	50	588,000	50	7,000	2	n/a
CS31X	Earl Pumping Station	Earl Pumping Station	541,000	27	594,000	30	51,000	4	24
CS32X	Deptford Storm Relief	Deptford Church Street	1,470,000	37	1,980,000	39	163,000	4	29
CS33X	Greenwich Pumping Station	Greenwich Pumping Station	8,280,000	51	3,940,000	28	573,000	4	36
CS34X	Charlton Storm Relief	No site required	600	2	900	2	900	2	n/a

[a] Small differences in volume result from rounding of small changes.
[b] Operation of the Hammersmith Pumping Station (and other sensitive CSO locations) will be determined with future operational experience and input from the Environment Agency.
[c] Change in design flow to the drop shaft from 46m^3/s to 30m^3/s due to reduction in diameter of shaft from 24m diameter to 22m diameter

This table should be read in conjunction with the *Engineering Statement Design* should replace Table 3.2.

6 Question: 36.6

Can the Applicant comment on the matters raised in the report, insofar as they relate to the benefits of the application project upon water quality?

6.1 Our response

6.1.1 As requested, this response focuses on the matters raised in Professor Binnie's report insofar as they relate to the benefits of the Thames Tideway Tunnel project with respect to water quality. It does not seek to address all the statements in Professor Binnie's report. However, it should be noted that we have worked with Professor Binnie over the past three years to address issues he has raised in variations of the report and several additional comments are provided to reflect the discussions we have had with Professor Binnie.

6.1.2 As noted by Professor Binnie (Appendix 2 of the Thamesbank written representation), the tidal Thames does not meet the requirements of the Urban Waste Water Treatment Directive (UWWTD) and it was expected that it should become compliant by 2000 (and at least by 2009[2]). Because the UWWTD requires the implementation of best technical knowledge not entailing excessive costs, the Environment Agency and others (sponsored by Thames Water) instigated the Thames Tideway Strategic Study (TTSS), chaired by Professor Binnie, to determine the best methods in order to comply with the UWWTD.

6.1.3 The TTSS investigated numerous technologies and pollution control methods and determined bespoke water quality requirements to protect and sustain the ecology of the tidal Thames. It recommended significant pollution control projects comprising improvements in capacity and treatment at five sewage treatment works (STWs) (Beckton, Crossness, Mogden, Riverside and Long Reach) and a tunnel from Hammersmith to Beckton.

6.1.4 Because of the significance of the Abbey Mills CSO discharges, the full length tunnel was split into two: the Lee Tunnel followed by an early design of the Thames Tideway Tunnel. The tunnels and STW improvements form the London Tideway Improvements Programme which, once in place, would enable the tidal Thames to comply with the UWWTD. As the STW improvements and the Lee Tunnel are nearing completion, failure to construct the Thames Tideway Tunnel would not fully realised the benefits of the improvement programme.

6.1.5 When the improvement works and the Lee Tunnel are completed, the tidal Thames would still fail the dissolved oxygen (DO) water quality standards set by the TTSS (see Table 6.1 below). It would continue to expose river users to frequent and high levels of bacteria and pathogens and to be polluted with human wastes, litter and street run-off. Therefore without the

[2] See para. 110 of the Opinion of Advocate General Mengozzi, January 2012

pollution capture provided by the Thames Tideway Tunnel, the TTSS's health, environmental and aesthetic objectives would not be met. Professor Binnie's reasoning that the tidal Thames can meet TTSS objectives and comply with the UWWTD without the Thames Tideway Tunnel is incorrect.

6.1.6 Water quality modelling, using the procedures set out in the TTSS, considered 41 years of rainfall and climate records from 1970 to 2010. It demonstrated that the tidal Thames would, absent the Thames Tideway Tunnel, continue to fail the four DO standards, as indicated in Table 6.1.

6.1.7 The DO thresholds would be exceeded without the Thames Tideway Tunnel because the 34 unsatisfactory CSOs identified by the Environment Agency would continue to discharge into the tidal Thames. This would occur even with the STW improvements and the Lee Tunnel in place. Therefore the environmental DO objectives would not be met.

Table 6.1 Simulated number of exceedances and scenario compliance against DO standards for the tidal Thames

DO standard	**1**	**2**	**3**	**4**
DO value and tidal duration threshold	**4 mg/l for 29 tides[1]**	**3 mg/l for 3 tides**	**2 mg/l for 1 tide**	**1.5 mg/l for 1 tide**
Allowable exceedances in 41 years (frequency)	**41 (1:1yr)**	**13 (1:3yr)**	**8 (1:5yr)**	**4 (1:10yr)**
Scenario	***Simulated maximum number of exceedances of DO thresholds***			
Existing system	211	193	99	60
	Fails[2]	**Fails**	**Fails**	**Fails**
Improvement works and Lee Tunnel	75	40	12	7
	Fails	**Fails**	**Fails**	**Fails**
Thames Tideway Tunnel (includes improvement works and Lee Tunnel)	21	4	1	1
	Compliant	Compliant	Compliant	Compliant

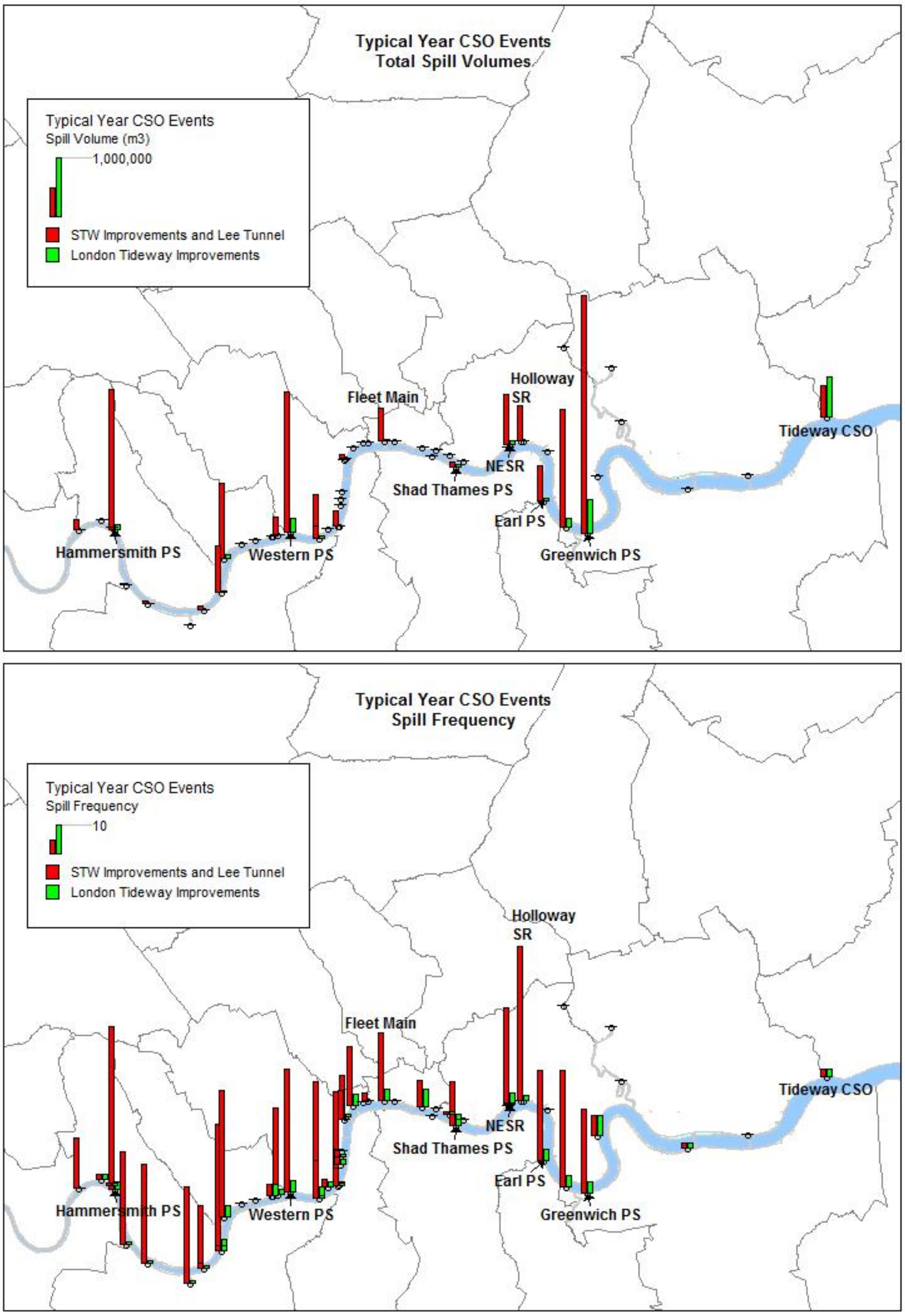
[1] A tide is a single ebb or flood.
[2] Failure of the standard occurs when the predicted number of exceedances at a single reach exceeds the allowable number of exceedances.

6.1.8 The reduction of Abbey Mills Pumping Station CSO discharges brought about by the Lee Tunnel has no effect on the 34 other unsatisfactory CSOs, as indicated in Figure 6.1, which shows in red the high discharge volume and frequency remaining with the STW improvements and the Lee Tunnel in place. Figure 6.1 shows in green the residual discharges with the Thames Tideway Tunnel (see also Table 1.1 in our response to second written question 36.05 for individual CSO values of frequency, durations and volumes).

6.1.9 Figure 6.1 also illustrates that the three discharges in the typical year from the Abbey Mills Pumping Station CSO go directly into the tidal Thames via the new Tideway CSO totalling 35 CSO-controlled discharges to the tidal Thames. The volume of discharge in the tidal Thames remains high (approximately 18 million m^3) with numerous locations continuing to discharge over 50 times per year.

6.1.10 It is estimated that discharges of this frequency affect the tidal Thames for up to 216 days (maximum 54 discharges at Hammersmith Pumping Station) in the Teddington to Putney Bridge reach of the river (see the *Environmental Statement*, Vol 3: Project-wide effects assessment, Doc ref: 6.2.03, Table 14.4.6). This has significant adverse impacts on river users and others who come into contact with the water. There would be no improvement to current conditions to the main body of the tidal Thames. Therefore the health objectives would not be met.

Figure 6.1 Typical year CSO performance along the tidal Thames



6.1.11 Although the total volume of CSO discharges would be reduced by the STW improvements and the Lee Tunnel, the frequency, duration and volume of discharges from Acton to Greenwich would not be reduced from the existing conditions. The exceptions are Acton Storm Relief CSO, due to ongoing increases in storm tank capacity from recent capital works to improve the facilities to clean-out the tanks after storm events, and Greenwich Pumping Station CSO, due to the upgraded treatment capacity of Crossness Sewage Treatment Works.

6.1.12 Professor Binnie states (page 2 and page 26 of his report) that there is an insufficient number of formal complaints from the public to support the aesthetic problem. However, formal complaints are not necessarily a reliable indicator of the adverse aesthetic conditions of the river. The high frequency and volume of discharges throughout the tidal Thames even with the STW improvement works and Lee Tunnel would continue to pollute the river with human waste, litter and street runoff during storm events. Therefore the aesthetic objectives would not be met. In addition, our pre-application consultation raised the awareness of the sources of pollution and formal complaints are therefore expected to increase if the Thames Tideway Tunnel is not constructed.

6.1.13 Professor Binnie provides a number of opinions which reverse the TTSS's recommendations to which we disagree. A summary response to some of these opinions and comments within Professor Binnie's report is provided in the following paragraphs. Although this goes beyond answering the specific question asked we believe that it is important to provide some additional information to the Examining Authority.

6.1.14 Professor Binnie recommends instigating additional studies, which would further delay compliance with UWWTD requirements. The ramifications of this delay in terms of fines are unknown but the adverse impact of the CSO discharges would certainly continue. In addition, a number of studies have been undertaken since the TTSS which continue to confirm that the Thames Tideway Tunnel is the only option to address the problem of discharging unacceptable levels of untreated sewage into the tidal Thames within a reasonable time and at a reasonable cost.

6.1.15 In paras. 6.1.16 and 6.1.17 we lay out the reasons we believe that Professor Binnie overstates the importance of population and water use, especially in respect of their impact on sewer flows, particularly during storm events. The problems of CSO discharges are today and although the Thames Tideway Tunnel is resilient to change the future projections is not a determining factor in seeking to address present-day problems.

6.1.16 It is clear that the population in the London catchment is increasing, particularly along the riverfront, which will increase the proportion of sewage in the combined sewerage system. This can only exacerbate the present day problem. However, base sewage flows are not the problem; it is rainfall-runoff that causes discharges therefore discussions on water use and population growth are academic and have limited influence on the frequency, volume and duration of discharges.

6.1.17 This is demonstrated in the change in total discharges with the STW improvements and the Lee Tunnel: the total discharge volume is estimated at 16 million m^3 in the typical year if the population remains static between 2006 and the 2020s (compared to an estimated 18 million m^3 if the population projections provided by the Greater London Authority are incorporated into the estimate).

6.1.18 The European Commission does not specify the number of CSO discharges that it would regard as 'acceptable' and leaves this to Member States to determine. The assertion (page 8 of Professor Binnie's report) that the European Commission and Advocate General Mengozzi ruled that

20 annual discharges to the tidal Thames would be acceptable is incorrect (see paragraphs 48 to 51 of the Advocate General's opinion dated 26 January 2012 and paragraph 61 of judgment of European Court of Justice dated 18 October 2012, in Case C-301/10)[3]. Twenty annual discharges would still be high and would occur outside of periods of 'unusually heavy rainfall'. Such a high frequency of discharges would not provide much protection to water users as impacts of discharges would last approximately 40 to 80 days. A storage and transfer tunnel would still be required albeit of a smaller storage volume but with limitations in handling locally occurring storms. According to the analysis in our response to first written question 18.1, the required storage for the Lee Tunnel and Thames Tideway Tunnel for 20 residual annual discharges would be approximately 630,000m^3 whereas a volume of 1,500,000m^3 would achieve a control level of four residual discharges.

6.1.19 Professor Binnie comments (page 11 of his report) on the investigations into alternatives and sustainable drainage systems by the TTSS and the additional work carried out on behalf of Thames Water. Neither the TTSS nor subsequent studies (see the *Needs Report*, Doc ref: 8.3) indicated that these options would be viable. These studies continue to show that the Thames Tideway Tunnel (in conjunction with STW improvements and the Lee Tunnel) is the best long-term solution to control CSO-derived pollution of the tidal Thames.

6.1.20 In terms of Professor Binnie's reference (page 4 of his report) to the removal of 50 per cent of impermeable surfacing in the London catchment, it should be noted that this scenario (see Appendix E: Potential Source Control and SuDS Application of the *Needs Report*, Doc ref: 8.3, Annex 1, Table 4.1) assumes that the rainfall-runoff from this 50 per cent area would be lost, that is, either stored, captured or somehow dealt with so that it would not enter the existing sewerage system. Even if this radical and impracticable amount of rainfall-runoff were removed from the system, CSO discharges would be unacceptably high. For example, under that scenario[4], Hammersmith Pumping Station CSO would discharge 43 times and Deptford Storm Relief CSO 31 times.

6.1.21 Professor Binnie's states (page 29 of his report) that booms could be used to meet the aesthetic requirements. However, constructions and effectiveness of the booms depend on the nature of the CSO discharge outlets. For example, the outfall at one of the largest CSOs (Hammersmith Pumping Station CSO) is located below low tide level and a third of the way across the river channel; therefore a boom would not be effective. The full tidal range on the tidal Thames would make booms impracticable and create navigational hazards. Even if booms could be installed and somehow serviced to remove what they have collected, they would do nothing for dissolved pollutants that impact on dissolved oxygen levels that

[3] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:62010CC0301:EN:NOT#

[4] Professor Binnie uses values from the *Needs Report* and the applicant recognises that the model results used in the *Needs Report* Appendix E has since been updated with additional information from survey work at several CSOs and development of the project design. However, values given are to demonstrate the effect of reduction of 50 per cent impermeable area which uses the same base model, and therefore is valid for showing the effect of change in volume and CSO discharge frequency.

impact the ecology or the bacteria and pathogens that affect the health of river users.

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