

Chris Binnie FREng

**Independent Water
Consultant**

**Brockwell Farm
Wootton Courtenay
Minehead
Somerset
TA24 8RN**

**Phone: 01643 841212
Fax: 01643 841233
Email: chrisbinnie@btopenworld.com**

Mr Simon Hughes
Environment Agency,
London Executive
Ergon house,
Horseferry Road,
London SW1P 2AL

Dear Mr Hughes,

31st December 2013

Thames Tideway issues

Thank you for your letter of 28th November in response to my correspondence of 10th November attaching my 9th November measures report. I apologise for this rather long reply but you raise issues that I believe require specific and carefully reasoned response.

REA of SuDS

You state that the Rapid Evidence Assessment (REA) *“is a tool for getting on top of available research evidence as comprehensively as possible within the constraints of a given timetable. It is a... quick overview..and a synthesis of the evidence.”* *“It is a statement that can be investigated.”* This implies that it is not necessarily fully comprehensive.

The REA does include consideration of a large number of reports relating to the applicability of SuDS . However it does not include all the evidence, and in particular does not include important evidence set out in my Measures report. I attach a note I prepared on the REA. Particular points include ;

1. The European Commission at the infraction proceedings in 2012 proposed not 10 spills a year but 20 spills a year.

The Advocate General’s Opinion of the infraction proceedings, January 2012, states in para 48 *“On several occasions, however, both in the pre-litigation stage and before the Court, the Commission did indicate that, as a rule, exceeding **the limit of 20 overflows a year** would be a cause for concern, suggesting a possible failure to fulfil obligations. Despite all its limitations and without prejudice to the need for a case-by-case assessment, a numerical criterion of that nature may be reasonable and acceptable as it had been determined by comparing the **practices existing in the various Member States.**”* Emboldenment added by me.

The judgement, para 28, states that the Commission *“does not propose a strict 20 spill rule but points out that the more an overflow spills, ...the more likely it is that the overflow’s operation is not in compliance with Directive 91/271.”*

Thus it is possible that a spill frequency up to 20 spills a year is likely to be allowed.

As an instance, the approved up-rated Mogden STW has spilled 15 times in the 9 months from April to 31st December 2013. This would indicate that a spill frequency of about 20 times a year has been accepted by the Environment Agency for the Upper Tideway.

2. The sewer model flows, as carried out by TW in early 2010 and used in Appendix E of the Needs report and quoted in your REA, were shortly after found to be inaccurate and were revised in June 2011, see Table of Performance in Annex C.

Catchment	Existing system spill frequency Appendix E	Existing system spill frequency TW Model 2011	Appendix E 50% impermeable removed	Likely revision 50% impermeable removed
West Putney	59	26	52	about 20
Putney Bridge	33	33	16	stays at 16
Frogmore	29	19	10	less than 10

Hence, with 50% impermeable area reduction, the Putney CSO spills would meet the EC 20 spills a year proposal and, in my view, should not have been rejected by the REA on out of date information.

There are similar, but less dramatic, reductions in spill frequency in the REA table 3, see note attached.

3. The predicted dry weather flow, done in the 2010 and 2011, for the future sewer model runs assumed an appreciable increase in dwf whereas, despite increasing population, TW's own Water Resources Management Plan (WRMP) shows reducing water delivered and reducing leakage by the design date 2021. The result would be reducing dry weather flows, and hence reducing spill frequency. This is shown in detail in section 15 of my note on fish benefit, attached and on pages 3 & 4 of the note on the REA.
4. The REA report states that the BGS evidence highlights the limited scope for infiltration storage of storm water as part of SuDS. However more detailed analysis by Bloomberg shows that 67% of the area would be suitable for SuDS, subject to some technical adjustments. A single cross check by me in a typical area in Fulham which is shown by BGS as "*very significant constraints*" shows that the area has Kempton Park gravel and BGS show it is suitable for infiltration except for "*groundwater less than 3m from the surface*". A borehole has showed that the groundwater is lower than 3m. This is only once location but it would appear that the SuDS infiltration restriction may be less onerous than suggested. Thus it is likely that more use could be made of infiltration than suggested.

Thus, since the REA report has been issued specifically to support the contention that SuDS alone could not meet the spill frequency required, ought not the EA, as the responsible regulator/Competent Authority, not consider the more detailed analysis done by me and, if found correct, to issue a revised report? It might well not change some of the conclusions but it would be more robustly based, as it should be for a Regulator advising government and others.

Roundtable discussion of 31st May 2012

You state that *“A round table discussion that included a cross section of renowned professionals concluded that the adopted standards regarding salmon species were appropriate and not gold plated. Removal of these sensitive species to change the objectives is therefore not appropriate.”*

I agree that the standards set for salmon are appropriate for salmon.

The Roundtable discussion on fish took place on 31st May 2012 and was instigated by a report on fish sustainability by me. I was present at the roundtable discussion. I provided my notes of the meeting and then found that the notes of the meeting provided by the EA did not correspond with what, in my view, was said and agreed at the meeting itself. My email response of 29th July 2012 to the Agency, see Annex B to this letter, says *“The EA notes say “ the group agreed” a number of matters which I never heard discussed. In particular whether **the current standards were appropriate and not gold plate**. I had expected these aspects to be discussed and had my points ready to make but they never came up. In that case I would be grateful if you would **circulate the attached response to all those to whom the notes and the position paper have been sent**, so that there can be a balance of view.” “Thus, as a member of the group at the meeting, I was not shown any draft notes and **cannot agree that, “the group agreed that the standards are still appropriate without salmon being present”.**”* my emboldening. I am not aware that my comments have been incorporated.

Further, salmon are the most sensitive species tested. The notes of the meeting state *“there is currently no evidence to challenge the hypothesis that salmon may not be sustainable in the longer term due to climate change.”*

You say *“Removal of these sensitive species to change the objectives is therefore inappropriate.”* My approach is the other way round. The prime objective is not to change the objectives but to ensure the fish suite is still appropriate. If salmon are no longer deemed sustainable, as I think we all agree, then, as the most sensitive species, as can be seen from the fish trials histogram, then is it not logical that salmon be replaced by a species which is present, or is sufficiently likely to be present in the future in sufficient numbers ? What evidence has been provided to support the allegation that, without salmon, the dissolved oxygen standards are appropriate.

In my fish benefit note, Annex A to this letter, I look at all the species proposed and find that, on the basis of the evidence that I can find, all of them bar sturgeon which is nearly extinct and cannot be tested, are reported to be less sensitive to dissolved oxygen than salmon. Thus I can find no evidence to support the allegation that, without salmon, the dissolved oxygen standards are appropriate.

All of the additional fish species are occasional stragglers bar sea trout for which average numbers are fairly steady at about 15 /year. Further none of them are yet established in sufficient numbers to be considered a representative species. The most appropriate might be sea trout of which there have been around 10 to 25 over most of the last two decades.

Thus I find it illogical, and possibly gold plating, not to replace salmon with another species.

Until the dissolved oxygen standards are revised they could be considered as “gold plated”. The Coalition in its Our Programme for government section 2 Business has stated *“We will end the so-called “gold-plating” of EU rules, so that British business are not disadvantaged*

relative to their European competitors.” In this case the disadvantage would be the cost on business and people in paying increased sewerage charges.

Aspects of fish benefit.

Following your letter, I have prepared a note on the aspects of fish benefit on the Tideway. I still await the response to my request to you for information on the previous Tideway fish kills and I am grateful to you for arranging that that will be sent to me shortly. In the meantime I attach the note on fish benefit which is of course subject to information on fish kills in the Tideway being provided by the Agency. This is long so I set out in Annex A to this letter the executive summary

The Tideway Fish Risk Model analyses the sustainable situation with fish of different characteristics and sustainable mortality. This is a powerful tool and more relevant than an arbitrary table. The model output which includes salmon is stated in the FARL report “*not sustainable incidences zero.*” Similarly the Tideway Fisheries Review 2010 states “*Tideway fish populations should already be sustainable.*” Note in the past when dissolved oxygen conditions were worse, some 300 salmon a year have migrated up the Tideway. Thus the conclusion would be that fish/ecology could not, at present, support the considerable cost of the tunnel. Other requirements such as frequency of spill might well do so anyway.

The TFRM was also run for 2020 conditions. Unfortunately this included sewer dry weather flows which were appreciably more than they would be if based on the TW WRMP. There is also no evidence provided, despite my request, to support the assumption that water temperature would increase by 0.4C above the increase in air temperature. Thus the future TFRMs of the future are not robust.

Further measures

Were there any doubts about the efficacy of the post Lee tunnel situation, there are a number of further measures that could be adopted. For dissolved oxygen and fish, in addition to the current mobile bubbler boats, there could be fixed bubbler systems in the river as provided in the River Seine at Paris. If there were to be concern about aesthetics, then booms could be placed round most of the CSO to retain visible floaters. There is sailing and water skiing in the London Docks and if thought appropriate, treatment could be provided to the top up water.

Measures Report

My measures report tried to provide the evidence base for a number of considerations which I believe should be considered in more detail. The paucity in your reply of comment on my Measures report is disappointing. I will be incorporating this response, along with some new information that has reached me recently, into an updated version.

Combination of measures

I agree with you that it is important that the focus remains on preventing waste water from entering the river. I have seen statements of the cost of complete implementation of single measures, and clearly, as we found in the TTSS studies, single solutions would not be economical.

The defra RBPG Vol 2 August 2008 states in 9.4 “*As river basin planning principle makes clear the Environment Agency should consider the **full range of measures** which are available.*” My emboldening

In 9.5 the RBPG states “*The **WFD requirement is to make judgements about the most cost effective combination of measures, so it is important that the Environment Agency considers the inter-relationship between measures.***” My emboldening.

The letter from defra to the EA North West Regional Director 4th April 2005 states “***Defra is committed to obtaining the best value for money.** I know that the Agency shares this commitment and will continue to treat value for money as an important consideration in assessing solutions proposed.*”

However I have been unable to find any study of a combination of measures, utilising those other measures to the extent that they are cost effective. That is why I have proposed that a study be done of a combination of measures to see whether they could be both effective in reducing the spill frequency to that proposed by the European Commission in the Infracation proceedings, 20 spills a year, at a more economical cost than the tunnel. The next version of my measures report will elucidate this further and i trust it will be given favourable consideration.

I hope this is helpful and that I can receive your response to my reasoned consideration.

Yours sincerely

Chris Binnie
Cc Tony Berkeley.

Attach file

Annex A Aspects of fish benefit. dated December 2013 Executive summary

Annex B Email of Binnie/Bain 29th July 2012.

Annex C Table of Performance of the CSOs.

Response to Environment Agency report” An assessment of evidence on the sustainable drainage systems and the Thames Tideway standards. October 2013.

File Thames tideway –Aspects of Fish benefit.

Doc TT response to EA final 28.11.13

Annex A Executive Summary of Thames Tideway-Aspects of fish benefit December 2013

On the basis of the evidence below it is concluded that

1. The objective of the UWWTD is to protect the environment from the adverse effects of waste water discharges. Since it is recognised that fish are the most sensitive indicator of ecological quality, the decision was taken to derive standards that are protective of relevant fish species. The objective is to limit ecological damage by ensuring that fish species are sustainable.
2. The TTSS carried out trials on a representative suite of fish to establish their response to dissolved oxygen conditions. Salmon were the most sensitive. From these trials a table of dissolved oxygen standards was established.
3. The two big fish kills in 2004 & 2011 were primarily due to Mogden STW overflows.
4. Mogden STW has now been upgraded. Spill frequency has dropped from about 110 spills a year to about 20 spills a year, the limit proposed by the EC. Fish kills as a result of its overflows should not occur in future.
5. Beckton and Crossness STW are currently being upgraded to remove the chronic low dissolved oxygen conditions in the middle/lower Tideway and these are due for completion in 2014.
6. The sustainable mortality of various species depends on the factors such as length of life and a sustainable mortality. For salmon it was found to be 30%.
7. Further major investment could only be warranted by the need to provide sustainable conditions for the most sensitive fish species that will be present for sufficiently long to warrant the expenditure.
8. Migration and spawning conditions for salmon in the Thames catchment are not favourable but are being improved.
9. Salmon numbers have reduced to an average of less than 10 a year, 2013 3. They are considered by the EA as not sustainable in the Tideway in the short, and medium term and the Dr Friedland model shows that salmon would not be sustainable in the long term, primarily because of adverse temperature and marine conditions.
10. Salmon are the most sensitive fish species so if they are no longer sustainable then they need to be replaced by a similar species or the D.O. Table reconsidered. The additional fish species mentioned are all more tolerant of low dissolved oxygen (DO) than salmon and/or not sufficiently established. Thus the D.O. table needs reconsidering.
11. A meeting on 31st May 2012 discussed fish but the notes contain points that were not heard at the meeting and the notes were subsequently challenged.
12. In earlier years over 300 salmon migrated through the Tideway, so adverse dissolved oxygen conditions would have had limited effect on migration.
13. The 2011 analyses by TW of CSO and water quality conditions in 2021 were based on increasing dry weather flows in the sewers, and thus show deteriorating Tideway D.O. conditions. The 25 year Thames Water (TW) Water Resources Management Plans show reducing water delivered and reducing leakage, hence sewer dry weather flows will be reducing. Hence the conditions predicted in the models for future years

are worse than would actually occur. Consequently the models need re-running with the latest information.

14. Storm runoff will be affected by climate change. The Met Office has said that during winter increases in heavy rain may start to be discernible in the 2020s whilst any changes in summer are not expected to be discernible for many decades. Also middle rainfall events will get smaller. TW has assumed that water temperature increase will be 0.4C more than the air temperature increase. No justification has been provided for this odd assumption which would adversely affect dissolved oxygen conditions. Any re-run of the models should include the latest climate change information.
15. Dr Turnpenny has developed a Tideway Fish Risk Model. This multiplies the proportion of stock in each river zone by month by the probability of standard breach to arrive at a risk factor. This is then multiplied by the mortality to assess the population effect. This is a powerful tool.
16. The Tideway Fish Risk Models risks for salmon were described as “precautionary” in the challenged roundtable meeting notes, hardly a strong basis for supporting a £4.2bn project.
17. TFRM output descriptions state FARL “*not sustainable incidences zero.*” Tideway Fisheries Review 2010 “*Tideway fish populations should already be sustainable.*”
18. The post tunnel TFRM are based on increasing sewer flows in 2021 and are thus not robust.
19. The AMP4 TFRM assumes that all salmon are present in the Tideway for 7 months of the year. In reality they are assumed to take about two weeks to migrate through the Tideway over a 3 to 4 month period. Thus only a small proportion would be affected by any one spill. Thus, at the time of any one spill, there will be those who have not yet entered the Tideway and those that have already arrived in freshwater prior to the spill.
20. The AMP4 post current works dissolved oxygen plot for Threshold 2 shows 1.15 dissolved oxygen failures a year on average. It would, on average, take about three weeks for a failure plume to exit the Tideway, thus failure conditions could last for the equivalent of less than a month a year on average. Salmon migrate over a three to four month period in the summer. Combining these factors, then the population level effect would be less than the 30% impact which is the limit of sustainable conditions for salmon.
21. Thus the AMP4 conditions, prior to construction of the tunnel, would indicate that, in the unlikely case of there being sufficient salmon, the salmon would be sustainable.
22. Thus, post the current works, fish in the Tideway would be sustainable and, subject to the future conditions not worsening, no further works would be required to meet ecology sustainability.

Annex B email dated 29th July 2012 as sent to attendees at the meeting of 31st May 2012

Dear Isobel,

Thank you for sending me on 17th July the EA notes of the Roundtable meeting on 31st May and also the EA Position Paper on Thames Tideway Water Quality Standards.

I have been waiting since the meeting for the supporting information to the statements made at the meeting, as asked for by me both at the meeting and in my notes. The BEEMS report has arrived, for which many thanks, and comments on the points I raised about problems for salmon in the Thames catchment. However, despite my waiting for the remaining supporting information, none has arrived so I have had to do an assessment without them.

The EA notes say "the group agreed" a number of matters which I never heard discussed. In particular whether the current standards were appropriate and not "gold plated". I had expected these aspects to be discussed and had my points ready to make but they never came up. In that case I would be grateful if you would circulate the attached response to all those to whom the notes and the Position Paper have been sent, so that there can be a balance of view.

My response is attached.

Regarding the TFRM, the notes allege that "*the mortality taken by CB has no data to support*". The mortality figures are in Appendix 1 to my Fish Sustainability report This was circulated before the meeting. In this I have taken the mortality figures from the FARL report, the basic document. See page 33 and 34 of my response. To say the mortalities taken by me are without support is, I believe, untrue. Thus, for those reasons alone, my response should be circulated to all those who have received copies of the notes, and presumably the position Paper.

One of the points made is whether the standards would be "*appropriate regardless of the presence of salmon*". Whereas salmon have a LC10 of about 3.2 mg/l, the next most sensitive species in the fish suite is dace with an LC10 of about 2.1 mg/l. Thus, without salmon, the standards could be changed significantly. One could retain the existing DO standards provided one was confident that other fish species with the same DO tolerance as salmon would become sufficiently established. My response discusses this in detail and concludes that there is insufficient evidence to support such a situation. Further, unfortunately, there are good reasons, why the "southerly" species are unlikely to establish themselves in the Tideway. Were Twaite shad to actually become established, then they are reported as being less sensitive to low DO than salmon, so anyway the DO standards should be modified. Thus, as a member of the group at the meeting, I was not shown any draft notes and cannot agree that, the group agreed that the standards are still appropriate without salmon being present. I trust you will circulate my response to those to whom the original documents have been sent.

Best wishes
Chris Binnie.

Annex C Table of performance

LTT ID	EA Cat	CSO Name	Existing System & Existing STW 2006 (June 2011)			STW Improvements and Lee Tunnel 2021 (June 2011)			Recommended Phase 2 Consultation Scheme 2021 (June 2011)		
			Total Volume (m ³) ^a	No. of Spills ^a	Spill Duration (hrs) ^a	Total Volume (m ³) ^a	No. of Spills ^a	Spill Duration (hrs) ^a	Total Volume (m ³) ^a	No. of Spills ^a	Spill Duration (hrs) ^a
CS01X	Cat 1	Acton Storm Relief	312,000	29	152	325,800	30	163	0	0	0
CS02X	Cat 2	Stamford Brook Storm	500	2	2	500	2	2	400	2	2
CS05X	Cat 1	West Putney Storm Relief	34,300	26	113	36,400	28	119	1,500	1	4
CS37X	Cat 3	LL1 Brook Green	0	0	0	0	0	0	0	0	0
CS03X	Cat 2	North West Storm Relief	2,800	1	1	4,100	1	1	700	1	1
CS04X	Cat 1	Hammersmith Pumping Stn	2,208,000	50	648	2,362,100	51	690	103,600	1-3	16
CS06X	Cat 1	Putney Bridge	68,100	33	107	70,800	33	111	1,600	1	3
		Upstream Putney Bridge Total / Maximum^b	2,626,000	50	1,023	2,800,000	51	1,086	108,000	3	26
CS07A	Cat 1	Frogmore SR - Bell Lane	17,300	26	124	18,100	27	130	500	1	4
CS07B	Cat 1	Frogmore SR - Buckhold Road	85,600	19	68	88,600	21	72	1,500	1	3
CS08A	Cat 1	Jews Row - Wandale Valley SR	300	1	2	2,900	1	5	0	0	0
CS08B	Cat 3	Jews Row - Falcon Brook SR	7,400	2	7	7,500	2	7	7,500	2	7
CS09X	Cat 1	Falcon Brook Pumping Stn	708,900	40	263	779,300	42	291	56,200	4	26
CS10X	Cat 1	Lots Rd Pumping Stn	1,135,000	38	346	1,263,000	42	410	91,600	4	31
CS11X	Cat 2	Church Street	0	0	0	0	0	0	0	0	0
CS12X	Cat 2	Queen Street	0	0	0	0	0	0	0	0	0
CS13A	Cat 2	Smith Street Main Line	1,400	4	8	1,500	4	8	1,500	4	8
CS13B	Cat 2	Smith Street Relief	0	0	0	0	0	0	0	0	0
CS14X	Cat 1	Ranelagh	283,000	26	142	305,700	27	153	18,500	2	10
CS15X	Cat 1	Western Pumping Stn	2,046,200	37	200	2,323,900	41	228	244,500	4	24
CS17X	Cat 1	South West Storm Relief	227,900	12	38	238,400	13	40	3,900	1	3
CS16X	Cat 1	Heathwall Pumping Stn	654,900	34	200	748,300	38	246	62,500	4	26
CS18X	Cat 2	Kings Scholars Pond Storm Relief	1,400	2	4	1,800	3	5	500	1	2
CS19X	Cat 1	Clapham Storm Relief	12,700	5	12	14,400	6	15	7,900	1	5
CS20X	Cat 1	Brixton Storm Relief	264,600	28	131	278,600	29	137	5,700	1	4
CS21X	Cat 2	Grosvenor Ditch	2,600	3	7	3,000	4	9	500	1	3
CS39X	Cat 3	Horseferry	3,400	3	7	3,800	3	7	300	1	2
CS40X	Cat 3	Wood Street	0	0	0	0	0	0	0	0	0
CS22X	Cat 1	Regent Street	22,200	4	12	25,700	8	19	0	0	0
CS23X	Cat 1	Northumberland Street	71,500	13	34	88,400	14	43	300	1	2
CS24X	Cat 2	Savoy Street	8,400	18	47	8,500	18	47	1,400	4	7
CS25X	Cat 2	Norfolk Street	0	0	0	0	0	0	0	0	0
CS26X	Cat 2	Essex Street	2,100	3	6	2,300	3	6	0	0	0
CS27X	Cat 1	Fleet Main	521,100	20	73	571,200	23	83	36,800	4	14
CS42X	Cat 3	Pauls Pier	0	0	0	0	0	0	0	0	0
CS55X	Cat 4	London Bridge	8,300	7	14	8,900	7	14	4,300	5	10
		Downstream Putney Bridge to London Bridge Total / Maximum^b	6,086,000	40	1,745	6,784,000	42	1,975	546,000	5	191
CS28X	Cat 1	Shad Thames Pumping Stn	91,900	15	70	100,400	15	69	71,300	4	14
CS43X	Cat 3	Battle Bridge	0	0	0	0	0	0	0	0	0
CS44X	Cat 3	Beer Lane	0	0	0	0	0	0	0	0	0
CS45X	Cat 3	Iron Gate	200	1	2	200	1	2	300	1	2
CS46X	Cat 3	Nightingale Lane	0	0	0	0	0	0	0	0	0
CS49X	Cat 3	Cole Stairs	0	0	0	0	0	0	0	0	0
CS50X	Cat 3	Bell Wharf	0	0	0	0	0	0	0	0	0
CS29X	Cat 1	North East Storm Relief	782,400	31	286	847,400	31	303	84,300	4	32
CS51X	Cat 3	Ratcliffe	0	0	0	0	0	0	0	0	0
CS31X	Cat 1	Earl Pumping Stn	539,000	26	184	593,900	30	207	50,500	4	26
CS30X	Cat 1	Holloway Storm Relief	7,800	8	18	8,400	9	23	7,000	2	9
CS52X	Cat 3	Blackwall Sewer	0	0	0	0	0	0	0	0	0
CS36X	Cat 2	Wick Lane	0	0	0	0	0	0	0	0	0
CS32X	Cat 1	Deptford Storm Relief	1,471,500	36	252	1,976,000	39	343	161,300	4	29
CS33X	Cat 1	Greenwich Pumping Stn	8,322,500	51	672	3,940,100	28	240	571,500	4	35
		Downstream London Bridge to Greenwich Total/ Maximum^b	11,215,000	51	1,484	7,466,000	39	1,187	946,000	4	147
CS56X	Cat 4	Isle of dogs Pumping Stn (Foul)	12,900	6	9	13,100	6	10	13,100	6	10
CS35X	Cat 1	Abbey Mills Pumping Station from STATION F	15,319,000	56	873	0	0	0	0	0	0
CS35X	Cat 1	Abbey Mills Pumping Station from STATION A	4,099,800	45	403	0	0	0	0	0	0
CS57X	Cat 4	Canning Town Pumping Stn	0	0	0	0	0	0	0	0	0
CS34X	Cat 1	Charlton Storm Relief	600	2	3	900	2	3	900	2	3
CS53X	Cat 3	Henley Road	0	0	0	0	0	0	0	0	0
		Downstream Greenwich to Henley Road Total/ Maximum^b	19,432,000	56	1,288	14,000	6	13	14,000	6	13
		Crossness STW Storm Tanks	308,300	5	27	50,200	3	8	50,600	3	9
		Tideway CSO				609,100	3	19	698,300	3	22
		Total / Maximum^b to the River (CSO + Tunnel Overflow)	39,667,000	56	5,567	17,723,000	51	4,288	2,363,000	6	408
Sewerage Treatment Works ^c		Beckton Catchment	444,610,000		8784	508,290,000		8784	508,240,000		8784
		Tunnel Pump Out	n/a		n/a	6,201,000		791	22,128,000		1551
		Beckton STW (Catchment + Tunnel Pump Out)	444,610,000		8784	514,490,000		8784	530,370,000		8784
		Crossness STW	200,560,000		8784	230,940,000		8784	230,280,000		8784
Notes		a. All CSO spills less than 100m3 have been removed. Volume, number and duration of spills have been adjusted accordingly.									
		b. For Volume and Duration, the sum of all CSO spills in the reach is reported. For Number of Spills, the maximum number of spills in the reach is reported.									
		c. Typical Year Model simulation is only for 270 days. The table includes infilling the remaining days with average daily DWF for Beckton and Crossness STW.									