PART 2 OF WASP'S REVIEW OF UNPERMITTED SPILLS FROM SEWAGE TREATMENT WORKS

Peter Hammond, Windrush Against Sewage Pollution (WASP), January 2022

HEADLINES

WASP had to omit 3 water companies from the review because:

- Anglian Water appears to have no sewage treatment works allowing "early" spill verification
- Northumbrian/Severn Trent Water declined/ignored requests for data essential to spill verification

WASP believes

- 7 water companies made, in total, at least 2,405 "illegal" spills from the 44 STWs reviewed (2017-21)
- 10 chalk streams between them received at least 1,028 "illegal" spills
- Thames Water's Dorking STW alone made over 223 "illegal" - damaging the ecology of the River Mole
- Chichester STW spilled for 4 months almost continuously between December 2019 and March 2020
- it employs 100 times more data than is typically used by the Environment Agency to monitor compliance
- its analysis supports findings on microplastics pollution in the River Tame by The University of Manchester[1]
- the Water Industry's self reporting of spills is incomplete and incorrect
- the Environment Agency's regulation of sewage spilling is inadequate
- OFWAT's regulation of water companies is based on incomplete and incorrect compliance data

These STWs spilled untreated and partially treated sewage for over 150,000 hours, some for months on end.

SUMMARY

If a sewage treatment works spills untreated sewage when there is no rainfall it is a "dry" spill. If it spills untreated sewage before reaching, or while failing to maintain, its obligatory minimum treatment rate, it is an "early" spill. "Dry" and "early" spills breach Environment Agency (EA) permit conditions and are illegal.

Three water companies were excluded from this report because records of sewage treatment at eligible STWs, essential to detecting "early" spills reliably, were either vacuous or witheld:

Anglian:	confirmed only 1 eligible sewage works but its spill detector malfunctioned after 8 weeks
Northumbrian:	declined a formal request to identify eligible sewage works
Severn Trent:	ignored a formal request to identify eligible sewage works

WASP believes the remaining 7 water companies in England and Wales made at least 2,405 spills from 2017 to 2021 at 44 sewage treatment works (STWs): **1,080 were "dry"** and **1,325 were "early"**. These are in addition to 735 "illegal" spills at 14 other Thames Water STWs covered in Part 1 of the review[2].

Besides revealing illegal spills, this report has established yet more evidence that neither operator self-reporting by the water industry nor regulation by the EA is working. It has further demonstrated that the annual Environmental Performance Assessment of sewerage providers, a key element of OFWAT's and DEFRA's financial regulation of the water industry, is based on incomplete and incorrect data.

As with Part 1, the analysis presented here is based solely on data gathered from the EA and water companies using Environmental Information Regulation (EIR) requests. It does not employ machine learning inference.

BACKGROUND

The water companies in England and Wales manage tens of thousands of "assets" (STWs, sewage pumping stations and sewage storage tanks) using networks of pipes and pumps to transport and treat wastewater.

The EA permits water companies to discharge treated wastewater (effluent) from STWs to land and water (ditch, brook, stream, river, estuary and sea) provided the effluent satisfies specific standards.

The EA also permits discharges of untreated and partially treated wastewater, hereafter "spills", to both land and water, when rain induced surface water combined with sewage is liable to overload wastewater transport or treatment. Such spills via combined sewer overflows (CSOs) occur at STWs, on sewerage networks and at sewage pumping stations (SPSs).

[1] Woodward, J.C. *et al.* (2021) Acute riverine microplastic contamination due to avoidable releases of untreated wastewater. *Nature Sustainability* 4, 793–802

[2] WASP Review of Unpermitted Spills from Sewage Treatment Works – Part 1 Thames Water – control+click to download

FOCUS OF PART 2 OF WASP's REVIEW

In Part 1 of WASP's review, the focus was 14 Thames Water STWs, given WASP's location in West Oxfordshire, and the detection of "early" spills. In this 2nd part of the review, WASP has added another 10 Thames Water STWs and 34 STWs operated by 6 other water companies. The 58 STWS reviewed, serving a population of about 4.42 million, are broadly representative of STWs across England and Wales in terms of scale, design and operation. WASP's findings, therefore, are likely to reflect the picture across England and Wales.

Fourteen of the STWs in Part 2 were inherited from the *River Pollution Scandal* selection made by Joe Crowley and the BBC Panorama team. The remaining 30 have not been previously reviewed and arose from suggestions of fellow campaigners, pollution incidents in the media and spill data published by the EA.

Where data were available, WASP has investigated "dry" as well as "early" spills. A common cause of "dry" spills is groundwater infiltration through cracks and joints in the pipes transporting wastewater. The CEO of the EA, Sir James Bevan, in a letter to Cotswolds MP Sir Geoffrey Clifton-Brown, said

Discharges of untreated sewage due to groundwater infiltration alone are not permitted

Essential to the reliable detection of "early" spills at STWs is a meter measuring flow to full treatment (FFT) to establish that STWs have reached and maintained an obligatory minimum treatment rate throughout a spill. Therefore, each of the 10 water companies in England and Wales was sent an EIR request for a list of STWs with an FFT meter. This was ignored by Severn Trent Water and turned down by Northumbrian Water. Anglian Water reported 22 STWs with an FFT meter of which only 1 was permitted to spill. On checking what seemed unbelievable to WASP, Anglian Water's response was "Yes, that is right, there is only one at the moment, which is Canvey". It became clear later that Canvey Island's spill detection device failed weeks after installation. So, in 2020, Anglian had no STW for which "early" spill compliance could be directly verified.

WASP has omitted Anglian, Northumbrian and Severn Trent from its review until more data is available.

Southern Water agreed only to identify how many STWs had an FFT meter, not their names. However, spill data on the company's website, not optimal for detecting "early" spills, was used to detect "dry" spills.

Therefore, this 2nd part of WASP's review was limited to STWs operated by the 7 remaining water companies:

Southern, South West, Thames, Welsh, Wessex, Yorkshire and United Utilities.

DATA COLLECTED AND METHOD OF ANALYSIS

WASP submitted EIR requests to each company for details of sewage treatment and spill data for each STW. The generic format of the request is provided in appendix A, along with an email address for contacting the EIR department at each water company. Electronic copies of permits summarising the conditions under which STWs are allowed to discharge to watercourses were requested through the EA's online Public Register[3]. Rainfall data were obtained from free online sources[4] and for the River Tame catchment from the EA. The EU Wastewater Directive website provides historic loading rates of individual STWs[5]. The Riverstrust sewage spill map was another excellent source of summary data on individual STWs[6].

From 2014, the EA initiated a programme for water companies to install Event Duration Monitors (EDMs), devices that record spill start/stop times and to report annually the number of spilling hours per CSO. In addition, water companies are obliged annually to report daily totals of sewage treatment at all STWs. The EDM data for 2020 for all water companies were available from the EA website[7]. WASP obtained EDM data for 2017-2020 from the EA.

[3] https://environment.data.gov.uk/public-register/view/index

[4] https://www.meteocentre.co.uk/ and https://nrfa.ceh.ac.uk/

[5] https://uwwtd.eu/United-Kingdom/treatment-plant/ukensoswtp000111/history

[6] https://experience.arcgis.com/experience/e834e261b53740eba2fe6736e37bbc7b/

[7] https://environment.data.gov.uk/portalstg/home/item.html?id=045af51b3be545b79b0c219811d3d243

In contrast to the EA, WASP asks water companies for sewage treatment rates recorded every 15 minutes (96 times a day) and start/stop times of each individual spill. The EA requires this detailed information to be measured and recorded but does not request it unless, as the EA have said, there is suspicion of a permit breach.

Unfortunately, as Part 1 of WASP's review showed, a daily total of sewage treated masks evidence of unpermitted spills that is detectable from 15-minute treatment data. Suspicion is less likely to be aroused with the EA's approach and, therefore, it is relatively easy to avoid scrutiny. Similarly, annual spilling hours mask the frequency and length of individual spills or groups of STWs spilling for long periods to the same body of water at multiple locations.

In short, **WASP reviews 100 times finer grained data than the EA typically considers**. WASP's analysis employed simple yearly spreadsheets with automated monthly charting of flow, spill start/stop times and rainfall. Days where a spill occurred with **no rainfall on the day or the day before** are labelled as "dry" and as "early" if the sewage flow receiving full treatment (FFT) did not reach or remain above the permitted minimum rate, also known as the pass forward flow rate or storm overflow setting, for the entire spill. The EA allows up to 8% error for certified flow meters so WASP applies **a minimum FFT to storm overflow ratio during spills of 92% to detect "early" spills**.

It is important to emphasise that, in this review, there was no application of the machine learning techniques WASP previously developed for detecting historic spills when EDM detected start/stop times of spills are unavailable[8].

ORGANISATION OF FINDINGS

The findings of Part 2 of WASP's review are presented in four parts:

- a map showing the location of each STW to enable the reader to locate those nearby
- a table of the numbers of days when WASP believes "unpermitted" spills occurred at each STW
- a list of the watercourses receiving the "unpermitted" spills
- a detailed analysis and examples, if there are any, of "unpermitted" spills from each STW

supplemented by three appendices

A) the form of the EIR request for flow and spill data;
B) WASP's list of regulation errors made by The Environment Agency
C) Open data and EIR response

ACKNOWLEDGEMENTS

The author is particularly grateful to colleagues within, and working with, WASP who spent precious spare time to comment and suggest improvements to this report:

Eileen Boothroyd, Vaughan Lewis, Victoria Marsh, Ashley Smith, Geoff Tombs.

Special thanks are due to Joe Crowley and the BBC Panorama team for gathering/sharing data on STWs featured in *The River Pollution Scandal* and to Nicola Cutcher during the making of *Rivercide*.

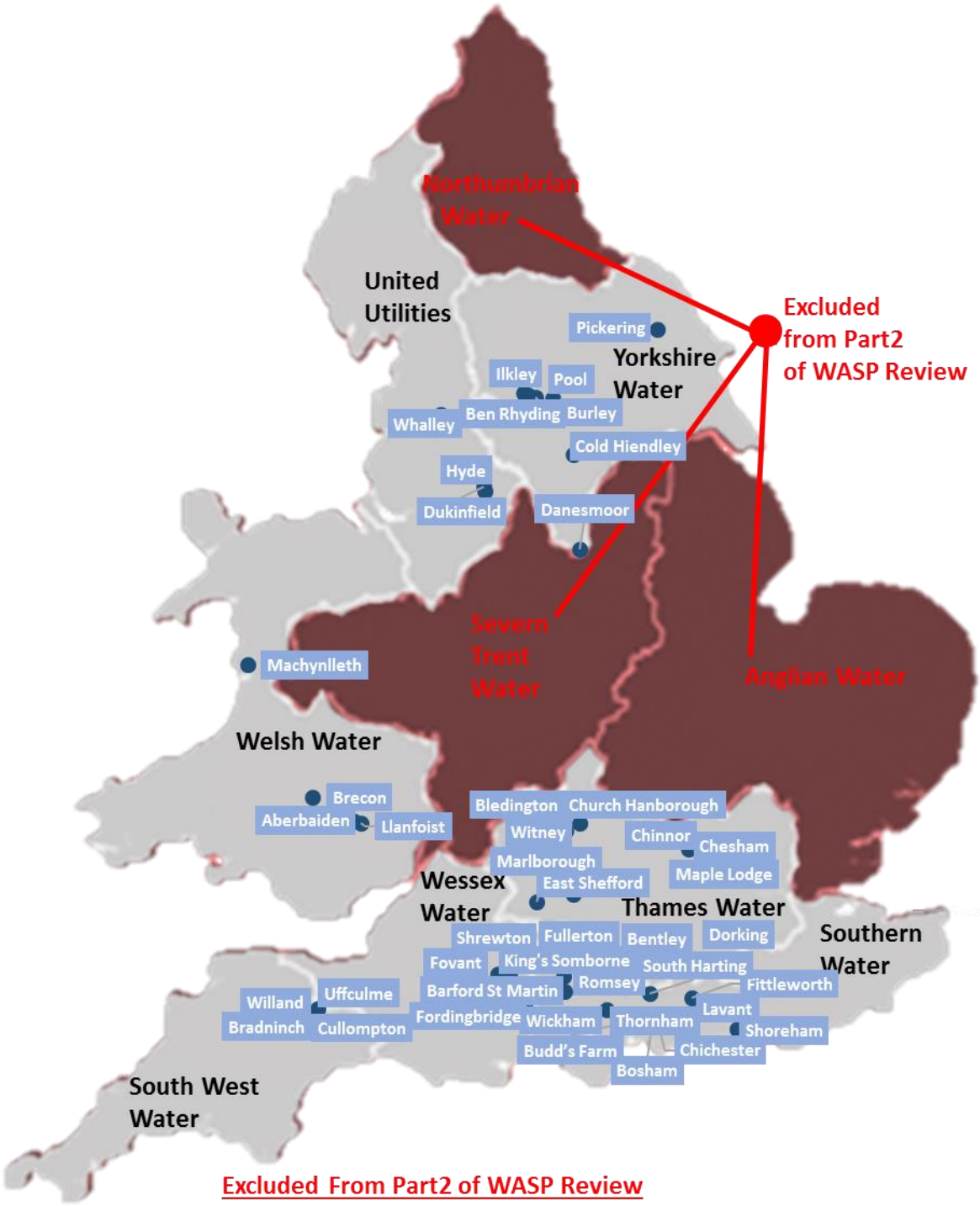
The following individuals and campaign groups shared data and/or suggested troubled rivers and STWs:

Robert Bailey	Mike Owens	Fish Legal	Salmon and Trout Conservation
Rhys Blakely	Mark Swaby	Ilkley Clean River	South Coast Sirens
Patrick Heaton-Armstrong	David Wales	River Chess Association	Wild Trout Trust
Mark Hull	Paul Wyatt		

Whilst every effort has been made to ensure the accuracy of information in this report, it may contain errors or omissions which WASP will be pleased to correct.

[8] Detection of untreated sewage discharges to watercourses using machine learning P Hammond et al NPJ Clean Water 4 (1), 1-10, 2021.

APPROXIMATE LOCATION OF THE 44 STWs CONSIDERED IN PART 2 OF WASP'S REVIEW



Excluded From Part2 of WASP Review

Severn Trent Water : ignored EIR request to name STWs with FFT meters

Northumbrian Water: refused EIR request to name STWs with FFT meters

Anglian Water : only 1 STW with FFT meter and spill monitor (monitor failed weeks after installation)

NUMBERS OF UNPERMITTED SPILLS WASP BELIEVES HAVE OCCURRED AT 44 STWS (2017 – 2021)

COMPANY	STW	TOTAL	2017	2018	2019	2020	2021	PE	Watercourse(s) involved
SOUTHERN WATER	Bosham	26	2	9	0	15	NDA	3,637	Chichester Harbour
	Budd's Farm	39	11	16	2	10	NDA	374,241	Langstone Harbour
	Chichester	50	1	23	10	16	NDA	49,143	Chichester Harbour
	Thornham	67	16	21	17	13	NDA	21,457	Chichester Harbour
	Lavant	147	7	83	57		NDA	2,617	Lavant*/Chichester Harbour
	Fittleworth	26		5	7	14	NDA	720	Rother* (W Sussex)
	Fullerton	???				?	NDA	65,329	Test*
	King's Somborne	21		8	1	12	NDA	2,293	Test*
	Romsey	27		3	12	12	NDA	1,907	Test*
	Shoreham	114	18	23	33	40	NDA	56,524	English Channel
	South Harting	130	12	36	53	29	NDA	2,920	Rother* (W Sussex)
	Wickham	72	6	15	7	44	NDA	2,442	Meon*
SOUTH WEST WATER	Bradninch	33			4	29	NDA	2,038	Culm
	Cullompton	24				24	NDA	9,244	Culm
	Uffculme	45	0	7	23	15	NDA	2,475	Culm
	Willand	27				27	NDA	3,590	Culm
THAMES WATER	Bentley	193			12	105	76	2,335	Wey*
	Bledington	16			7	6	3	600	Evenlode
	Chesham	46	NDA	NDA		18	28	34,601	Chess*
	Chinnor	38	NDA	NDA	20	15	3	7,090	Henton Stream/Thame
	Church Hanborough	25		12	11	0	2	8,926	Hanborough Stream/Evenlode
	Dorking	223		22	63	116	22	28,905	Mole
	East Shefford	79	NDA			47	32	5,432	Lambourn*
	Maple Lodge	24	NDA	NDA	7	17		506,028	Grand Union Canal
	Marlborough	67	NDA		18	44	5	10,213	Kennet*
	Witney	21			11	7	3	49,297	Windrush
UNITED UTILITIES	Dukinfield	168	4		103	42	19	77,083	Tame (Upper Mersey)
	Hyde	140		29	85	22	4	82,977	Tame (Upper Mersey)
	Whalley	39		8	11	20		5,321	Calder
WESSEX WATER	Barford St Martin	23			4	13	6	386	Nadder*
	Fordingbridge	6			2	4	NDA	9,579	Avon (Hants)
	Fovant	6			3	3		1,276	Nadder*
	Shrewton	191		37	31	61	62	1,916	Till* / Avon (Hants)
YORKSHIRE WATER	Ben Rhyding	16			6	10		4,433	Wharfe
	Burley	16				7	9	13,232	Wharfe
	Cold Hiendley	26	5		10	3	8	5,276	Cold Hiendley Reservoir
	Danesmoor	19	NDA	NDA	15	4	NDA	6,694	Rother (Derbyshire)
	Ilkley	9		5	1	3		15,829	Wharfe
	Pickering	15		15				7,879	Costa Beck
	Pool	52			17	35		4,349	Wharfe
WELSH WATER	Aberbaiden	22		12		10		5,359	Usk
	Brecon	51	11		23	17		9,977	Usk
	Llanfoist	14				14		16,784	Usk
	Machynlleth	12		2		2	8	3,450	Dyfi
	TOTAL	2,405	93	391	685	946	290	1.53 M	*chalkstream
			2017	2018	2019	2020	2021		

PE=population equivalent NDA=no/incomplete data available

43 of the 58 STWs included in WASP's review had a meter recording flow to full treatment and some of those also have a meter recording treated effluent flow. Generally, the difference corresponds to sludge and minor process losses.

15 STWs in Part 2 of WASP's review have only a meter recording treated effluent flow (Bentley, Bledington, Bradninch, Brecon, Chesham, Chinnor, Church Hanborough, Cold Hiendley, Cullompton, King's Somborne, Lavant, Maple Lodge, Uffculme, Willand, Witney).

WATERCOURSES AFFECTED BY SEWAGE SPILLS FROM STWs COVERED IN THIS REPORT

HARBOUR (2)	
Chichester & Langstone	Received **182** discharges from at least 4 STWs: **Bosham**, **Budd's Farm**, **Chichester** and **Thornham.**
CANAL (1)	
Grand Union Canal	Received discharges from many STWs including **24** from **Maple Lodge**.
LAKE/RESERVOIR (1)	
Cold Hiendley	Received **26** discharges from **Cold Hiendley** (not a clean water reservoir but canal feeder)
COASTAL WATER (1)	
English Channel	Received discharges from many STWs including **114** from **Shoreham.**
CHALK STREAM (10)	
Chess SSSI, UK BAP	Rises in the Chiltern Hills and flows through Buckinghamshire and Hertfordshire to join the R Colne; received **46** illegal discharges from **Chesham**.
Kennet SSSI	Important chalk stream, 72 kms long, rises in Wiltshire and joins R Thames in Berkshire; received discharges from at least 4 STWs including **67** illegal discharges from **Marlborough**.
Lambourn SSSI, SAC	Rises in Berkshire and joins the R Kennet between Newbury and Thatcham; received **79** illegal discharges from **East Shefford.**
Lavant SNCI	Small winterbourne chalk stream rises in Hampshire and flows to Chichester Harbour; received **147** illegal discharges from **Lavant**.
Meon SNCI	Rises in Hampshire and joins the R Solent at Hill Head; received **72** illegal discharges from **Wickham**.
Nadder SSSI	Rises in Wiltshire and joins the R Avon near Salisbury Cathedral; received **29** illegal discharges from **Barford St Martin** and **Fovant**.
Rother (W Sussex) SNCI	Rises in Hampshire to West Sussex to join R Arun; received **156** discharges from **Fittleworth** and **South Harting.**
Test SSSI	Major chalk stream; rises near Basingstoke; flows to Test Estuary to meet R Itchen; received discharged **48** illegal discharges from **Fullerton**, **King's Somborne** and **Romsey**.
Till SSSI	Rises on Salisbury Plain and flows to the R Wylye in Wiltshire; received **191** illegal discharges from **Shrewton.**
Wey SNCI, SSSI, AONB	Tributary of R Thames with 2 branches (West Sussex/Surrey); received **193** illegal discharges from **Bentley.**
INLAND RIVER (13)	
Avon (Hants) AONB, SSSI	Major river with 2 arms rising near Devizes & near Pewsey; flows through Wiltshire, Hampshire to Christchurch Harbour; received **6** illegal discharges from **Fordingbridge**.
Calder AONB	Rises in Lancashire and flows through West Yorkshire to the R Ribble; received **39** illegal discharges from **Whalley**.
Costa Beck SSSI	Rises in North Yorkshire and is a tributary of the R Rye which joins the Derwent and then the R Ouse; received **15** illegal discharges from **Pickering**.
Culm SSSI, SAC, AONB	Rises in Somerset and joins the River Exe near Exeter; received **129** illegal discharges from **Bradninch**, **Cullompton**, **Uffculme** and **Willand**.
Dyfi SAC, SSSI	Rises in a lake 580 m above sea level and flows to Cardigan Bay: received **12** illegal discharges from **Machynlleth.**
Evenlode AONB, SSSI	Flows from Gloucestershire through Oxfordshire to R Thames; received **41** illegal discharges from many STWs including **Bledington** and **Church Hanborough**.
Thame SSSI	Rises near Aylesbury, has many tributaries and joins the R Thames; received discharges from 32 STWs including **38** illegal discharges from **Chinnor.**
Mole SSSI, SAC	Rises in West Sussex and flows through Surrey to join the R Thames at East Molesley; received discharges from several STWs including **223** illegal discharges from **Dorking.**
Rother (Derbyshire)	Rises in Derbyshire, links with the Chesterfield Canal and joins the R Don in Yorkshire; received discharges from several STWs including **19** illegal discharges from **Danesmoor**
Tame (Upper Mersey)	Rises in West Yorkshire and flows through Greater Manchester to join the R Mersey; received discharges from several STWs including **308** illegal discharges **Dukinfield** and **Hyde**.
Usk SAC, SSSI	Rises in the Brecon Beacons and joins the Severn Estuary at Uskmouth; received discharges from many STWs including **87** illegal discharges from **Aberbaiden**, **Brecon** and **Llanfoist**.
Wharfe SSSI	First inland river in England to receive Bathing Quality Status; received discharges from many STWs including **93** illegal discharges from **Ben Rhydding**, **Burley**, **Ilkley** and **Pool.**
Windrush AONB, SSI, SAC	Flows from Gloucestershire through Oxfordshire to R. Thames; received discharges from 7 STWs including **21** illegal discharges from **Witney.**

Flows through **SSSI**=Site of Special Scientific Interest **SAC**=Special Area of Conservation **AONB**=Area of Outstanding Natural Beauty
BAP = Site within Biodiversity Action Plan **SNCI**= Site of Nature Conservation Interest

DETAILED RESULTS

Records of sewage spilling hours from CSOs

Some individual STWs have been recording sewage spills for more than a decade because they discharge into sensitive locations affecting ecology, tourism or the fishing industry. The EA first requested all water companies to install event duration monitors (EDMs) on CSOs in 2014. The proportion of CSOs with EDM devices installed is about 90% with completion unlikely before 2023. WASP requested, and received from the EA, all annual CSO sewage spilling data submitted from 2017 onwards. **Fig**. 1 shows how the numbers of recorded spills and EDM monitored CSOs have grown. By 2020, average spilling was about 100 hours per CSO per year and, across all 10 utilities, a total of 3.1 million spilling hours was recorded for about 29,000 CSOs.

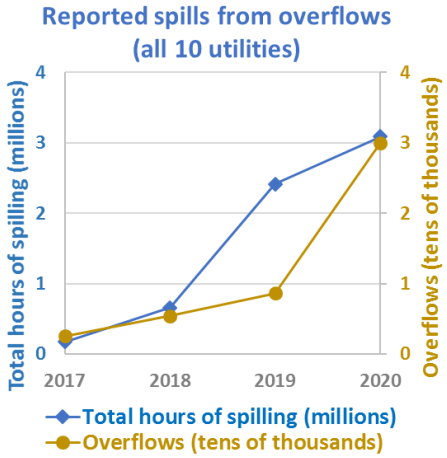


Figure 1: total spill hours (2017 to 2020)

Sandra Laville's Guardian article[9] brought CSOs, EDMs and spilling hours to the attention of the general public in July 2020. The Rivers Trust sewage map[10] can now be used by anyone to find out how many hours their local STW has discharged untreated sewage or their local river has received it.

Although total spilling hours give a useful estimate of river exposure to sewage dumping, it is important to recognise its weakness. An obvious one is that it does not record volume of spillage – only Thames Water's Mogden STW, as far as the author is aware, records and publishes sewage spill volume in a public arena[11]. Another weakness is that the EA only publishes total spilling hours for a calendar year. It is crucial to be aware that there is a spilling season (from October to March approximately) and that the lengths of individual spills can be several months long, cross the year end boundary and so be artifically shortened by the adoption of annual reporting. WASP has advocated, for some time, that the detailed start/stop times of individual spills be made public by the water industry. The figure below, explained in more detail on the next page, emphasises how STWs and CSOs spill untreated sewage into the same waters, for long periods of time and in unison.

Figure 2: A) approximate location: Henderson Rd CSO, Budd's Farm, Thornham, Bosham and Chichester STW primary outlets
B) spill pattern for autumn/winter 2019-20, some almost continuous for months

[9] https://www.theguardian.com/environment/2020/jul/01/water-firms-raw-sewage-england-rivers
[10] https://www.theriverstrust.org/key-issues/sewage-in-rivers
[11] https://www.thameswater.co.uk/about-us/performance/mogden

SOUTHERN WATER

Twelve individual STWs operated by Southern Water are included in this review. Because of their co-location and discharge into the same or connected watercourses, some of the them have been reviewed as a group.

Sewage Pollution in Chichester and Langstone Harbours

Chichester and Langstone Harbours receive treated, partially treated and untreated sewage discharges from multiple sources but notably from Bosham, Budd's Farm, Chichester and Thornham STWs as well as Henderson Rd CSO (**Fig**. 1A on previous page). The Lavant STW, about 5 km from Chichester STW, discharges to the River Lavant which joins Chichester Harbour right next to Chichester STW's discharge outlet. As long ago as 2011, a microbial pollution study[12] of Chichester Harbour concluded that

> *Increased levels of contamination in the winter could be associated with the increase in water levels in the **River Lavant** during the period November–December (CEH-NERC, 2008). In fact, the increase in E. coli levels at this site during the period September–January closely mirrors the rising limb of the River Lavant hydrograph.*

The River Lavant is a winterbourne. Consequently, between July and December/January the riverbed is dry upstream of the Lavant STW. Immediately downstream of Lavant STW, the river is 100% effluent with intermittent addition of storm discharges. A Google Earth satellite image (Jan 2005) shows this dramatically – the river is dry upstream and downstream its colour is the same brown hue of the contents of the tank (upper left) from which effluent is discharged.

Figure 2: view of Lavant STW where riverbed is dry upstream and reddish-brown sewage effluent downstream

Langstone Harbour received a great deal of publicity recently when drone footage captured a dramatic discharge from Budd's Farm STW[13]. An individual outlet can obviously cause significant pollution but it is important to consider the co-location of the STWs discharging to both Langstone and Chichester Harbours as well as the seasonal nature of the spilling pattern, typically starting in the autumn and continuing until the spring (**Fig**. 1B on previous page). Detailed accounts of the performance of these STWs start on the next page.

[12] https://www.researchgate.net/publication/272481562_Microbial_pollution_of_the_water_in_Chichester_Harbour

[13] https://www.bbc.co.uk/news/av/uk-59050129

Bosham

PE **3,637**

TOTAL SPILLS	
dry	early
7	19

Spilling hours	2017		2018		2019		2020		2021	
	SSO		SSO		SSO		SSO		SSO	
	0		0		271		1,140		NDA	
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	0	2	0	9	0	0	7	8	NDA	NDA

SSO=Settled Storm Overflow PE=Population Equivalent

Bosham STW discharges treated effluent and storm tank overspill into Chichester Harbour. It has been working at, or close to, full capacity for over 10 years[14].

2020

WASP believes that there were at least **7 "dry" and 8 "early" spilling days at** Bosham STW in 2020 (examples in **Fig**. 1)**.**

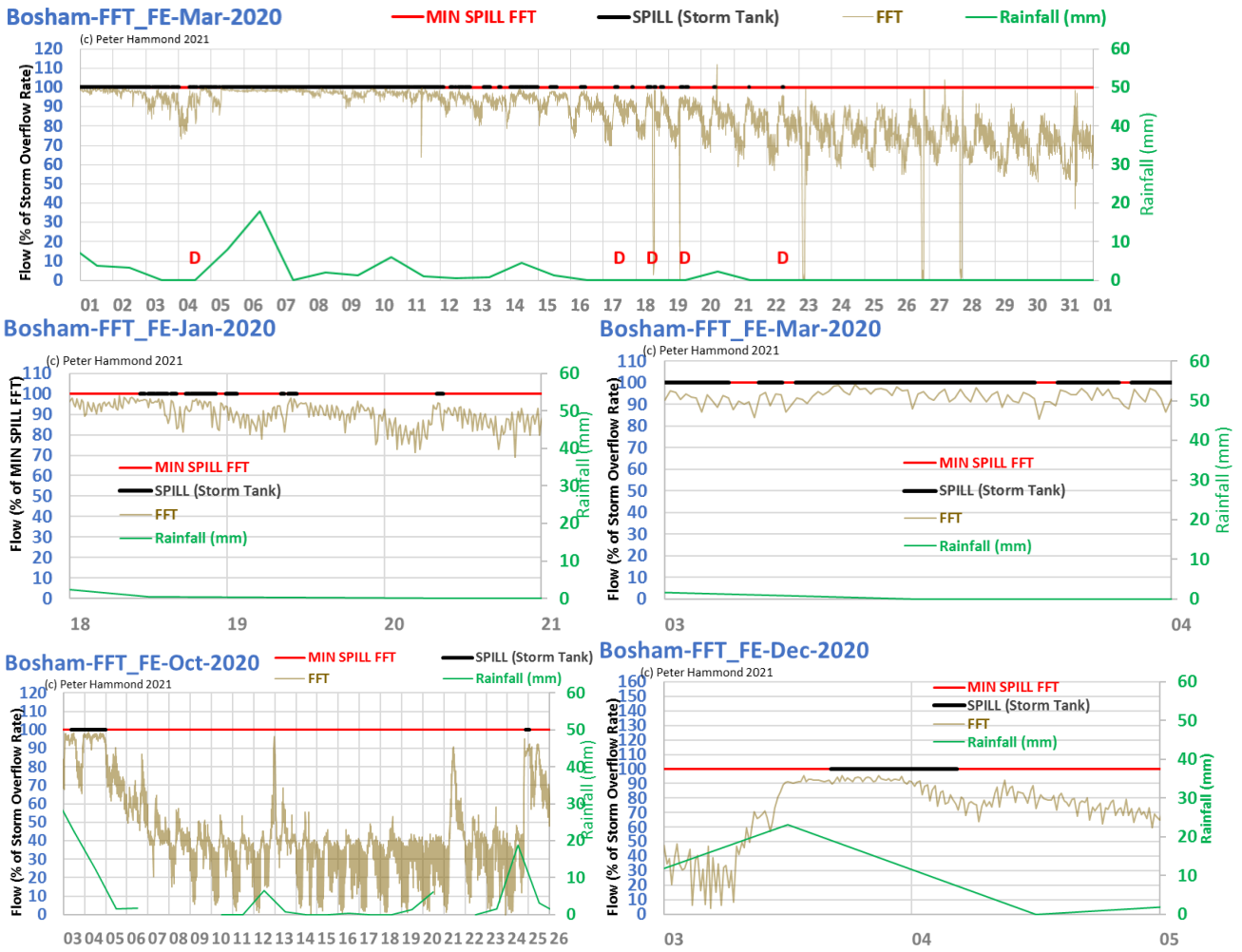
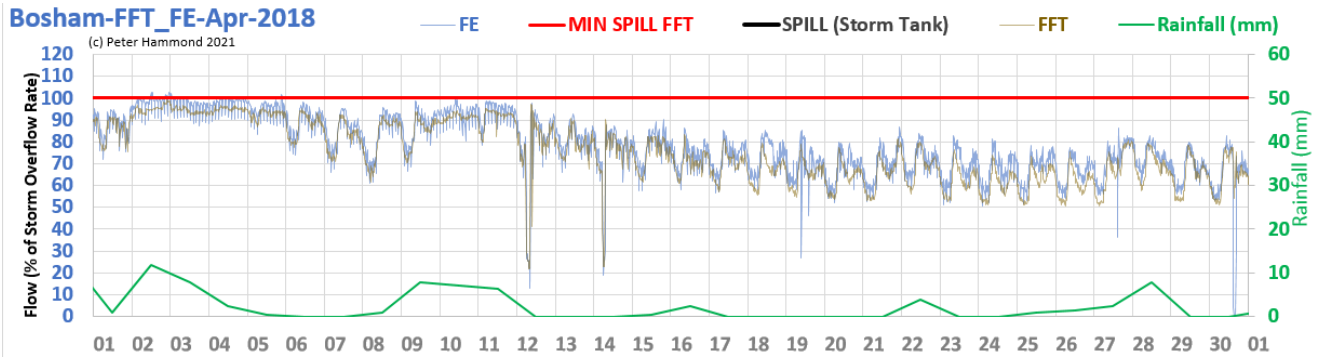


Figure 1: WASP believes the spill days included 5 "dry" (Mar 4,17-19,22) & 7 "early" (Jan 18-20; Mar 3; Oct 4,25; Dec 4)

2018

Southern Water's EDM returned no spills to the EA for 2018 and on the Southern Water website no spills were recorded. However, the pair of monthly charts below (**Fig**. 2) suggests there was spilling in April and December – possibly more than 240 hours. WASP believes **9 "early" spills** occurred during the year.

[14] https://uwwtd.eu/United-Kingdom/treatment-plant/ukensoswtp000106/history



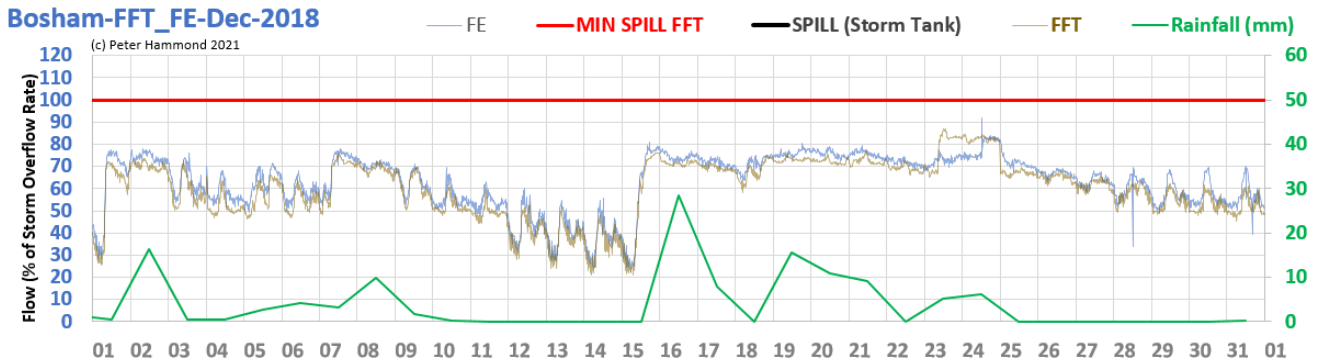


Figure 2: WASP believes there were spilling days in Apr'18 (2-5;10-11) and Dec'18 (15-25) with at least 9 "early"

2017

WASP believes there were at least 2 "early" spilling days in February (**Fig**. 3).

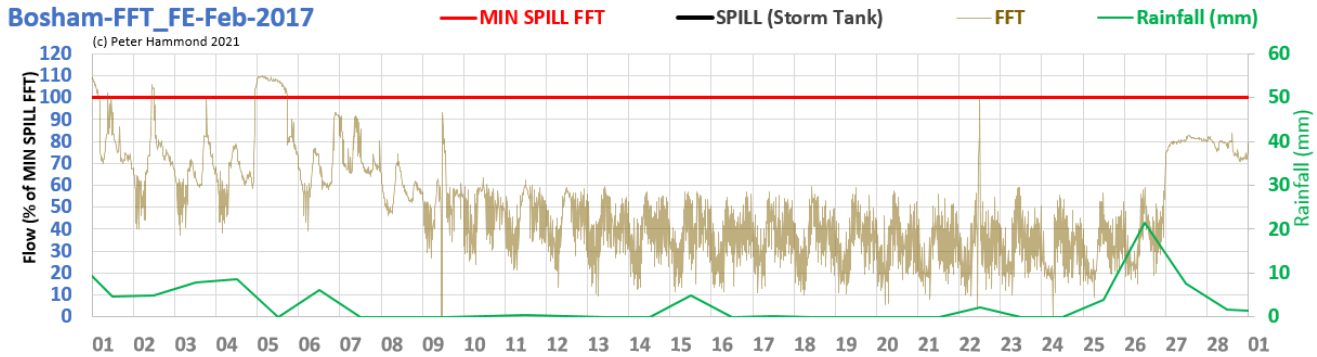


Figure 3: WASP believes there were at least 2 "early" spilling days in Feb'17 (27th-28th)

Budd's Farm

PE **374,241**

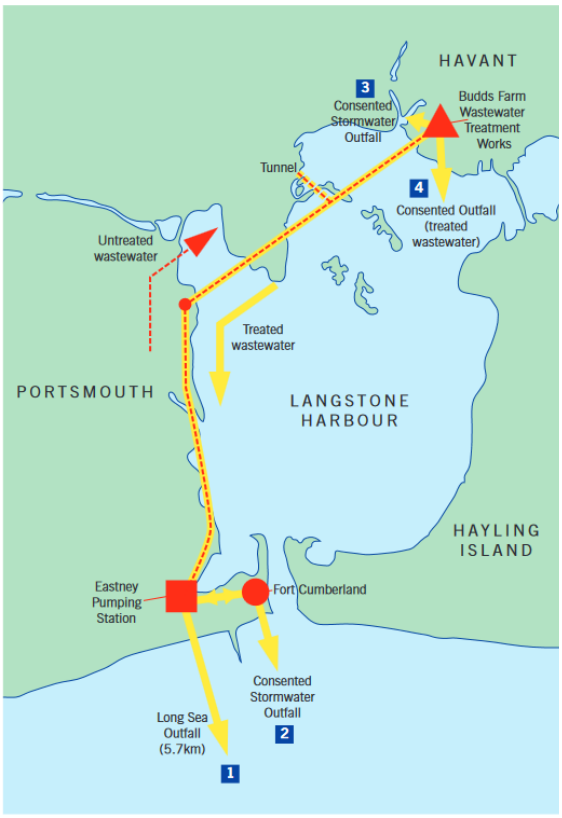
TOTAL SPILLS	
dry	early
4	35

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO		SSO		SSO		SSO	
	380		899		621		1,142		NDA	
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	0	11	2	14	0	2	2	8	NDA	NDA

SSO=Settled Storm Overflow PE=Population Equivalent

Budd's Farm STW is a very large works serving the Portsmouth Havant area. It has been working at full capacity for at least 6 years[15] and makes treated effluent, storm overflow, settled storm overflow and emergency overflow discharges into the Brockhampton Creek, Langstone Harbour and the English Channel via multiple outlets.

The recent drone footage featured on the BBC of sewage spewing into Langstone Harbour was taken at outlet 4 in the map below on the left [16]. Although the map refers to it as discharging treated wastewater, Budd's Farm EA permits says it is also an outlet for settled storm overflow (SSO) at E in the map on the right below with the permit condition above relevant to "early" spilling.



3.1.1 The Discharge shall consist solely of settled screened storm sewage.

3.2 **Location**

3.2.1 The Discharge shall be made in the manner and at the place specified as:

a discharging via a 1725 millimetre diameter pipe;
b discharging to Langstone Harbour;
c at National Grid Reference SU 70540 05100;
d shown marked E on the plans attached to this consent.

3.3 **Volume**

3.3.1 The Discharge shall occur when and only for as long as, the storm tanks are full. The Discharge of storm sewage to the storm tanks shall only occur when the rate of flow from the Havant catchment at the storm sewage separating weir is in excess of 983 litres per second due to rainfall and/or snow melt.

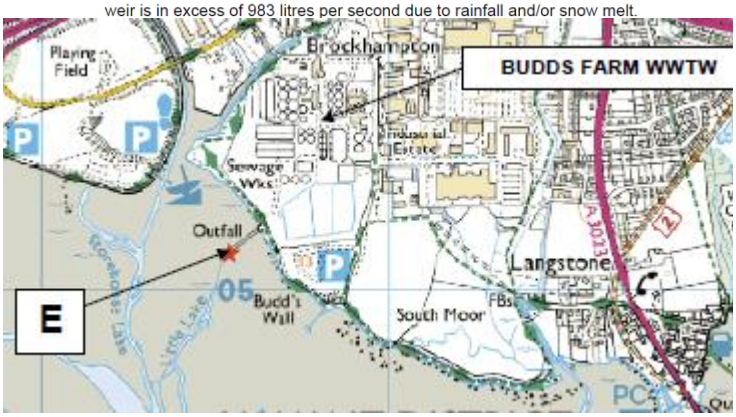


Figure 1: location of discharge outlets at Budd's Farm STW plus an extract of the EA permit for settled storm discharges into Langstone Harbour

In the following analysis, the focus is on "early" and "dry" spills from the SSO.

2020 & 2019

WASP believes there were "early" spilling days on Jan 10th, Feb 10th-11th, Apr 28th-29th, May 30th-Apr 1st, Oct 4th and "dry" spills on Mar 4th, Dec 25th as well as at least 3 "early" spilling days in 2019 (**Fig**. 2).

[15] https://uwwtd.eu/United-Kingdom/treatment-plant/ukensoswtp000004/history

[16] https://www.southernwater.co.uk/Media/Default/images/3060_PortsmouthHavant_WWT_v4.pdf

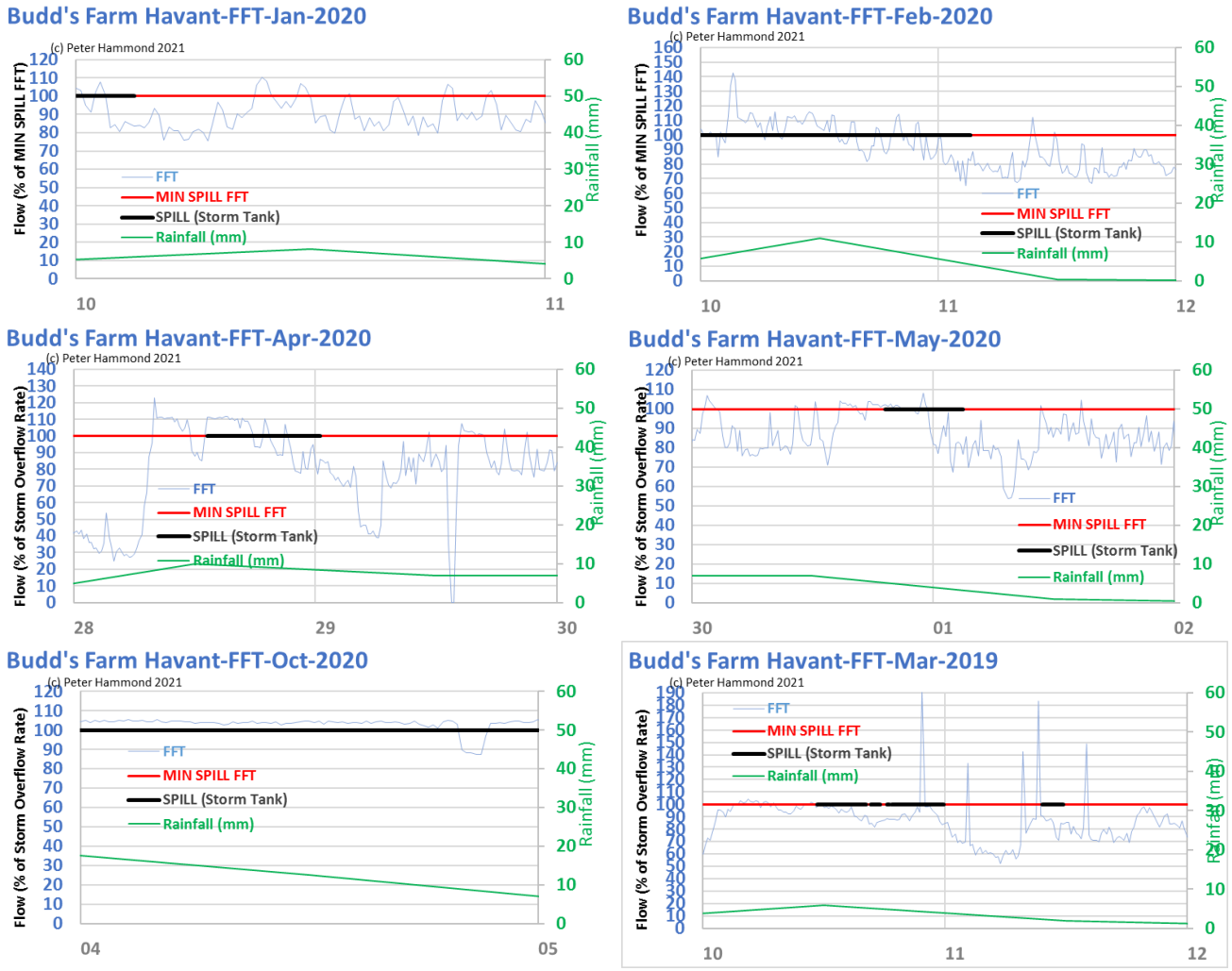
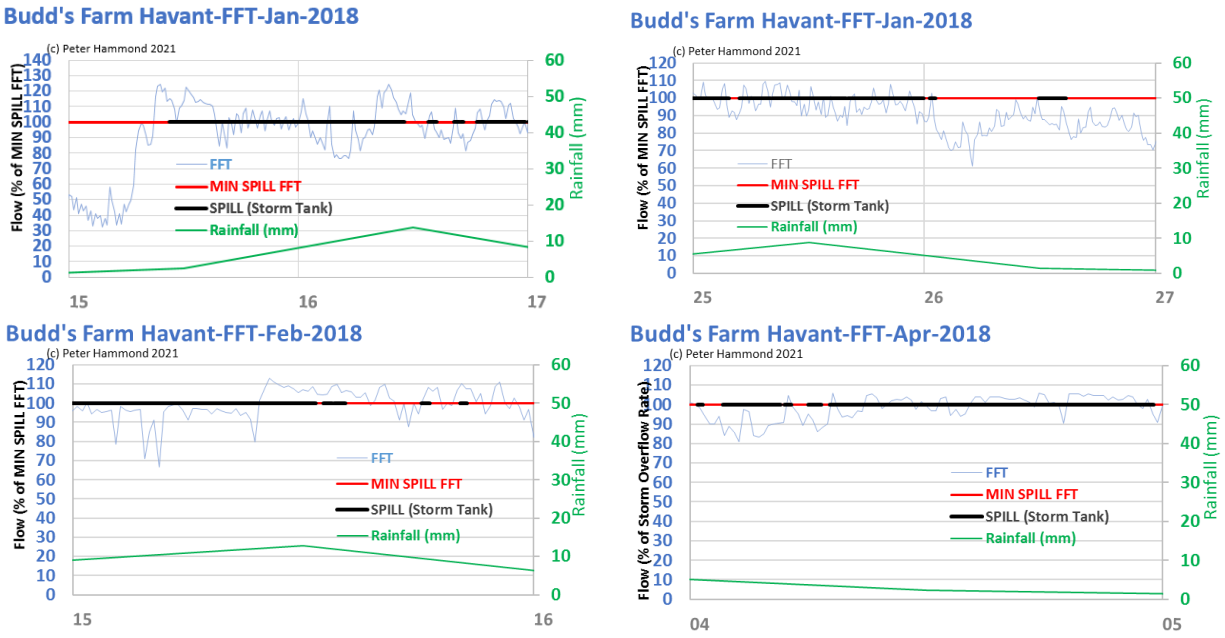


Figure 2: WASP believes there were at least 8 "early" spills from Budd's Farm in 2020 and at least 3 in 2019

2018

WASP believes there were "early" spilling days on Jan 15th-16th, 26th; Feb 15th; Apr 4th; Sep 22nd-23rd; Oct 14th; Nov 13th, 29th-30th; Dec 4th, 16th (**Fig**. 4). WASP also believes there were two "dry" spilling days.



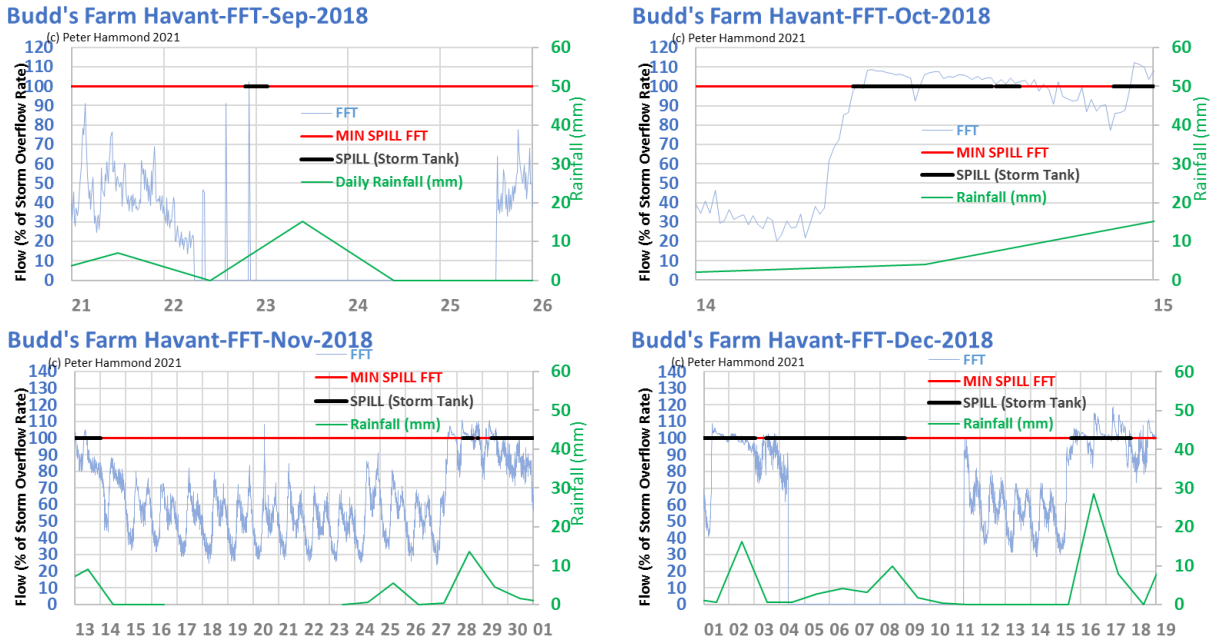


Figure 4: WASP believes there were at least 12 "early" spills from Budd's Farm STW in 2018

2017

WASP believes there were "early" spills on Feb 1st-2nd,4th-5th; Jul 29th-30th; Oct 11th; Dec 11th-13th

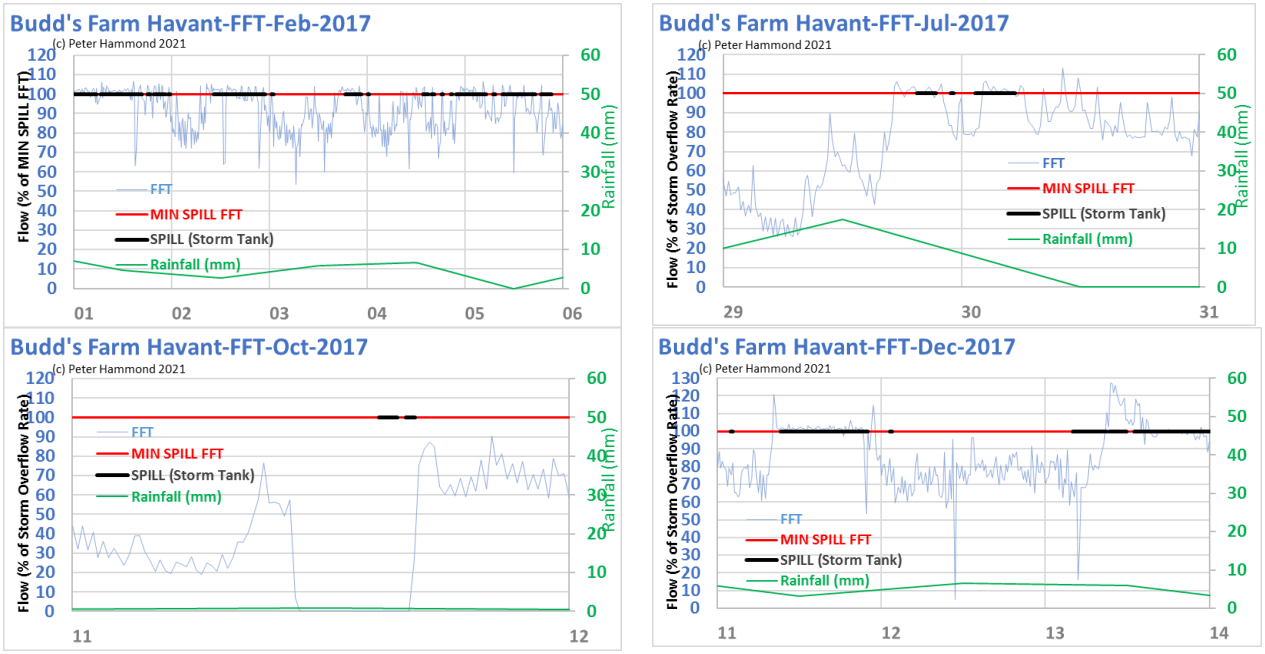


Figure 5: WASP believes there were at least 10 "early" spills from Budd's Farm STW in 2017

Chichester

PE **49,143**

TOTAL SPILLS	
dry	early
45	5

Spilling hours	2017		2018		2019		2020		2021	
	SSO		SSO		SSO		SSO disinfected	SSO not disinfected	SSO	
	112		112	0	1277	34	2,633	94	NDA	
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	1	0	23	0	5	5	16	0	NDA	NDA

SSO=Settled Storm Overflow PE=Population Equivalent

Chichester STW discharges to Chichester Harbour close to the point where the River Lavant flows into the harbour. Because of the sensitive nature of the local shellfish industry, the treated effluent receives ultraviolet (UV) radiation treatment before discharge. The storm overflow rate for Chichester STW is 300 litres/sec and any excess up to a further 300 litres/sec also receives UV radiation treatment. Beyond that, when the flow at the works is above 600 litres/sec, excess above 600 litres/sec does not receive UV radiation treatment before discharge. When the EDM devices detect that both discharges are simultaneously in operation it is possible to estimate the volume of the UV treated storm discharge by multiplying the rate (600 – 300 = 300 litres per sec) by the length of the spill interval. The excess above 600 litres/sec is not metered.

Figure 1: location of settled storm overflow relative to Chichester STW and the River Lavant's entry to the harbour
N.B. The café au lait colour of the tanks' contents suggests there was a Nocardia bacteria problem at the time

2020

In 2020, Chichester STW spilled on 121 days of which, WASP believes, **16 were "dry".** In fact, Chichester STW spilled almost continuously from 1/1/2020 to 27/3/2020 (**Fig**. 2).

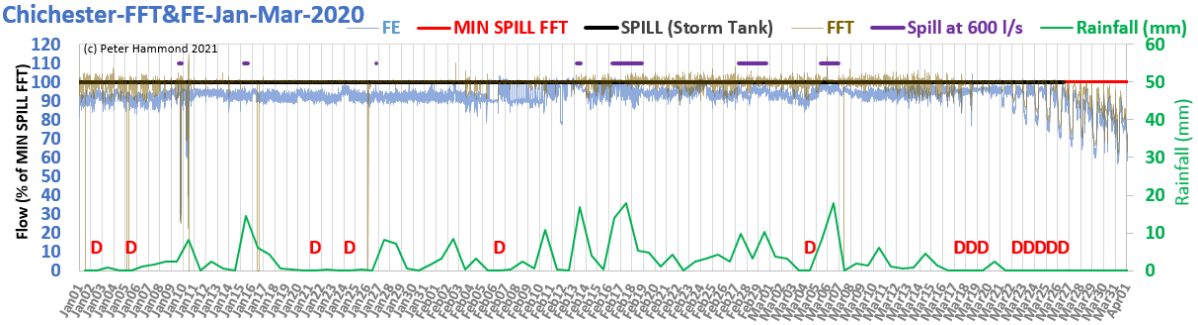


Figure 2: almost 3 months' continuous spill from Chichester STW into Chichester Harbour at the beginning of 2020

WASP believes an estimate for the volume of the UV treated storm discharge for 2020 is **101,657 tonnes** (or 101.7 million litres or 40 Olympic sized pools).

2019

The 78 spilling days in 2019 included **5 "dry"** with no rainfall on the day or day before and **5 "early"**. Two of these "dry" spilling days occurred in Feb'19 (**Fig**. 3). Both spills were also "early". Eighteen spills involved up to 1 mm of rainfall on the day and day before.

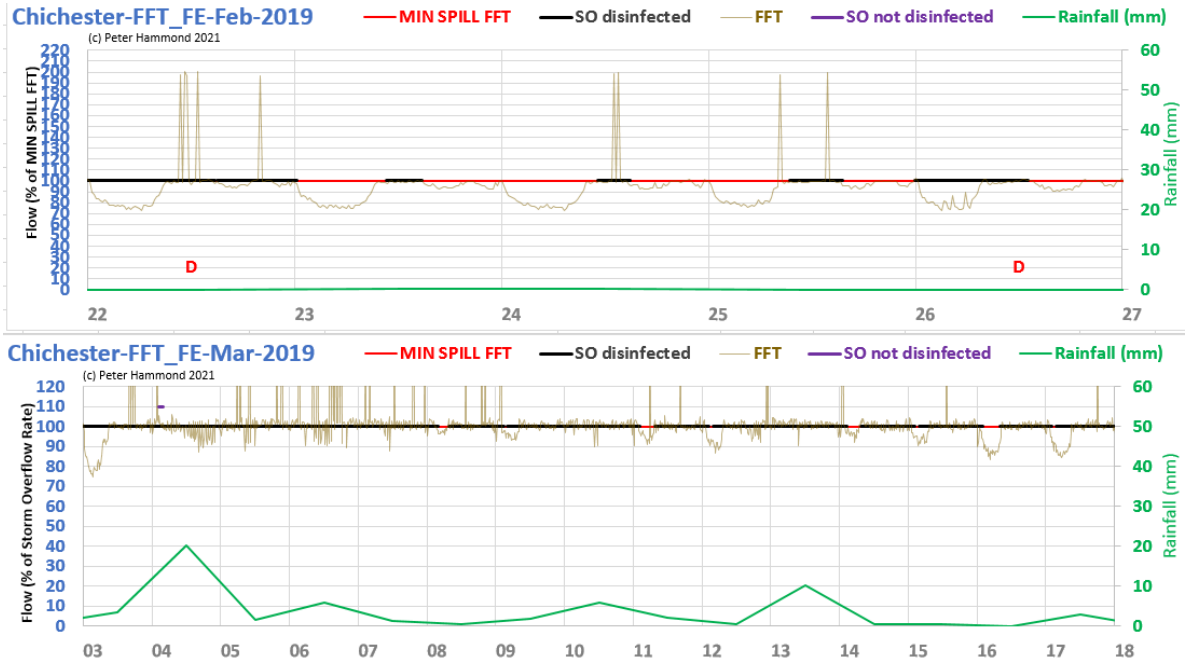


Figure 3: "early" spilling days in Feb (22nd, 26th) and March (3rd, 12th, 17th) at Chichester STW

2018

For 2018, there were 109 spilling days of which, WASP believes, **23 involved "dry" spills** with no rainfall on the day or day before (examples in **Fig**. 4) and 48 with up to 2 mm of rainfall on the day and day before.

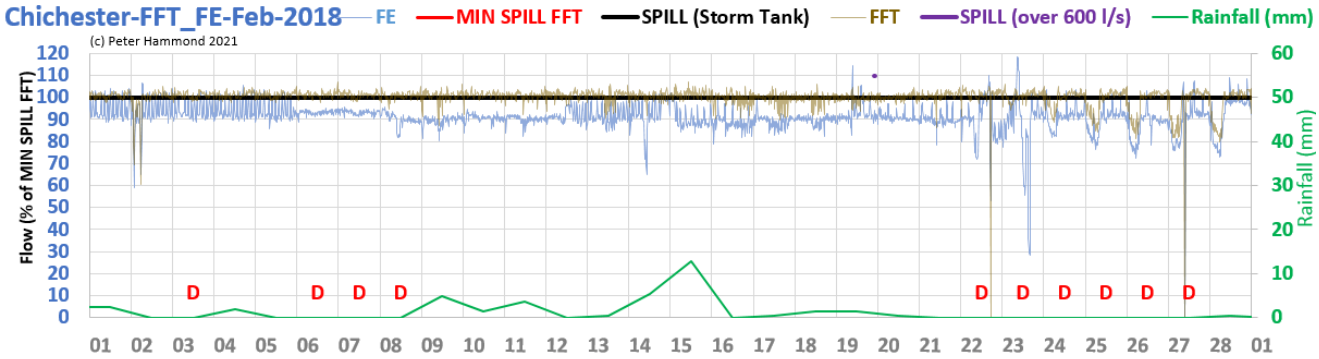


Figure 4: 10 "dry" spills at Chichester STW in February 2018

Lavant

PE	2,617
TOTAL SPILLS dry	TOTAL SPILLS early
147	

	2017		2018		2019		2020		2021	
Spilling hours	SO		SO		SO		SO		SO	
	0		4,574		3,805		245		NDA	
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	7		83		57		NDA	NDA	NDA	NDA

SSO=Settled Storm Overflow PE=Population Equivalent

Lavant STW has been at 100% capacity for at least the past 10 years[17]. Its storm tank is only 168 cu m when it should be 245 cu m to cope with the usual 2 hours at the storm overflow rate of 34 litres/sec. Increasing its size would avoid some of the spills.

The works is permitted to discharge in 4 ways: effluent and settled storm sewage into the river and onto an adjacent reed bed within the works boundary. As the examples show below, the works is subject to significant groundwater infiltration. The yearly overviews, in particular, demonstrate that when the River Lavant lifts its head above ground it is hit by almost continuous sewage spilling and for the rest of the year when dormant upstream of the Lavant STW, it is 100% sewage effluent immediately downstream and during spills also contains untreated sewage. Only daily treated volume was available at the time of the analysis but flow data is not necessary for identifying "dry" spills when EDM detected spills and rainfall is sufficient.

2020

Southern Water reported 245 spilling hours restricted to December. At first sight, this appears to be a remarkable reduction from the 3,805 and 4,574 spilling hours for 2019 and 2018. In fact, WASP believes there were many spills between January and May as the overview demonstrates (**Fig**. 1) and some were "dry".

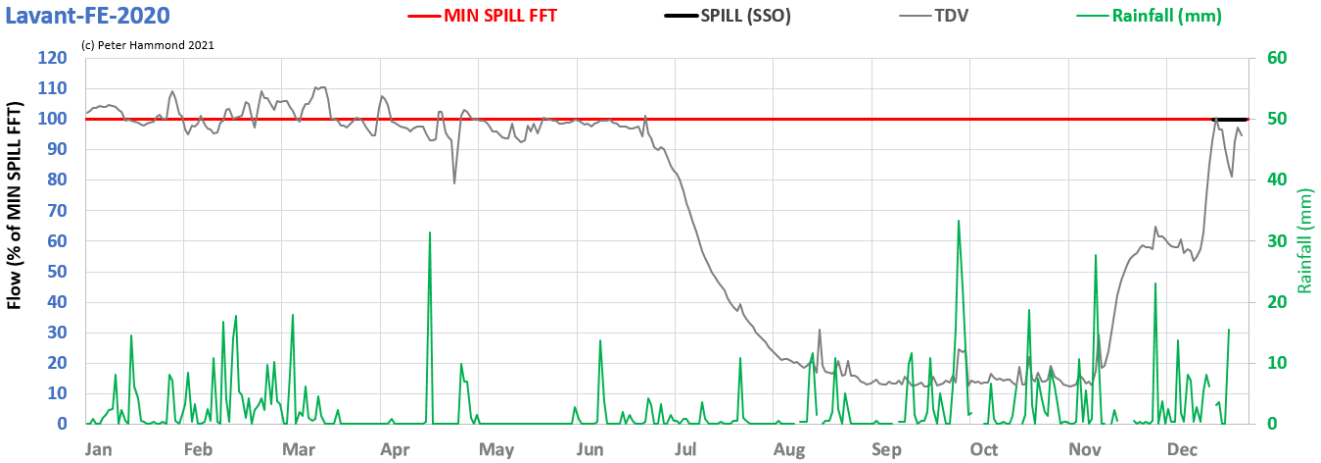


Figure 1: total daily volume of flow (TDV) which WASP believes shows undeclared spills, many "dry"

2019

Of the 167 spilling days, WASP believes 57 involved "dry" spills and 100 involved up to 2mm of rainfall on the day and day before. Year overview is shown in **Fig**. 2 and examples of "dry" spilling days in **Fig**. 3.

[17] https://uwwtd.eu/United-Kingdom/treatment-plant/ukensoswtp000111/history

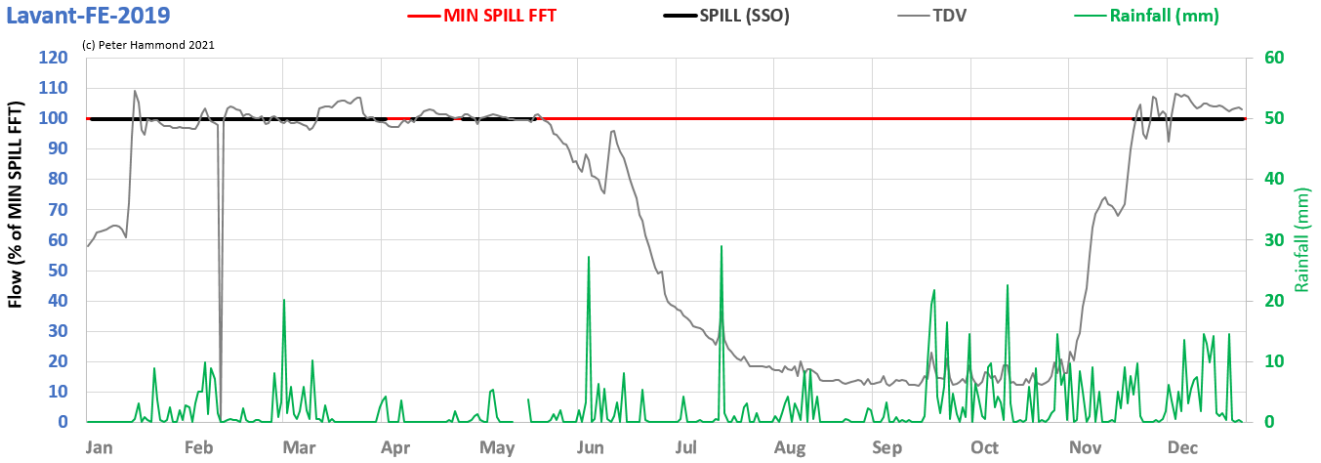


Figure 2: TDV and EDM detected spills for 2019 for Lavant STW

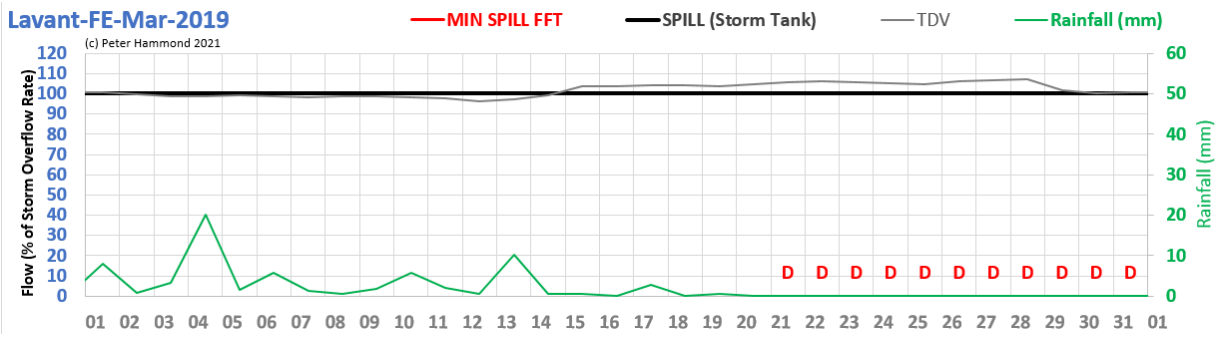


Figure 3: WASP believes there were 11 "dry" spills at Lavant STW in March 2019

2018

Of the 196 days (more than 6 months) of almost continuous spilling, WASP believes there were at least 83 "dry" spills and over 100 with at most 1 mm of rainfall on the day or day before (overview in **Fig**. 4 and examples in **Fig**. 5).

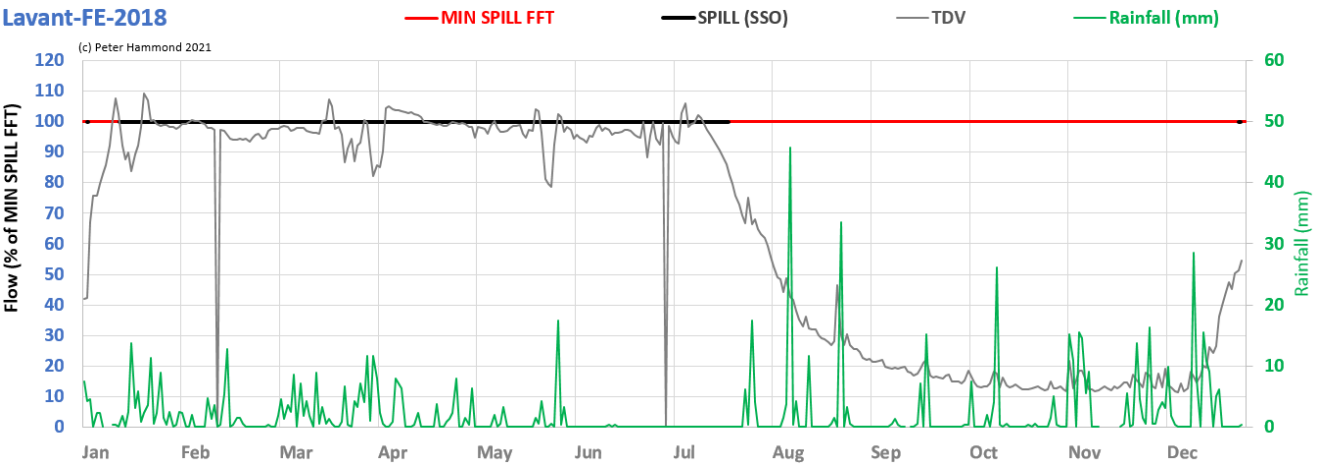


Figure 4: TDV and EDM detected spills for 2018 for Lavant STW

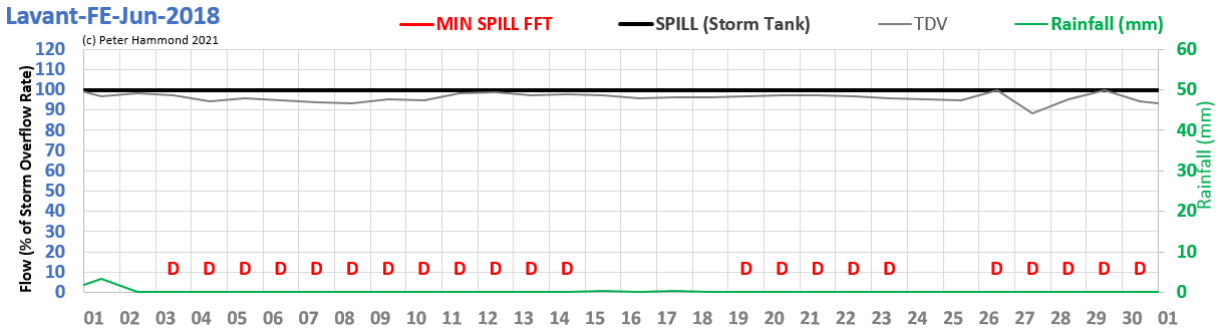


Figure 5: WASP believes there were at least 22 "dry" spills at Lavant STW in June 2018

2017

Southern Water declared zero spilling in 2017 but WASP believes there were a number of “dry” spills in April.

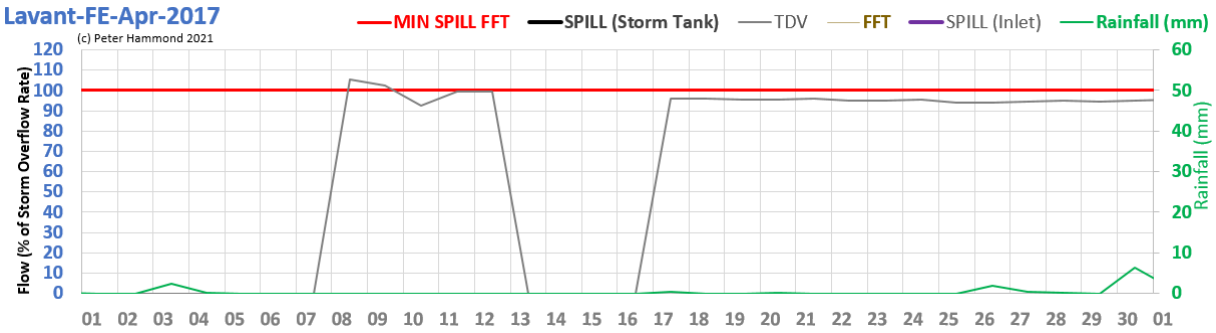


Figure 6: WASP believes there were at least 7 “dry” spills at Lavant STW in Apr’17 (18-19, 21-25)

Thornham

PE	21,457

TOTAL SPILLS	
dry	early
3	64

Spilling hours	2017		2018		2019		2020		2021	
	SSO		SSO		SSO		SSO		SSO	
	96		434		363		634			
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
		16		21		17	3	10		

SSO=Settled Storm Overflow PE=Population Equivalent

Thornham STW serves a population of 21,457 and has been functioning at 99% to 100% of full capacity for at least 10 years[18]. According to local campaign group (Save Our Harbour Villages), Thornham STW will exceed capacity by 2024 given recent/planned housing expansion[19].

2020

Southern Water reported 634 spilling hours over 45 days of which, WASP believes, 3 involved "dry" spills and 10 "early" spills. **Fig**. 1 shows 6 examples of "early" spills.

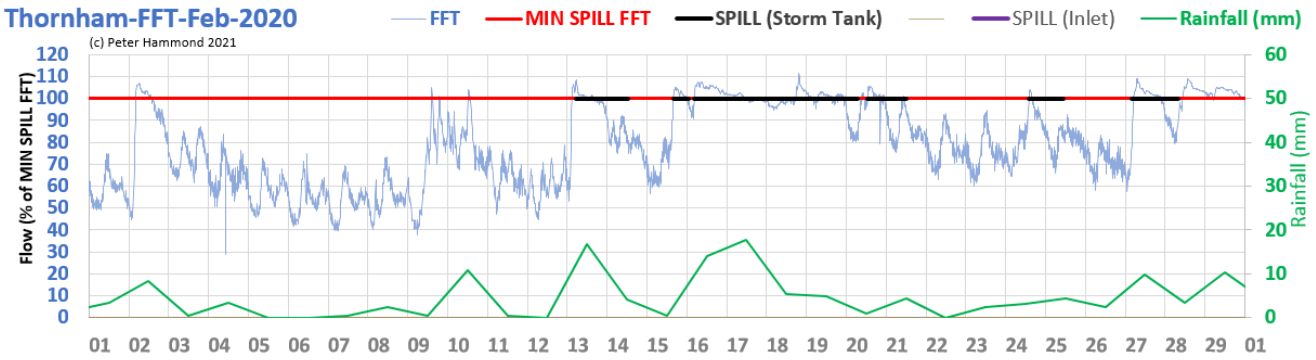


Figure 1: WASP believes there were at least 6 "early spills in February 2020 (14th, 20th, 21st, 24th, 25th, 28th)

There was a pollution incident at Thornham STW on August 4th 2020[20] involving a discharge of untreated sewage caused by an unspecified "equipment failure". The incident can be clearly seen as the loss of flow between 6 am and 9 am on August 4th (**Fig**. 2). Southern Water said it was a small discharge and WASP estimates the difference between the amount typically treated during that three-hour period and what was treated to be about 300 tonnes. The EA issued Southern Water with a formal warning. Interestingly, there is another loss of flow 4 days later on August 8th 2020 (**Fig**. 2) between 12:15 and 15:00 of about 670 tonnes of untreated sewage. This may be worth investigating further (see also flow losses and anomalies later in 2017).

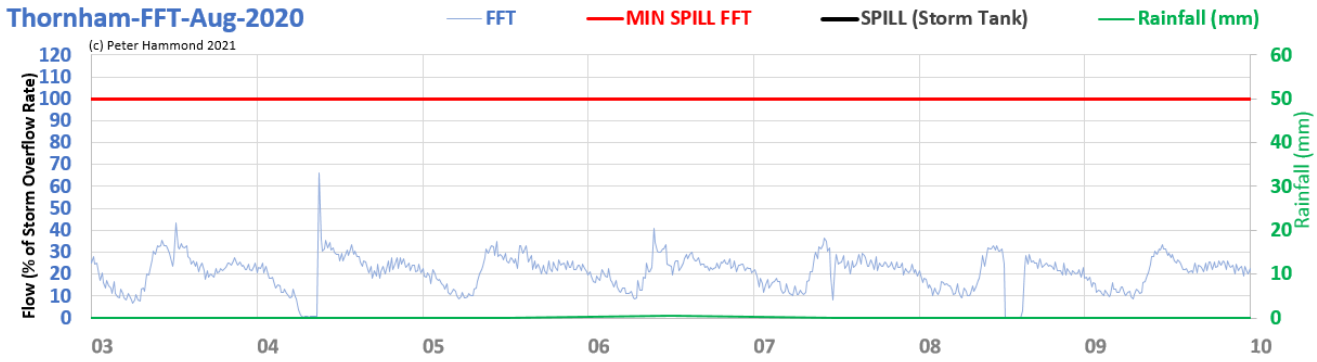


Figure 2: flow loss on Aug 4th & Aug 8th 2020 at Thornham STW – first reported and WASP believes second unreported

2019

Of the 27 spilling days in 2019, WASP believes 17 involved "early" spills, 4 in November alone (**Fig**. 3).

[18] https://uwwtd.eu/United-Kingdom/treatment-plant/ukensoswtp000109/history

[19] https://www.chichester.co.uk/news/politics/madness-to-build-houses-without-adequate-sewage-capacity-3068109

[20] https://www.portsmouth.co.uk/news/people/southern-water-issued-warning-over-sewage-leak-into-chichester-harbour-2984477

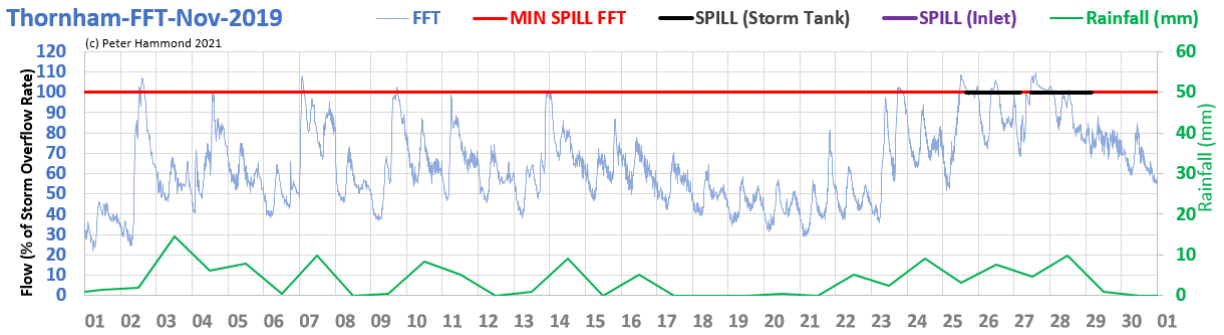


Figure 3: WASP believes there were 4 "early" spills at Thornham STW in November (26-29)

2018

WASP believes the "early" spilling in 2018 to have been particularly bad. There were 434 spilling hours over 33 days of which, WASP believes, 21 were "early". Examples in **Fig**. 4 are for January and December.

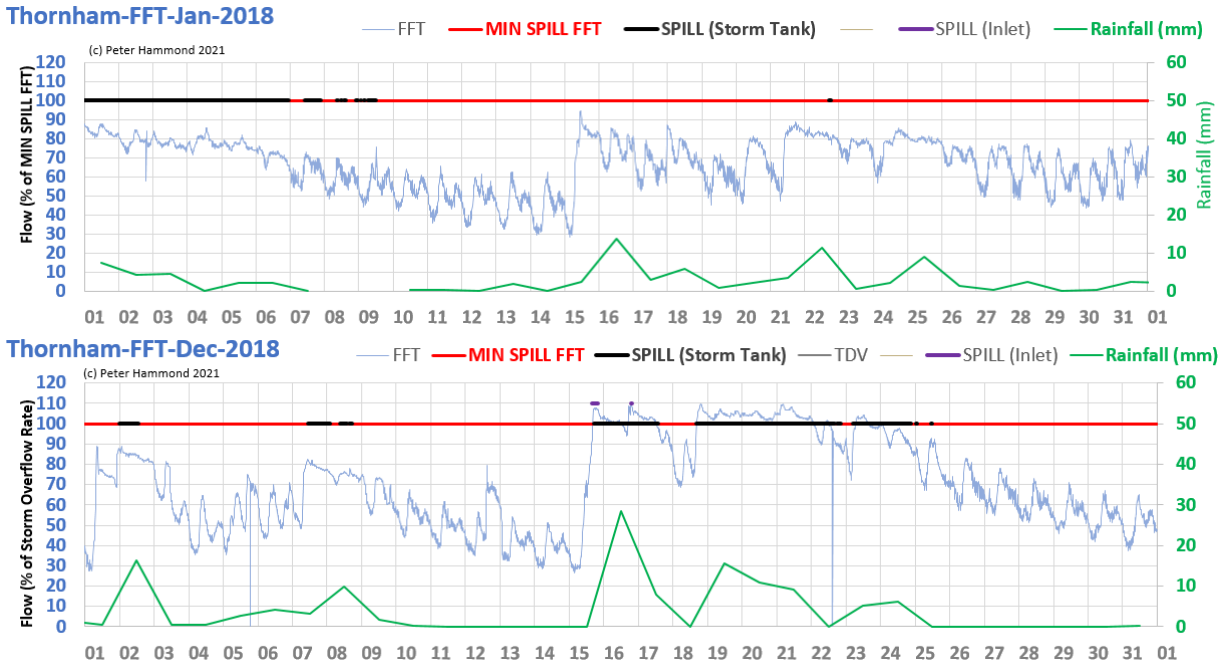


Figure 4: WASP believes there were "early" spills in Jan (10 days) & Dec (2nd, 7th, 8th, 22nd-24th) 2018 at Thornham STW

2017

Given the pollution incident on August 4th 2020 investigated by the EA, WASP is very concerned about the losses and anomalies in the flow to treatment data for 2017 (**Fig**. 5). The amount of missing flow data alone is a permit breach and then there are the huge quantities of sewage unaccounted for.

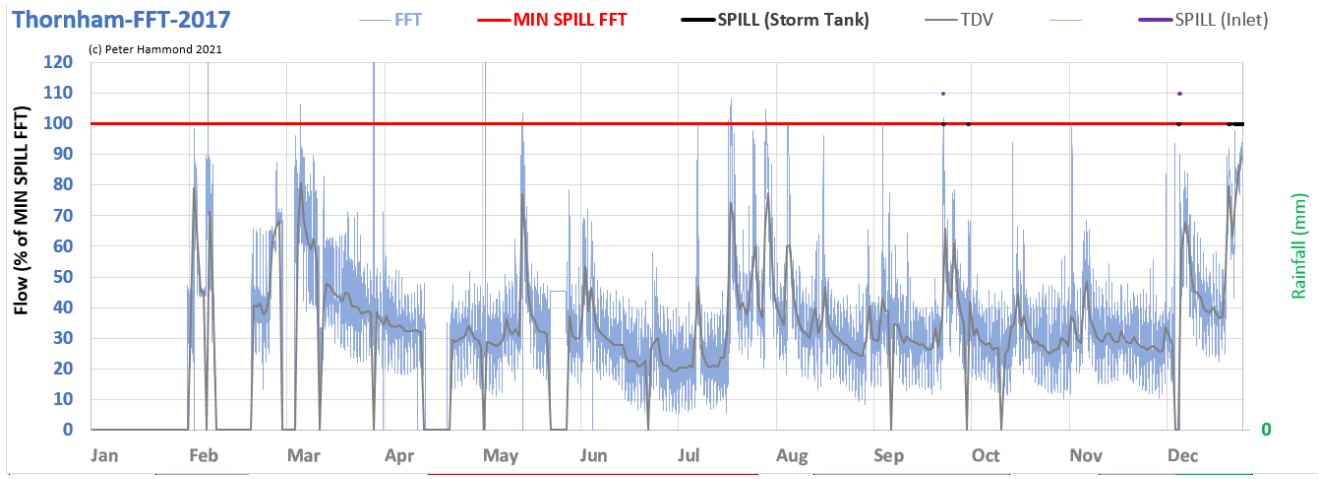


Figure 5: WASP is very concerned about the missing and anomalous 2017 flow to treatment data at Thornham STW

Considering the EDM spill data provided by Southern Water, WASP believes there were at least 7 “early” spilling days in 2017 (examples in **Fig**. 6)

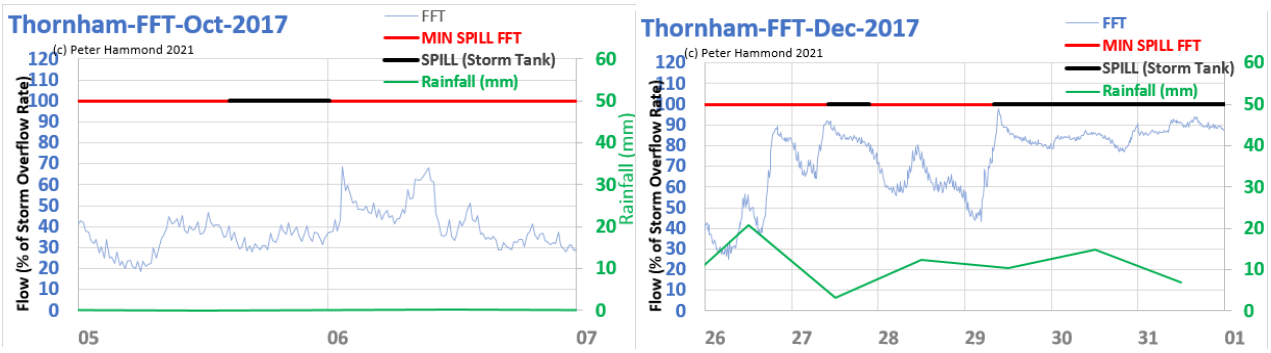


Figure 6: WASP believes there were “early” spills on Oct 5th-6th, Dec 27th and Dec 29th-31st

The flow to treatment data in February 2017 has a 10-day hiatus with what looks like several “early” spilling days either side. The loss of TDV (Total Daily Volume) after anomalous flow on 7th-9th and this 10-day gap could herald a major equipment failure that would need to be investigated further with telemetry alarm data.

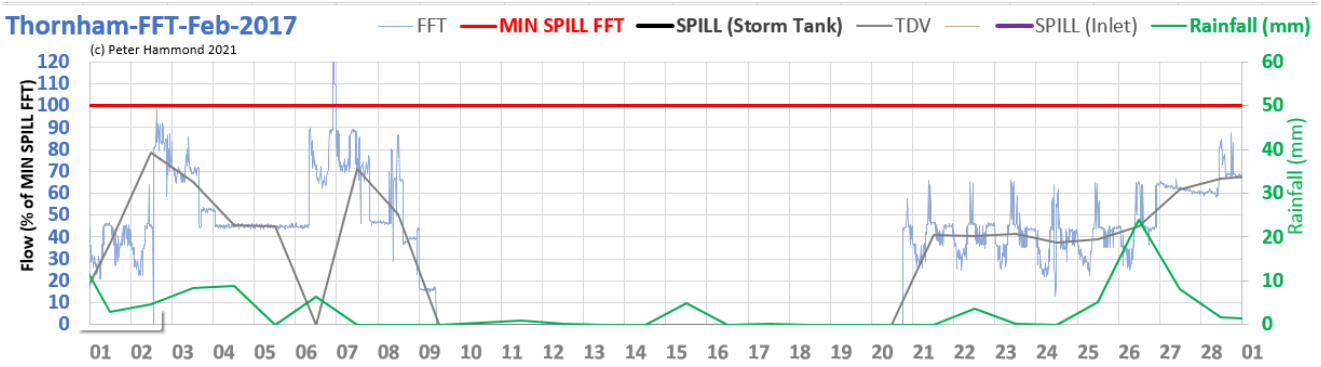


Figure 7: WASP believes there were at least 5 “early” spilling days in February 2017 at Thornham STW

A similar loss of flow to treatment on 10th and 11th December after 20mm of rainfall on 9th (**Fig**. 8) with brief and rapid high flows is also consistent with some sort of equipment failure.

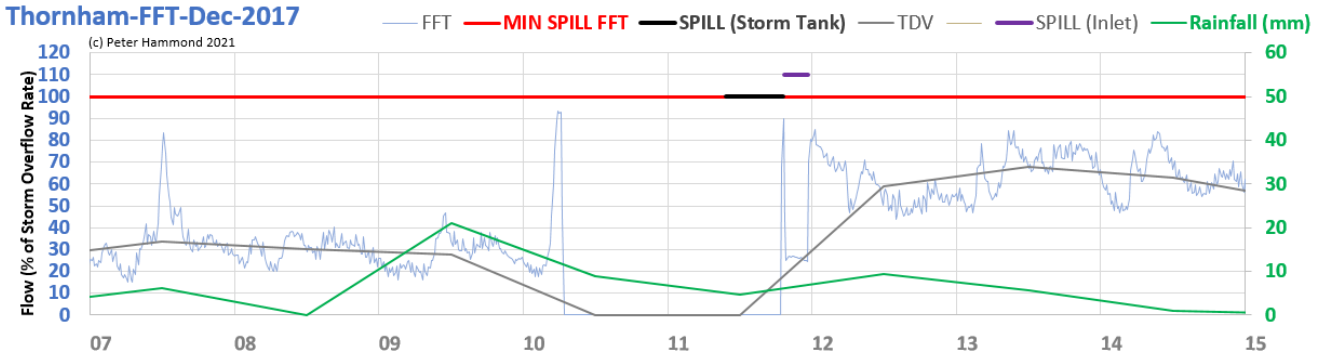


Figure 8: loss of flow to treatment and TDV, flanked by brief peaks suggests equipment failure on Dec 10th-11th 2017

Fittleworth

PE	720
TOTAL SPILLS dry	early
20	6

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO		SSO		SSO		SSO	
	NDA		126		1,480		3,112			
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	NDA	NDA	5		6	1	9	5		

SSO=Settled Storm Overflow PE=Population Equivalent

The population served by Fittleworth STW is small. But by the time Fittleworth STW discharges to the River Rother (West), a chalk stream, the river has already received discharges from at least 8 other STWs – including South Harting, an STW discussed later in this review (**Fig**. 1). In terms of total spilling hours, Fittleworth STW (3,112 hours) and South Harting STW (4,145 hours) were respectively 5th and 1st in Southern Water's top 20 worst spillers for 2020 (**Fig.**2).

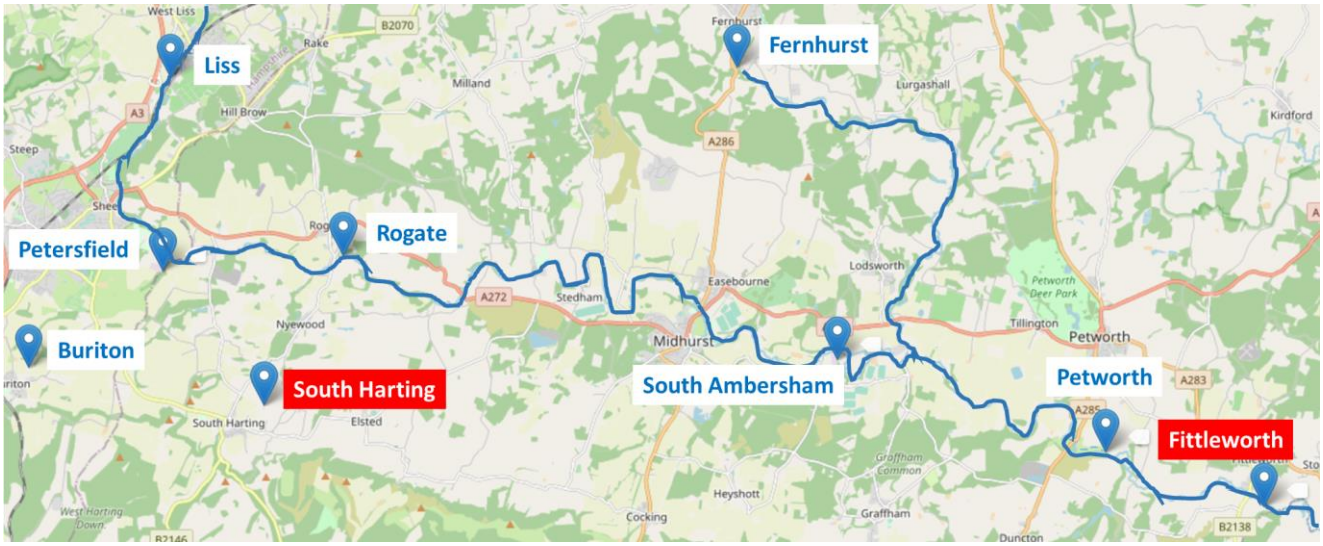


Figure 1: 9 STWs discharging to the River Rother

As shocking as they are, total annual hours do not fully capture the polluting impact on an individual river. The block spill series[21] for the 9 works shown discharging to the River Rother (**Fig**. 1b) demonstrates the importance of seeing when spills occur, for how long and in concert with which other STWs to the same watercourse.

Figure 2: 2020 block spills for 9 STWs discharging to the River Rother (West)

2020

The 2020 spilling occurred over 151 spilling days of which, WASP believes, **5 were "early"** and **9 were "dry"** (examples in **Fig**. 3).

[21] On its website, Southern Water publishes EDM spill data in the form of blocks rather than individual spills. So there may be gaps within a block series and the true spills are hidden. Thus, full transparency is not provided.

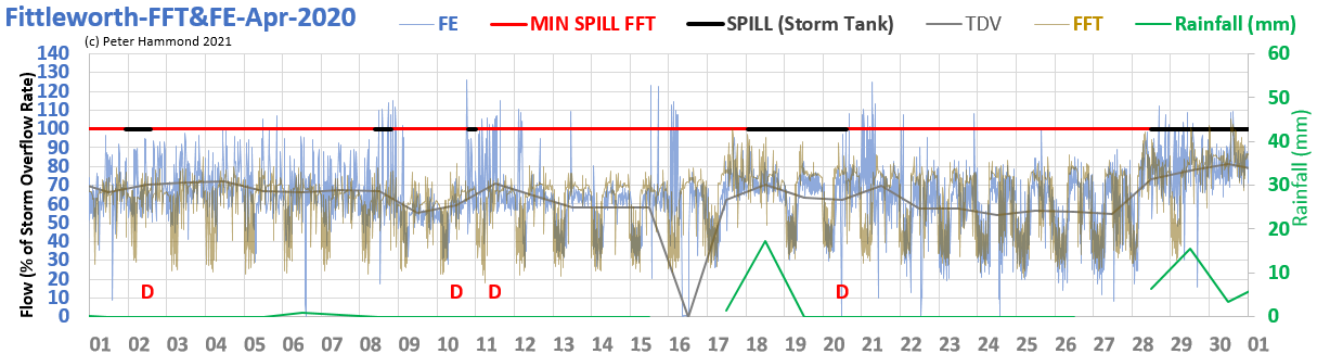


Figure 3: four "dry" spilling days in April 2020 at Fittleworth STW

2019

For 2019, the spilling was over 92 spilling days of which, WASP believes, **1 was "early" and 6 were "dry"** involving no rainfall on the day or day before. Some 15 spilling days received no more than 1 mm of rainfall on the day and day before.

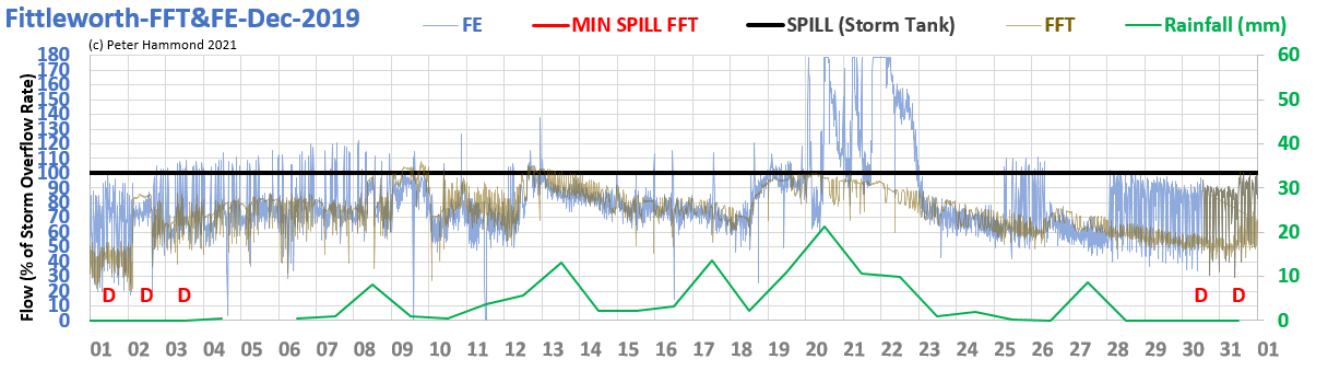


Figure 4: 5 "dry" spills in December 2019 at Fittleworth STW

It is likely that some of the spills in Fig. 4 are "early". Without individual spill start/stop times it is not straightforward to verify. But a block of 41 spills from 22nd Dec 2019 to the end of the year included several days when the FFT was always below 92% of the storm overflow (e.g. Dec 24th and 27th) and so any spill on those days was "early".

2018

In 2018, Fittleworth STW spilling occurred over 33 days of which, WASP believes, 5 were "dry. For example, **Fig**. 5 shows 3 "dry" spilling days.

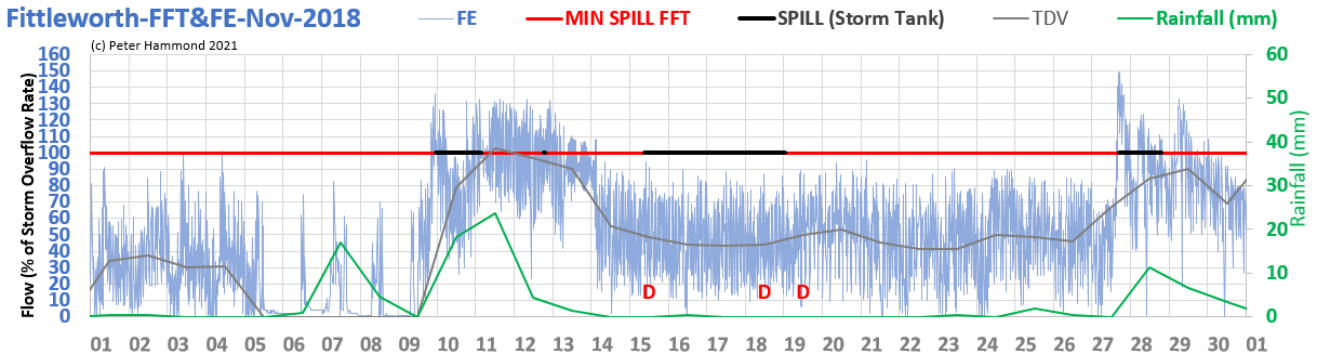


Figure 5: 2 "dry" spills in November 2018 at Fittleworth STW

South Harting

PE	920
TOTAL SPILLS	
dry	**early**
130	**0**

	2017		2018		2019		2020		2021	
Spilling hours	**SSO**		**SSO**		**SSO**		**SSO**		**SSO**	
	1,608		*4,176*		*4,128*		4,146		NDA	NDA
Unpermitted spills	**dry**	**early**	**dry**	**early**	**dry**	**early**	**dry**	**early**	**dry**	**early**
	12		*36*		53		29		NDA	NDA

SSO=Settled Storm Overflow PE=Population Equivalent italicised = WASP estimate

South Harting STW discharges into the River Rother (West) via the Elstead Stream. Southern Water's response to WASP's EIR request for flow and EDM data for South Harting STW included the following statement about spill data:

> *Spill data for South Harting STW has been recorded from 2014 onwards. There are no records of spills in 2014 for this site. For 2015 & 2016 spill records, please see this enclosed. For 2017-2020 spill data, this can be found on our website here: https://www.southernwater.co.uk/our-performance/flow-and-spill-reporting* **Southern Water**

2020 & 2019

In 2020, there were 176 spilling days of which, WASP believes, **29 were "dry"** and 69 occurred with at most 2 mm rainfall on the day and day before. Examples of the 29 "dry" spilling days in 2020 are shown in **Fig**. 1.

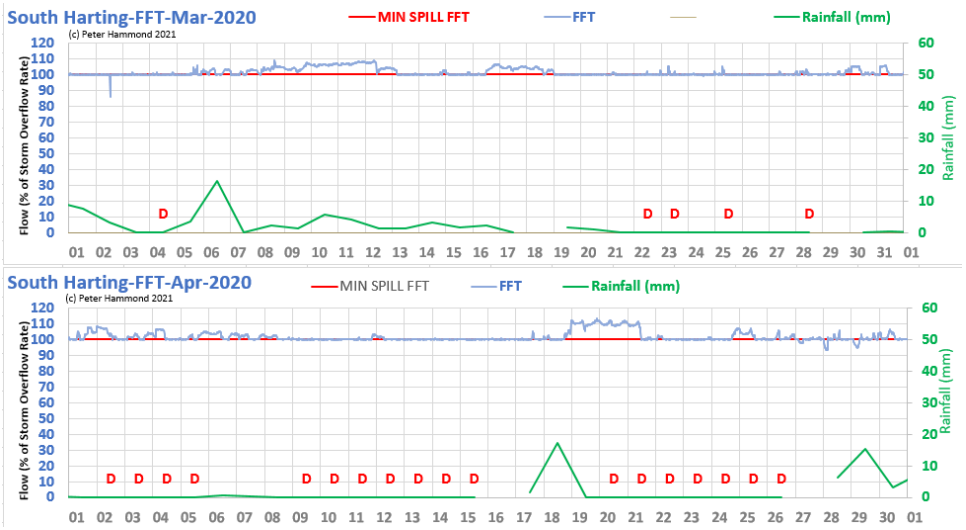


Figure 1: 23 examples of "dry" spilling days in Mar-Apr 2020 at South Harting STW

For 2019, the EDM return to the EA did not include South Harting and neither did the 2019 spill data on the Southern Water's website despite the EIR response above. WASP believes that in 2019, South Harting STW spilled for 4,128 hours on 172 days of which 53 included "dry" spills (examples in **Fig**. 2).

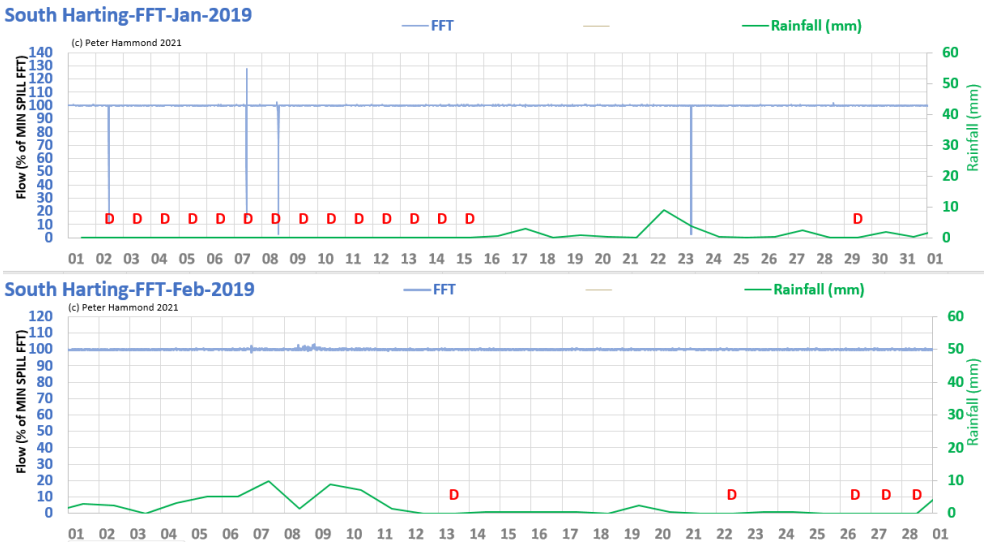


Figure 2: 20 examples of "dry" spilling days in Jan-Feb 2019 at South Harting STW

Spilling Season 2019 - 2020

South Harting STW provides an opportunity to demonstrate WASP's view that the EA has made an error of judgement in requesting total spilling hours specific to a calendar year. Consider a far more informative, combined view of 2019 and 2020 flow and rainfall data (**Fig**. 3) where the flatlining flow suggests that **South Harting STW spilled untreated sewage almost continuously for six months between November 2019 and April 2020 inclusive**. At this and many other STWs reviewed, there is clear evidence of a spilling season – typically Autumn to Spring – for which the EA should be collating spill data.

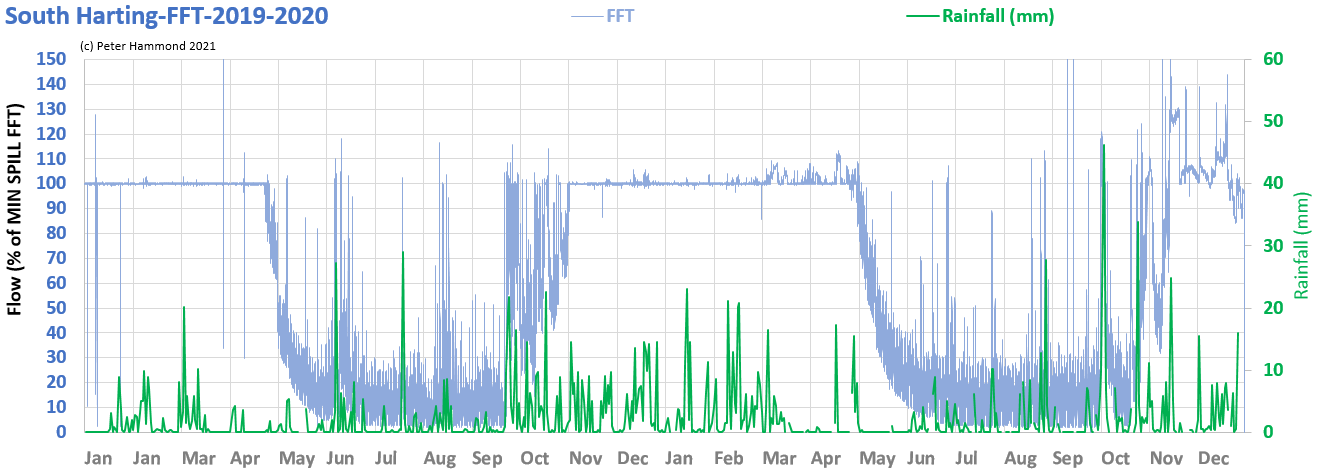


Figure 3: 2 year overview reveals an autumn to spring spilling season that the EA should adopt for data collation

2018 & 2017

As for 2019, Southern Water did not make an EDM return for South Harting for 2018 and 2017. Furthermore, no 2017 and 2018 spill data were found on the Southern Water website, contrary to the suggestion in the response to WASP's EIR request. WASP has estimated the total spilling hours at South Harting for 2017 and 2018 to be 1,608 hours and 4,176 hours respectively. WASP believes that the number of days with **"dry" spills in 2017 and 2018 were 12 and 36 respectively**.

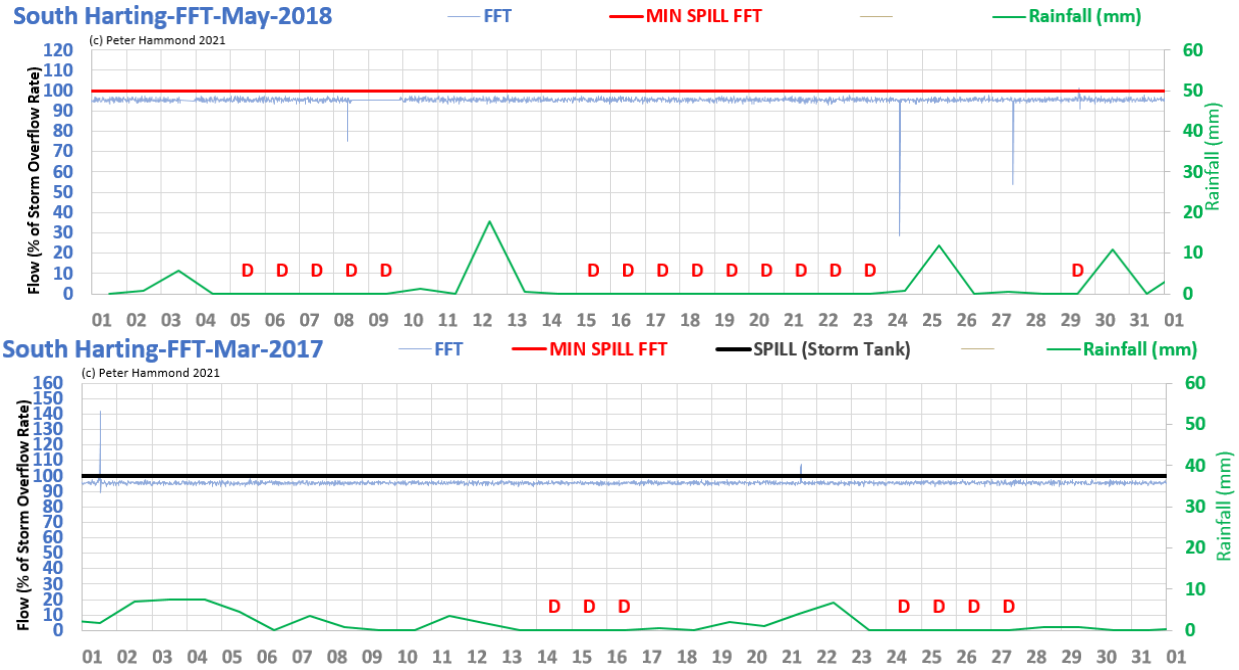


Figure 4: examples: 21 "dry" spilling days in May 2018 and 7 in Mar 2017 at South Harting STW

This analysis of the performance data for South Harting STW provides further examples of Southern Water's permit non-compliance, lack of transparency and its withholding of data it is legally required to provide.

Fullerton			2017		2018		2019		2020		2021	
P.E. 65,329		Spilling hours	EDM	EIR	EDM	EIR	EDM	EIR	EDM	EIR	EDM	EIR
			0	0	5		0	0	0	0	-	-
Dry	Early	Unpermitted	dry	early	dry	early	dry	early	dry	early	dry	early
???	???											

Fullerton STW serves the town of Andover and has been working at, or very close to, full capacity for 10 years[22]. Although located adjacent to the River Anton, the effluent and storm discharge outlet is some 2.5 kms away on the River Test, a celebrated chalk stream.

2020

Southern Water did not return any spills in their 2020 return to the EA and in their EIR response said there were "*no reportable 2020 events based on spill telemetry".* However, the flow pattern in February and March supports at least diversion of flow to the storm tank if not actual sewage spill to the River Test. Perhaps, the EDM device failed to detect any spills and/or the telemetry system failed to transfer a record of detection.

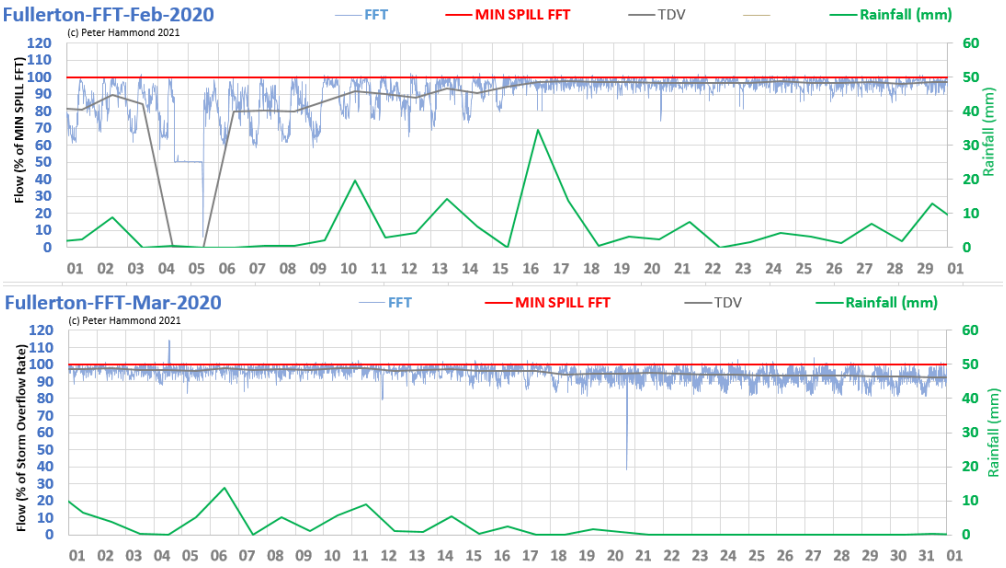


Figure 1: flattened flow pattern in February and March 2020 suggesting diversion to or overflow from a storm tank

2019

There are flow anomalies in both January and February initiated by a wet spell. Telemetry alarm would help identify if there was an associated equipment malfunction that caused a spill.

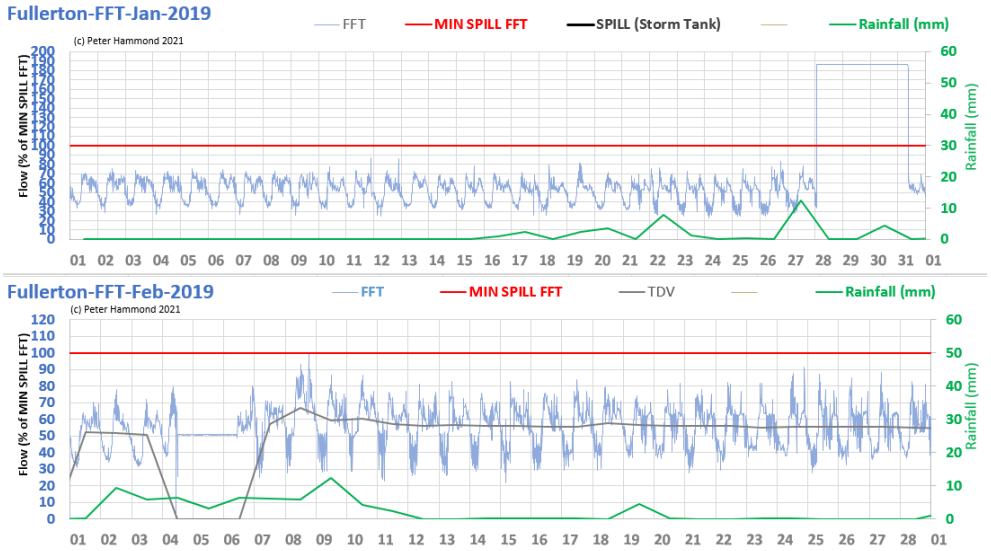


Figure 2: recorded flow anomaly and zero flow to treatment initiated by a wet spell in Jan/Feb 2019

[22] https://uwwtd.eu/United-Kingdom/treatment-plant/ukensoswtp000006/history

2018

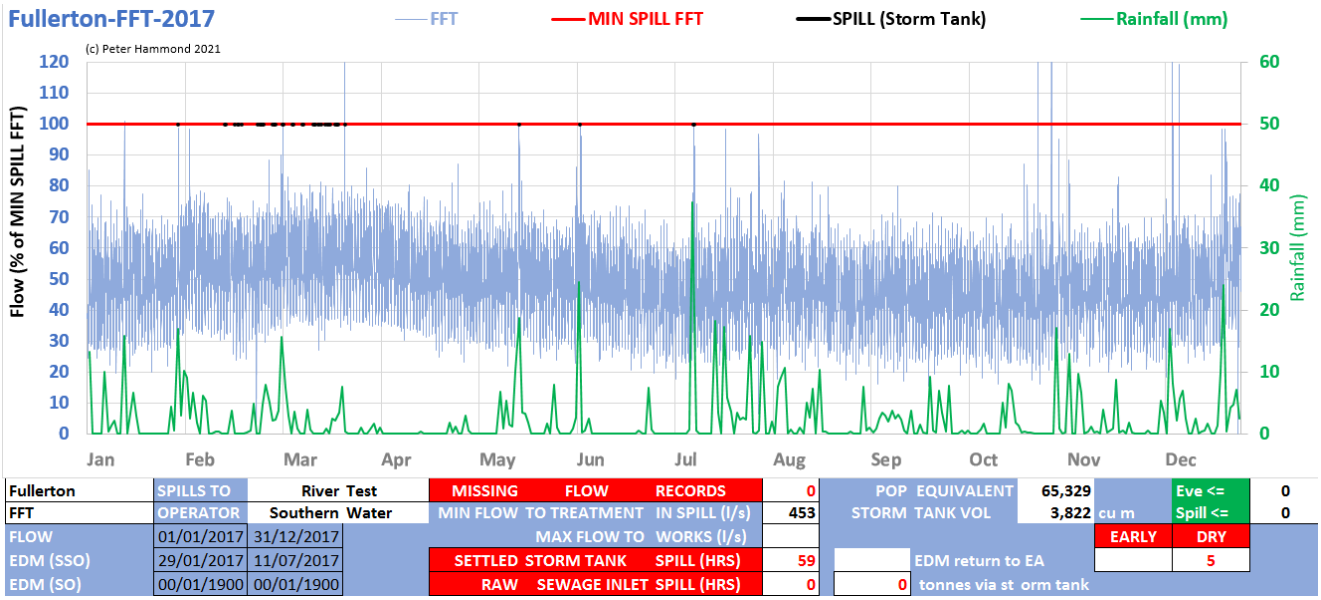


Figure 3: flow to full treatment is hardly disturbed in 2017 by the rainfall pattern

It is remarkable how little the flow to treatment responds to rainfall in 2017 (**Fig**. 3). In contrast, the flow to full treatment is significantly disturbed by the rainfall in 2020 (**Fig**, 4). It would be interesting to know how the flow can be so stable during significant variations in daily rainfall.

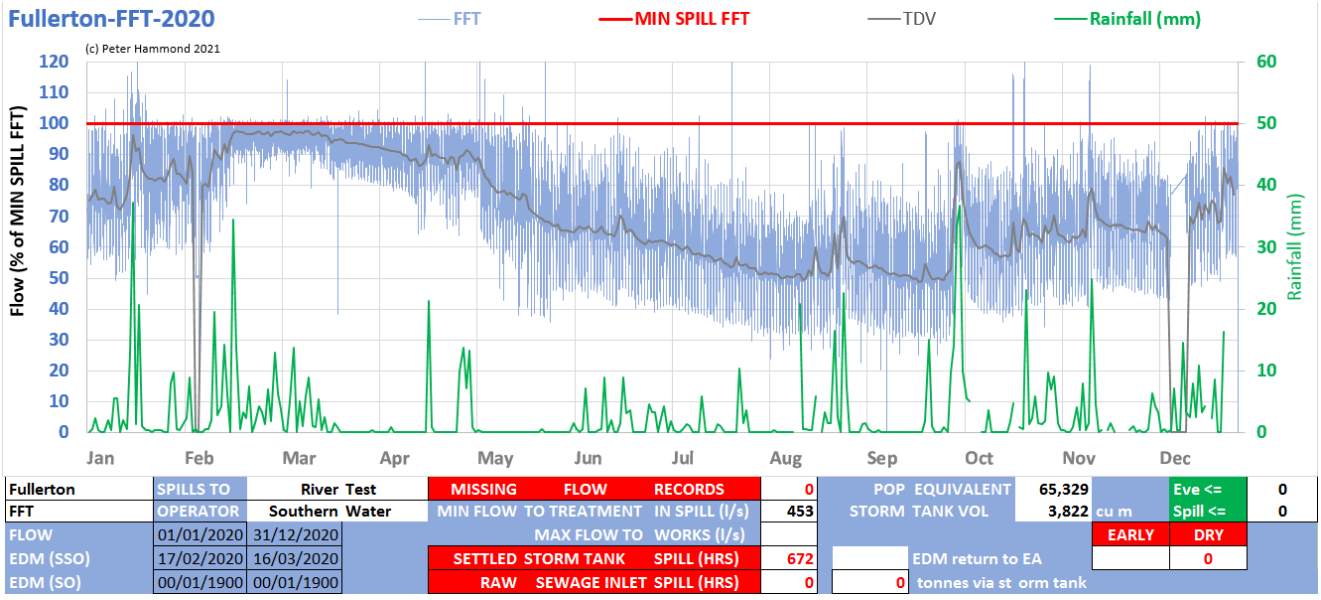


Figure 4: flow to treatment is significantly disturbed in 2020 by the rain fall pattern

WASP believes that Fullerton STW needs closer inspection.

King's Somborne

PE 2,293

TOTAL SPILLS	
dry	early
20	1

Spilling hours	2017		2018		2019		2020		2021	
	SSO	SO	SSO	SO	SSO	SO	SSO	SO	SSO	SO
	NDA	NDA	599	366	235	260	1,646	398	NDA	NDA
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
			8			1	12		NDA	NDA

SSO=Settled Storm Overflow PE=Population Equivalent

King's Sombourne STW has a settled storm overflow (SSO) and an inlet storm overflow (SO), both of which discharge via a single outlet to a tributary of the River Test, the celebrated chalk stream. The inlet weir allows up to 73.5 litres/sec into the works and the storm overflow passes 31 litres/sec on to the full treatment process. When both storm overflows are in operation simultaneously, a net 42.5 litres/sec (i.e. 73.5 – 31) is discharged to the river and so it is possible to estimate the spill volume via the storm tanks. King's Sombourne STW is not a frequent early spiller but the "dry" spills suggest it suffers from groundwater infiltration.

2020

Of the 92 spilling days in 2020, 39 involved up to 2 mm of rainfall on the day and day before.

Both overflows were in operation for 218 hours with an estimated 18,793 tonnes (18.8 million litres or 7.5 Olympic sized pools) of untreated sewage being spilled. For example, in January the works spilled almost continuously for the whole month. On Jan 26th the full day of spilling was "dry" and so unpermitted. As both overflows were in operation for the whole day, WASP believes an estimated 3,672 tonnes (3.67 million litres or 1.5 Olympic Pools) of untreated sewage was discharged illegally to the River Test.

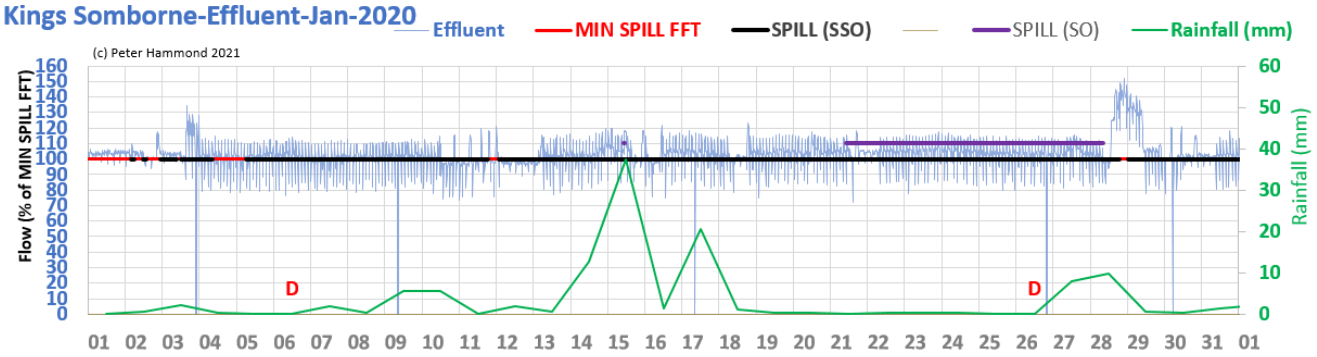


Figure 1: WASP believes 8 days of spilling with little rain (Jan 18th-26th) included an illegal spill of 3.7 M litres (Jan 26th)

Examples of 5 "dry" spills in March 2020 are shown in **Fig**. 2.

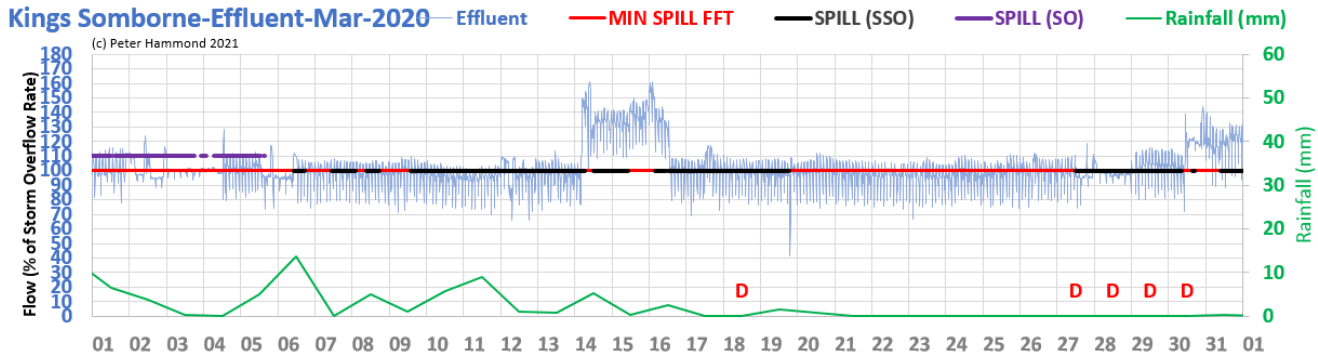


Figure 2: WASP believes 5"dry" spills occurred in March 2020 at King's Sombourne STW

2019

According to the return to the EA, there were only 12 spilling days in 2019 and the EDM spill start/stop times provided in response to the EIR request suggest they all occurred in December (**Fig**. 3).

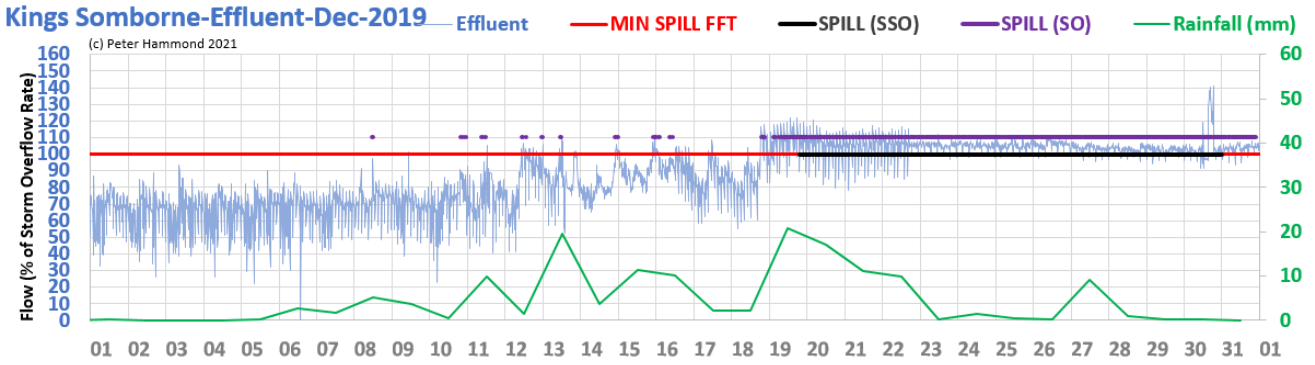


Figure 3: 12-day spill discharged more than 15 Olympic pools of untreated sewage

During a long, continuous spill of 12 days or so (Dec 19th-30th), WASP believes that an estimated 32,660 tonnes (32.7 M litres or 13 Olympic pools) of untreated sewage was discharged to the River Test. On 3 of these days, less than 1 mm of rainfall occurred on the day and the day before.

2018

Of the 29 spilling days in 2018, 17 involved up to 2 mm of rainfall on the day and day before. The **8 "dry"** spilling days, with no rainfall on the day and day before, all occurred in April and May (**Fig**. 4). On May 29th, the effluent is almost zero for 7 hours or so when the SO is also in operation – an "early" spill. An issue to check further is whether the missing 781 tonnes of effluent correspond to a similar volume of discharge to the river of untreated sewage.

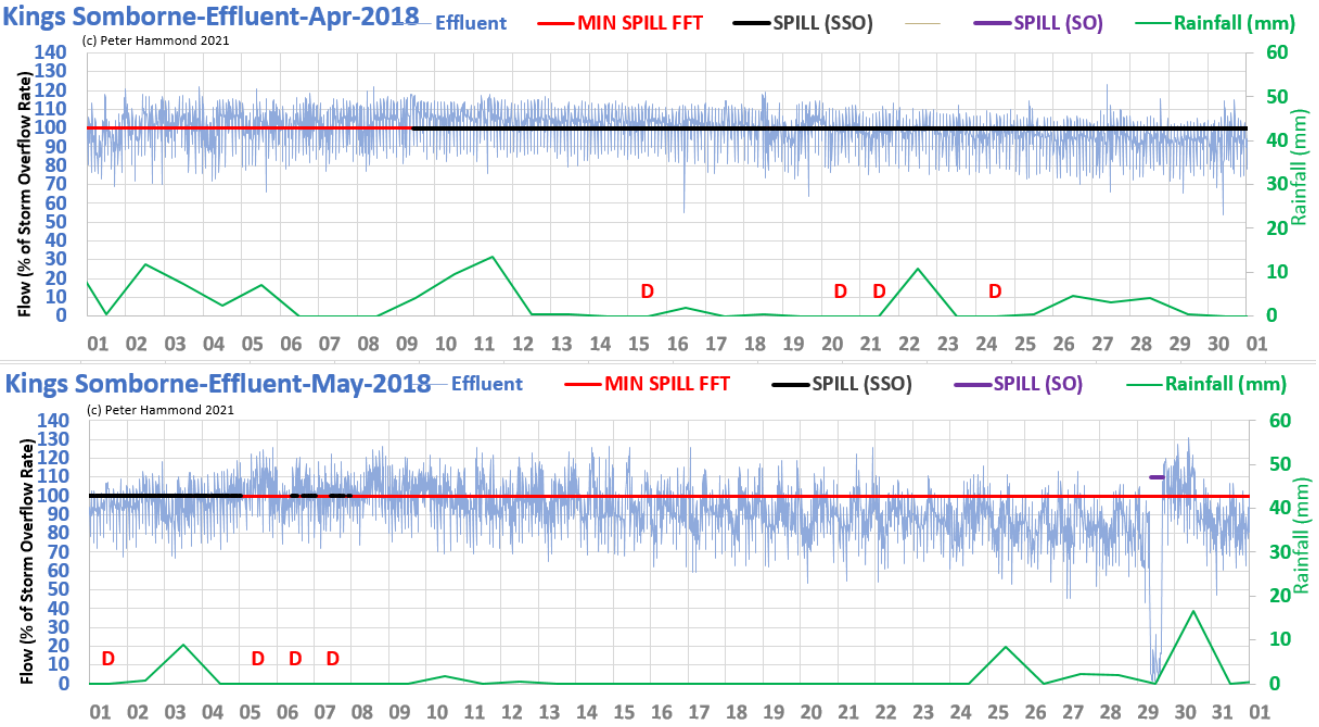


Figure 4: WASP believes there were 8 "dry" spilling days in April and May 2018

2017

The first obvious comment to make is that the missing 138 days of effluent flow data (**Fig**. 5) amount to several permit breaches since the EA allows for at most 14 consecutive blank or anomalous days and no more than 37 blank days in an annual return. At the very least, the EA should have admonished Southern Water in relation to the missing data.

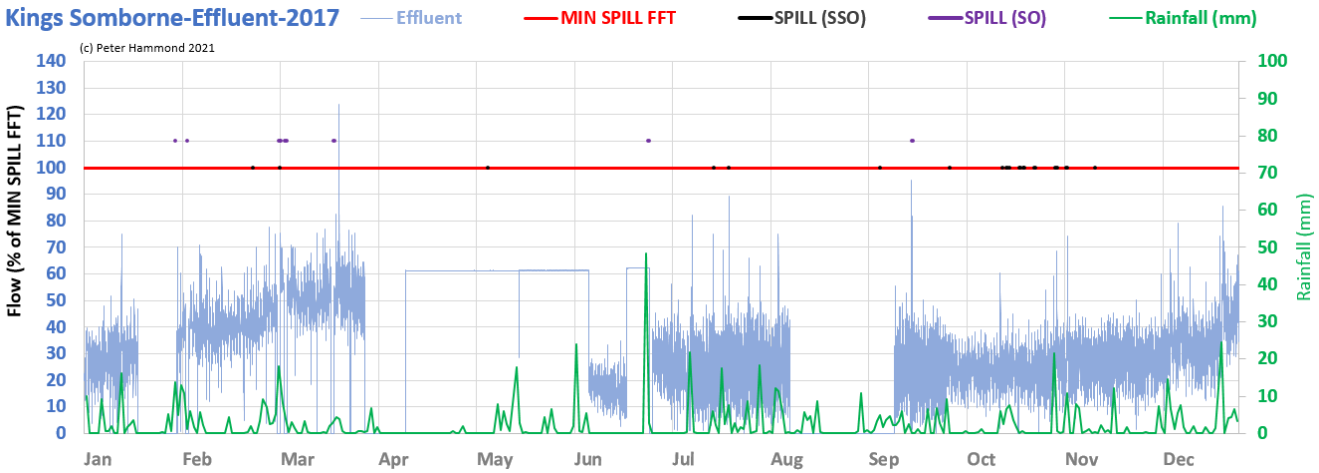


Figure 5: effluent flow data missing for 138 days which amounts to several permit breaches

There were no EDM spill data returned to the EA for 2017. The spill start/stop times provided in response to an EIR request amount to about 11 hours for the SSO and SO overflows, but they are not compatible with the flow data that is available except for occasional SO activity (e.g. single high rainfall days in June and September).

Romsey

PE	1,907

TOTAL SPILLS	
dry	early
5	22

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO		SSO		SSO		SSO	
	NDA	NDA			167		593		NDA	NDA
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	NDA	NDA	3		1	5	1	11	NDA	NDA

SSO=Settled Storm Overflow PE=Population Equivalent

Romsey STW has a settled storm overflow (SSO) that discharges to the River Test, a celebrated chalk stream.

2020

Romsey STW has frequent periods of "zero" flows according to the data provided in response to an EIR request. In January and February 2020, there are 3 separate losses of flow to treatment data with 2 including EDM detected spills. The absence of flow data makes it difficult to decide if the spills on Jan 16th-17th and Feb 20th-22nd were "early". As it is, there were "early" spills on February 17th-19th. In all, **1 "dry" and 11 "early".**

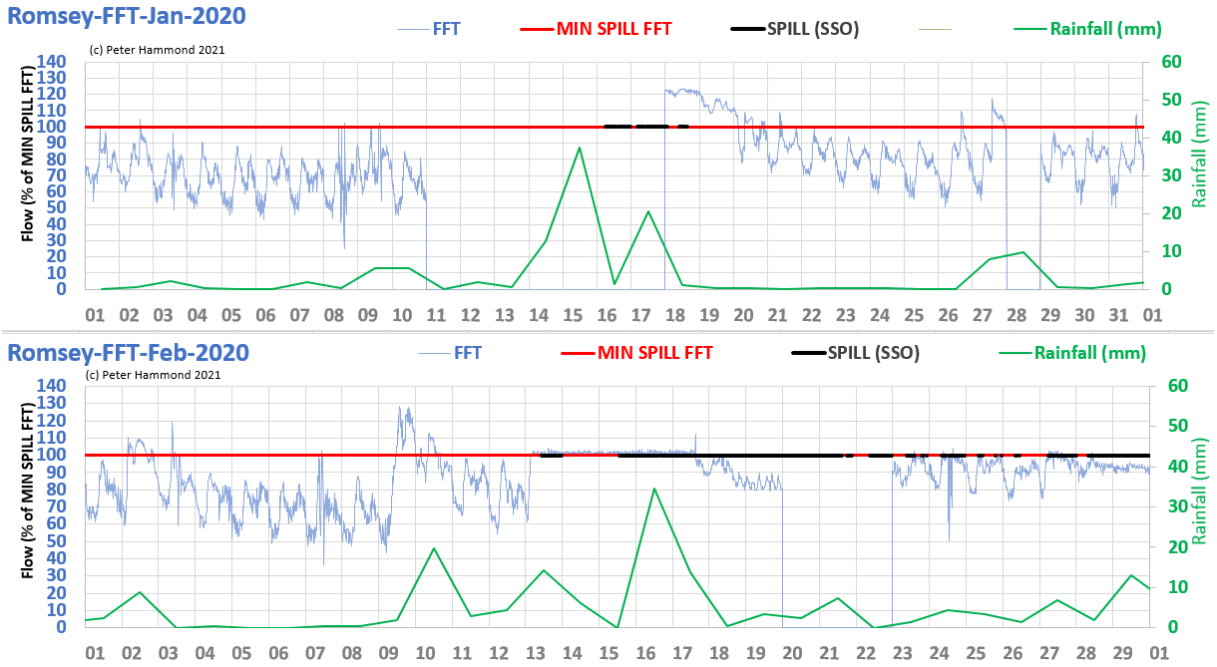


Figure 1: missing flow data coinciding with spills making compliance checking impossible (Jan 16-18 & Feb 20-22)

There are similar gaps in August and October 2020 (**Fig**. 2).

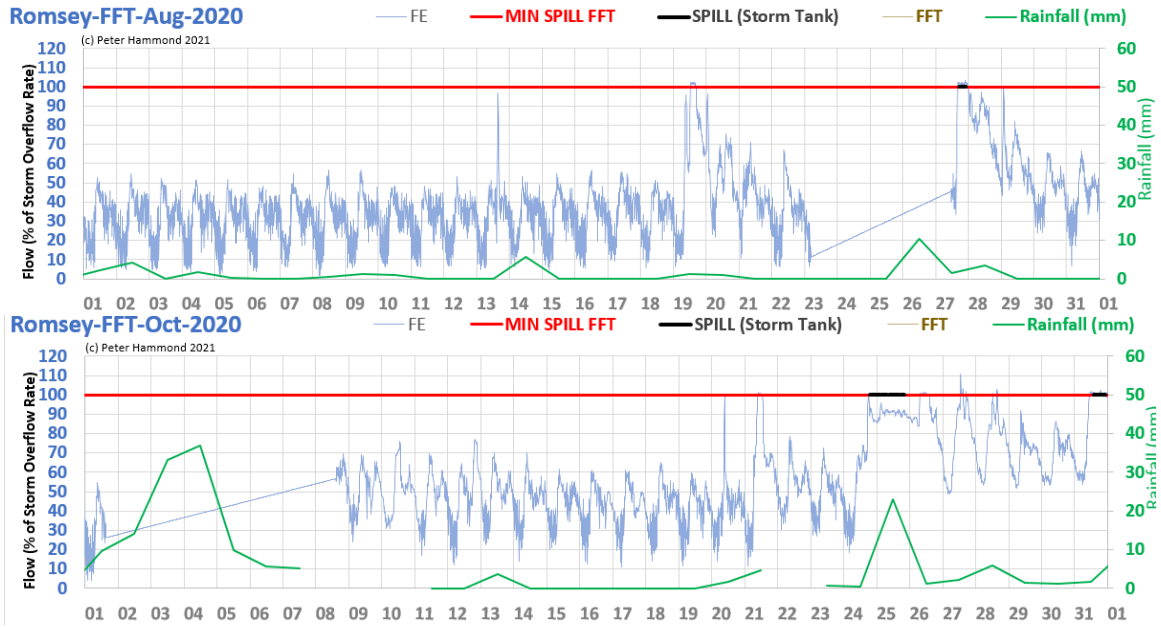


Figure 2: 12 days with missing flow data and an "early" spill on Ocotber 24th

2019

WASP believes there were **11 "early" spills and 1 "dry"** spill in 2019 (examples in **Fig**. 3)

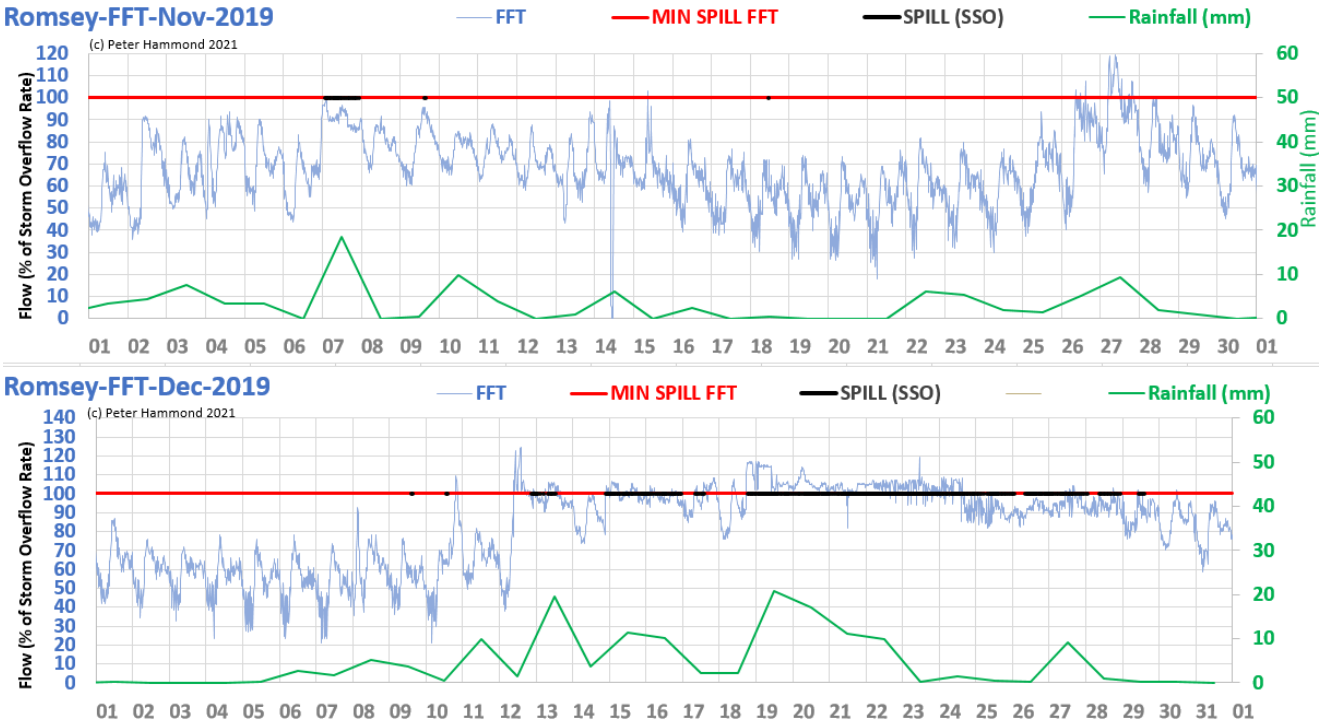


Figure 3: early spills on Nov 7th, 18th and Dec 9th, 10th, 25th, 26th

2018

WASP believes there were **3 "dry" spills** in 2018, 1 each in May, November and December (example in **Fig**. 4)

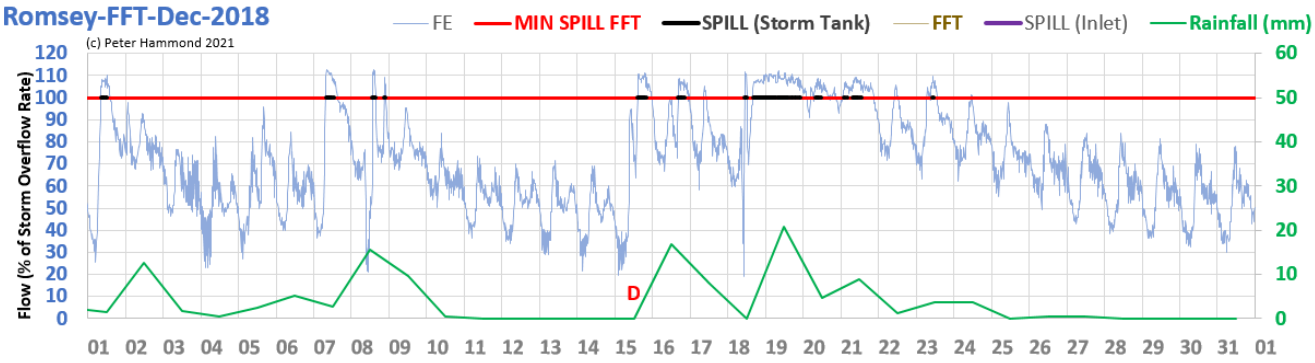


Figure 4: "dry" spill in December 2018

Shoreham

PE

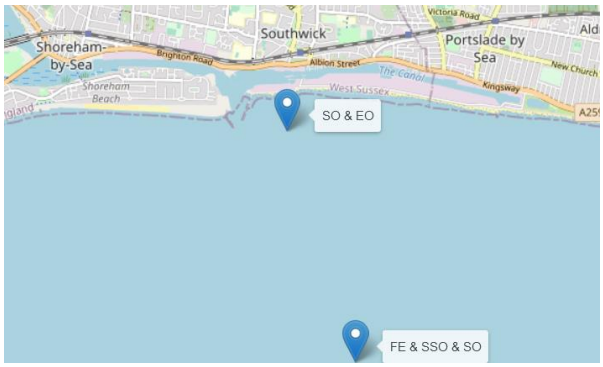
TOTAL SPILLS	
dry	early
16	98

Spilling hours	2017		2018		2019		2020		2021	
	SO (03)	EO (05)	SO (03)	EO (05)	SO (03)	EO (05)	SO (03)	EO (05)	SO (05)	EO (05)
	61	6.3	137	1.5	114	*0*	402	0	NDA	NDA
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	3	15	11	12		33	2	38	NDA	NDA

SSO=Settled Storm Overflow PE=Population Equivalent

Shoreham STW was brought to WASP's attention by the South Coast Sirens, a group of year-round swimmers in the Brighton area, who are very concerned about the sewage they come across when swimming.

Shoreham STW serves a population equivalent of 56,524 and has been working at full capacity for 10 years[23]. It has 2 outlets in the English Channel (**Fig**. 1).



FE = final effluent
SSO = settled sewage overflow

SO = storm overflow
EO = emergency overflow

Figure 1: outlets from Shoreham STW discharging effluent, settled storm and storm sewage to the English Channel

Each outlet discharges untreated, partially treated and treated sewage in several ways, described in the EA permit as follows:

Chemically Assisted Primary Settled Sewage	Schedule No. A.1105/S/CH/99 01
Secondary Treated Sewage Effluent	Schedule No. A.1105/S/CH/99 02
UWWTD Regulations	Schedule No. A.1105/S/CH/99 0U
Storm Sewage	Schedule No. A.1105/S/CH/99 03
Storm Sewage	Schedule No. A.1105/S/CH/99 04
Sewage in an Emergency	Schedule No A.1105/S/CH/99 05

The outlet farthest from the shoreline discharges "chemically assisted primary settled sewage" intermittently, treated effluent continuously and storm sewage intermittently. The last discharge format is subject to the following condition which in effect stipulates a storm overflow rate of 322 litres/sec:

4 The Discharge shall only occur when the rate of flow at the wastewater treatment works storm overflow exceeds 322 litres per second due to rainfall and/or snowmelt.

The discharges from the outlet nearest to shore are intermittent and should only occur when the works is overloaded or in an emergency. The former storm sewage discharge is subject to the following condition:

4 The Discharge shall occur only when the rate of flow at the Albion Street storm overflow weir exceeds 653 litres per second due to rainfall and/or snow melt and consists only of flows in excess of this figure.

The emergency outlet (EO) should only come into use when the Albion Street transfer pumps fail for one or more of specified reasons. From data provided by Southern Water, the EO has operated briefly in 2 of 4 years. WASP believes that Shoreham STW made at least **114 unpermitted "dry" or "early" spills of storm sewage between 2017 and 2020** from the outlet farthest from shore. Southern Water declined to provide EDM spill

[23] https://uwwtd.eu/United-Kingdom/treatment-plant/ukensoswtp000092/history

details for 2021 as the data will not be audited until March 2022. Other water companies have provided WASP with EDM data for 2021 with a caution on its accuracy and reliability.

2020

WASP believes that there were at least 38 "early" spilling days in 2020 and in particular that every spill in March was "early" and hence unpermitted (**Fig**. 2). The flow to treatment rate either never reached the storm overflow rate (or 92% of it) before spilling or failed to maintain it during the entire spill.

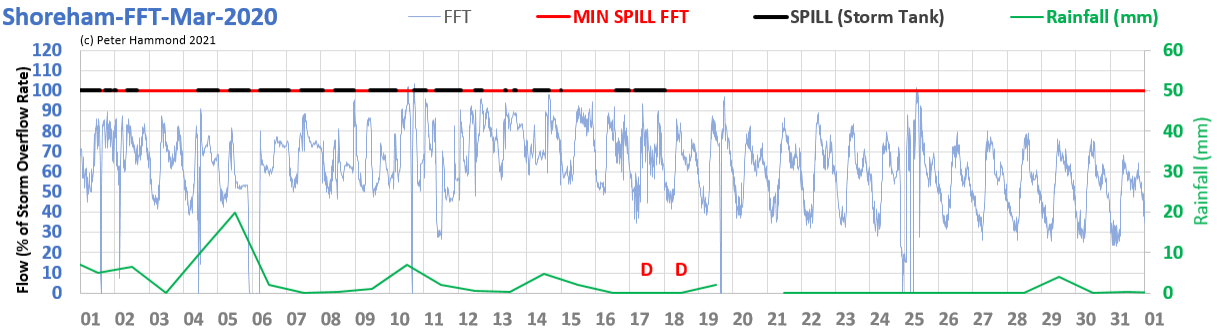


Figure 2: WASP believes that every spill in March 2020 was "early"

2019

WASP believes there were 33 "early" spills in 2019. Examples are shown in **Fig**. 3.

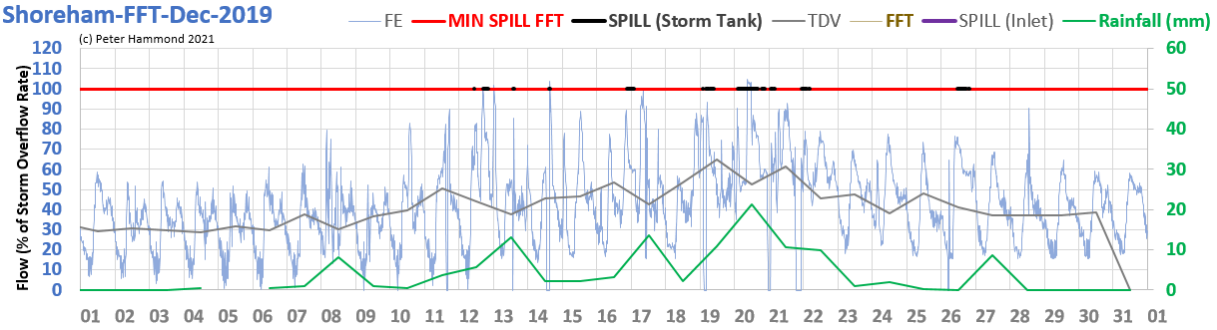


Figure 3: WASP believes there were "early" spills in December 2019 (on 12th, 13th, 16th, 19th, 20th, 21st, 22nd, 26th)

2018

WASP believes there were 11 "dry" and 12"early" (some both) spills in 2018 (examples in **Fig**. 4).

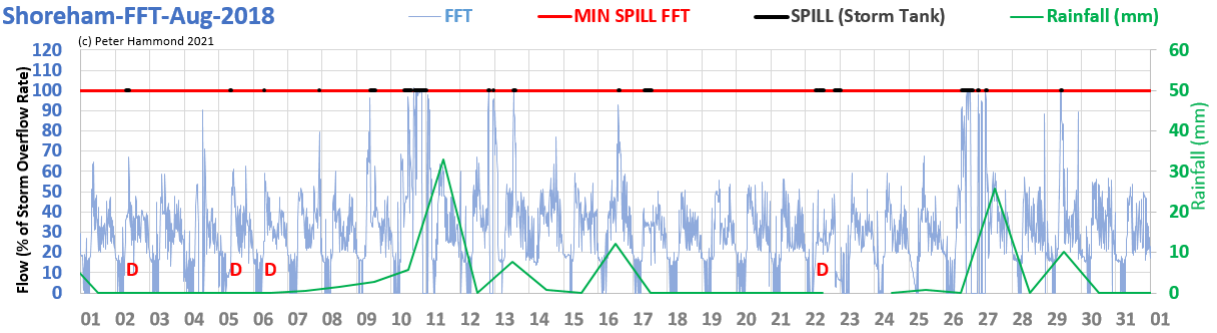


Figure 4: WASP believes there were early spills in August 2018 (e.g., 9th, 17th, 26th)

2017

WASP believes there were 15 "early" spills in 2017 (examples in **Fig**. 5).

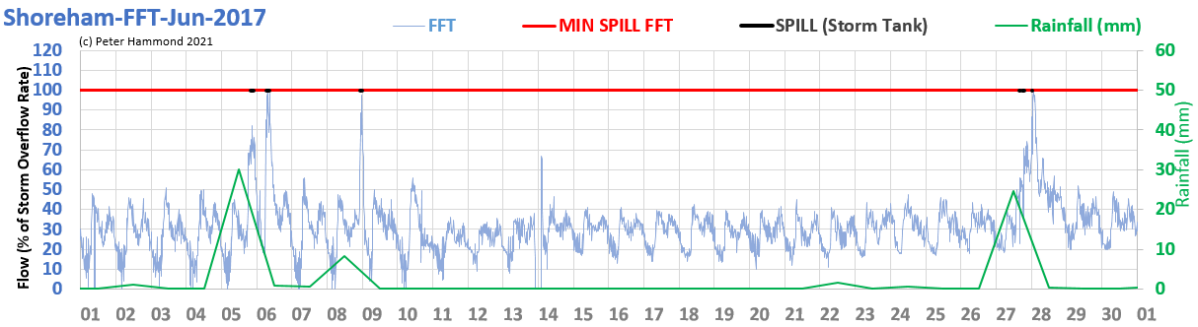


Figure 5: WASP believes there were "early" spills in June 2017 (e.g., 5th, 27th)

Wickham

PE 2,442

TOTAL SPILLS	
dry	early
24	48

Spilling hours	2017		2018		2019		2020		2021	
	SSO		SSO		SSO		SSO		SSO	
	1,308		2,726		744		1,386		NDA	NDA
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	6		15		2	5	1	43	NDA	NDA

SSO=Settled Storm Overflow PE=Population Equivalent

Wickham STW is located north west of Portsmouth on the River Meon, a chalkstream to which it makes untreated sewage discharges via an SSO (settled storm overflow). It currently functions at full capacity and according to Southern Water's Drainage Strategy for Wickham[24]

> *Over the next 25 years, population growth in Wickham is expected to result in a 17% increase in domestic properties connecting to our sewers.* **Southern Water**

Wickham STW's current permit is more than 12 years old. There appears to be confusion about the current storm overflow rate. The accumulated amendments contained in the 2010 permit show it was 15 l/s in 1991 with a suggested revision to 26 l/s at the start of 1992. After an appeal for compatibility with the dry weather flow (DWF) of 500 cu m/day (~5.79 l/s), the revision was overruled and the rate reverted to 15 l/s. Historically, storm overflow rates have been 3 * DWF, so an expected overflow rate might have been more like 18.4 l/s. Judging by the flow to full treatment (FFT), observed spills complied with an overflow rate of 15 litres/sec from Jan 2010 to Nov 2016 from when observed spills occur at an FFT of about 18.4 l/s (**Fig**. 1a and 1b).

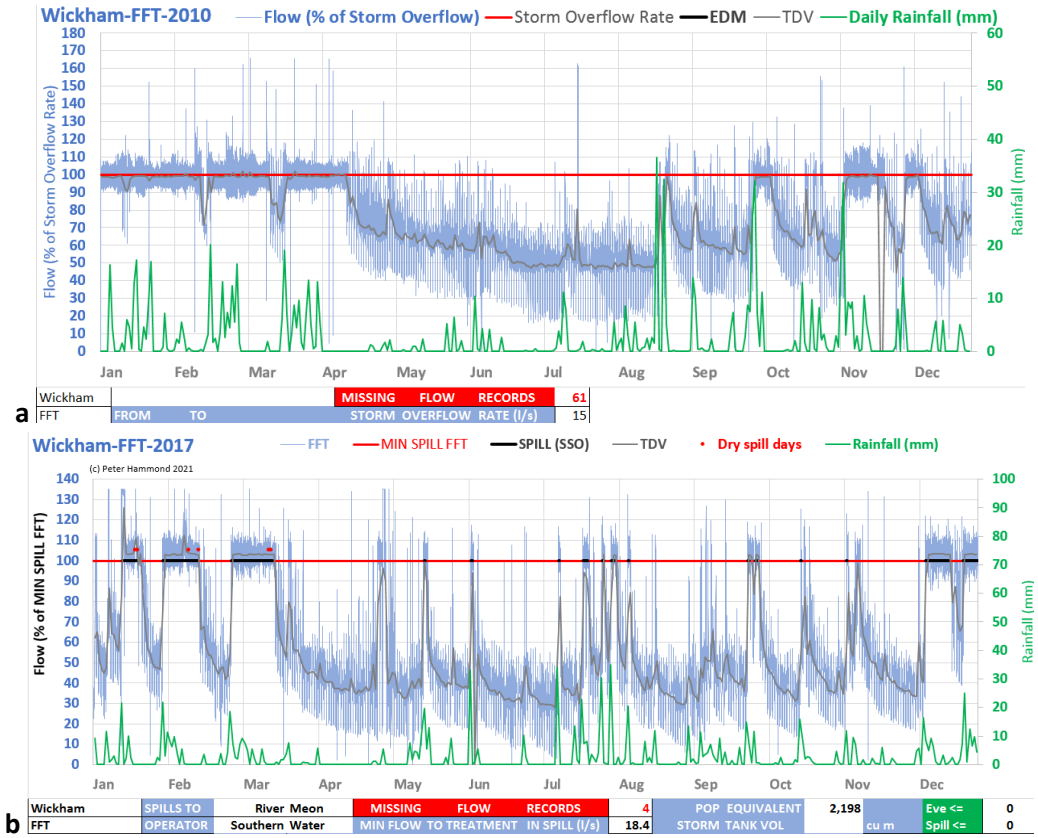


Figure 1: Observed FFT rates at which spills occurred a) 2010-16: 15 litres/sec; b) 2017-19: 18.4 litres/sec.

This rate appears to be observed until Feb/Mar 2019 and on 1st Oct 2019 observed spills appear to occur at an FFT of 26 l/s (**Fig**. 2).

24 https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiBzurbmuP0AhUkQkEAHQB3DG8QFnoECAwQAQ&url=https%3A%2F%2Fwww.southernwater.co.uk%2Fmedia%2F3270%2Fdrainage-strategy-report-wickham.pdf&usg=AOvVaw0p85begpL60kKxlqgTqRcM

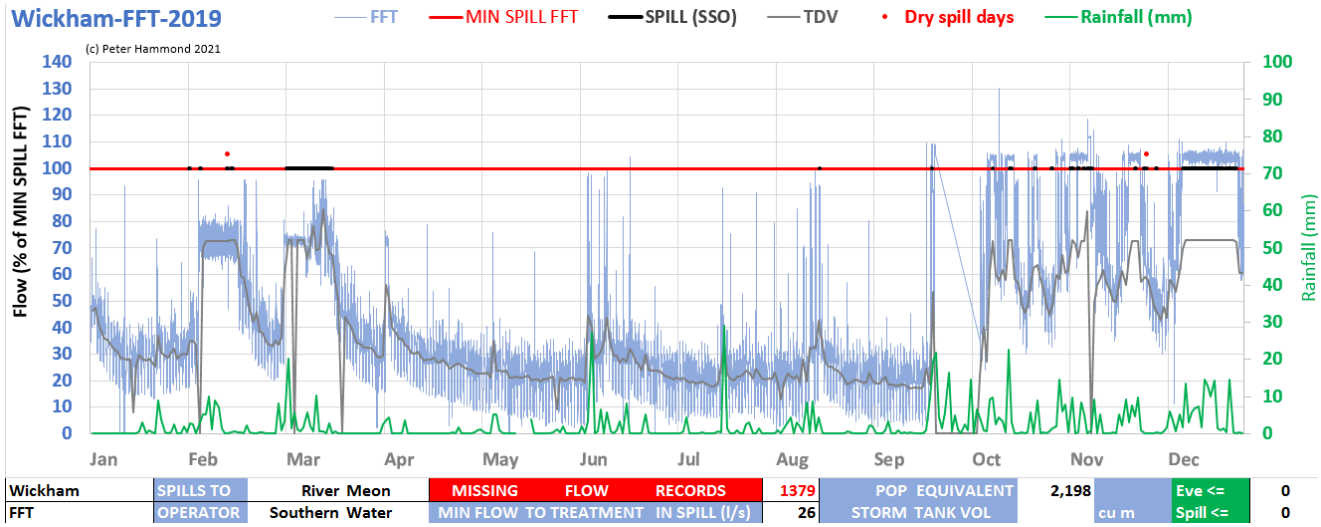


Figure 2: observed spill occurring at 18.4 l/s at the beginning of 2019 and at about 26 l/s from Oct 2019

In 2020, the observed spills occur at a range of FFT rates: 18.4 l/s; 17 l/s; and just under 26 l/s. There no longer appears to be any consistency in the FFT rate at which spills occur (**Fig**. 3).

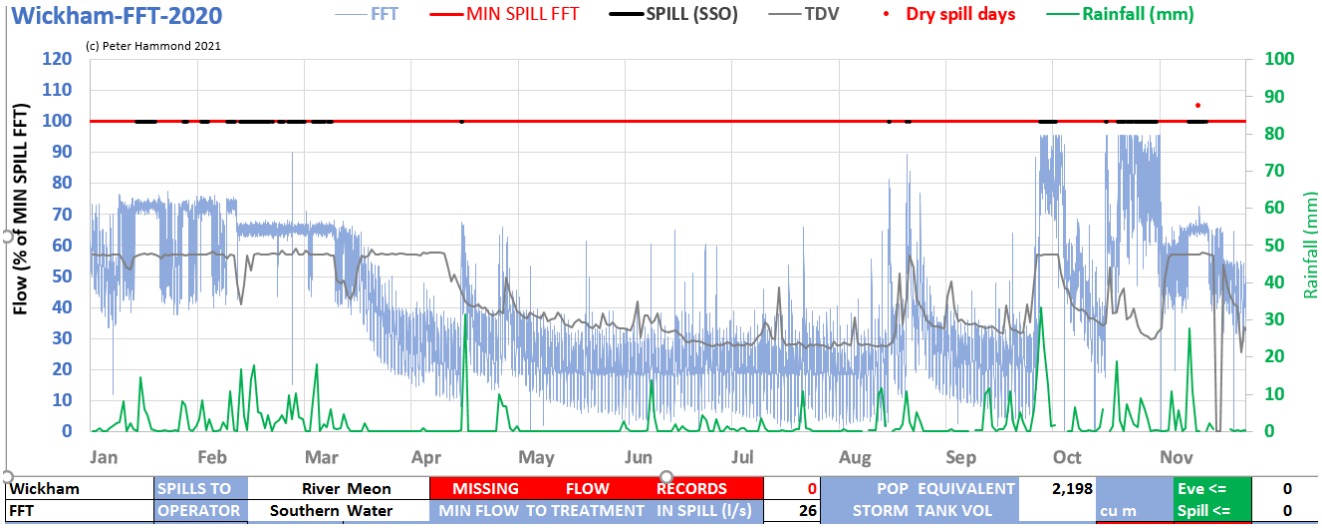


Figure 3: variable FFT rates at which spills occur in 2020

There are several references to DWF at Wickham STW. The permit of 2010 refers to both 500 cu m (corresponding to the overflow rate of 15 l/s) and 750 cu m/day (corresponding to an overflow rate of 26 l/s). A draft *Drainage and Wastewater Management Plan* for the East Hampshire Catchment[25], dated August 2020, says Wickhan STW has a consented DWF of 750 cu m/day. In response to an EIR request by WASP in early June 2020, the EA said Wickham STW's storm overflow rate was 26 litres/sec.

WASP has decided that there has likely been an update to Wickham STW's storm overflow rate that is yet to find its way into a new permit on the EA's public register. Therefore, in assessing "early" spilling at Wickham STW, WASP will be generous and overlook "early" spill detection before October 2019. Of course, the storm overflow rate does not affect the detection of "dry" spills which is simply based on spill intervals and rainfall data. The numbers of detected "dry" and "early spills at Wickham STW are summarised at the beginning of this section.

[25] https://www.southernwater.co.uk/media/3841/east-hampshire-dwmp-strategic-context.pdf

2020

Assuming a storm overflow rate of 26 litres/sec, WASP believes there are 35 "early" spills between Jan 1st 2020 and March 12th 2020 (**Fig**. 4).

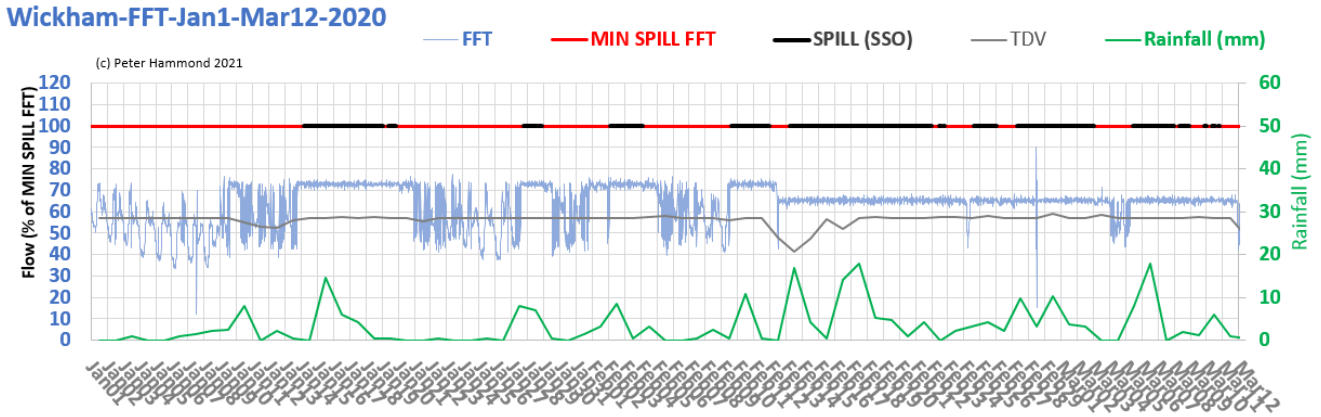


Figure 4: WASP believes all 35 spills between Jan 1st and March 12th 2020 were "early"

2019

All but 5 of the spilling days in Nov-Dec 2019 occur with the FFT at just over 26 litres/sec and hence are compliant with a storm overflow rate at that value. However, there are 5 spilling days where WASP believes there are "early" spills (Nov 1st, 9th, 13th, 30th; Dec 4th) and also one day with a "dry" spill (Dec 1st).

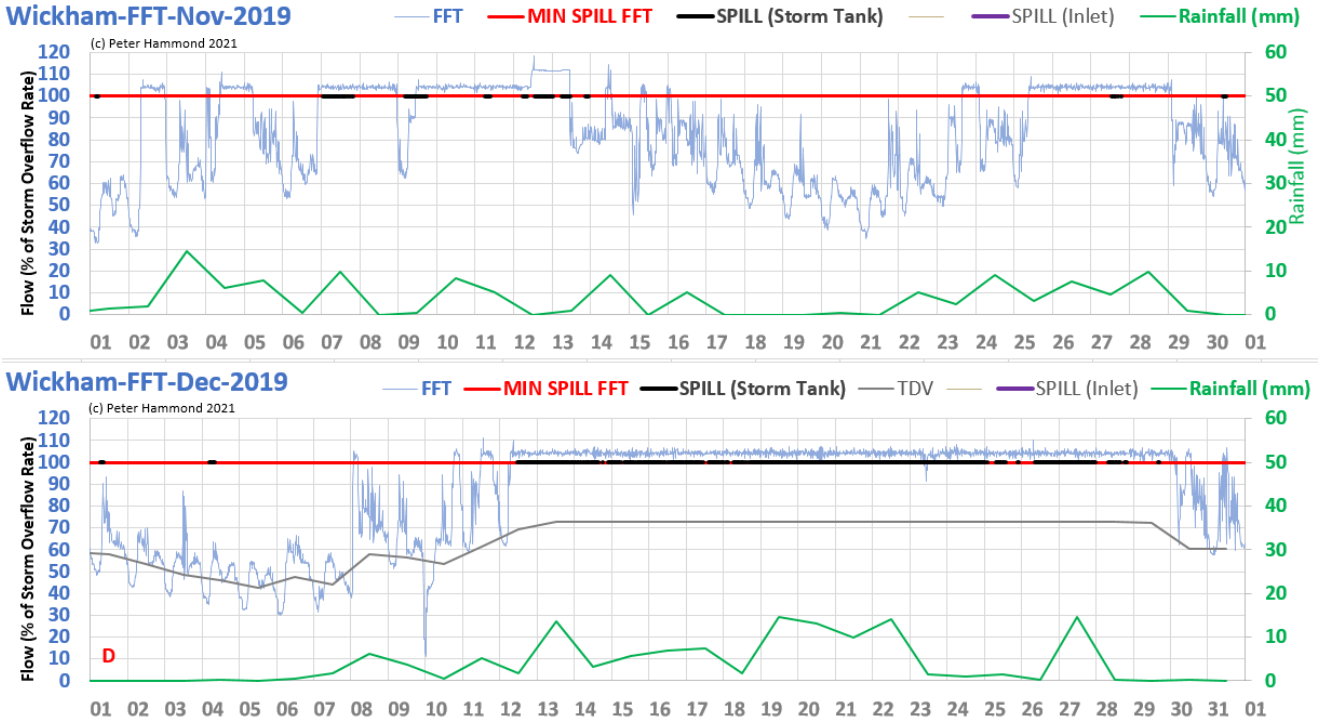


Figure 5: WASP believes all spills were compliant in Nov-Dec 20019 apart from 5 "early" and 1 "dry"

2018

Wickham STW spilled for 2,626 hours in 2018 over 141 spilling days of which, WASP believes, 15 involved "dry" spills (examples in **Fig**. 6).

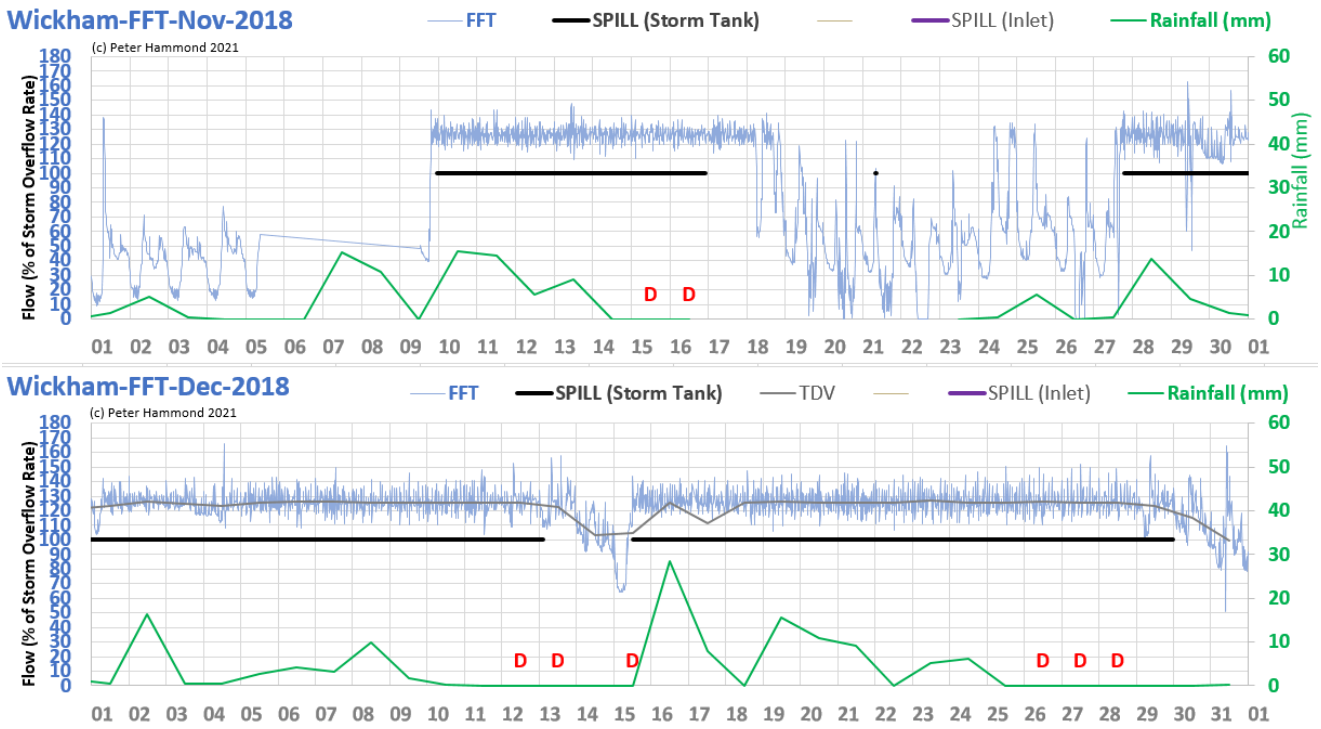


Figure 6: WASP believes there were 8 "dry" spills in Nov-Dec 2018

2017

Wickham STW spilled for 1,308 hours in 2017 over 75 spilling days of which, WASP, believes 6 were "dry" (examples in **Fig**. 7).

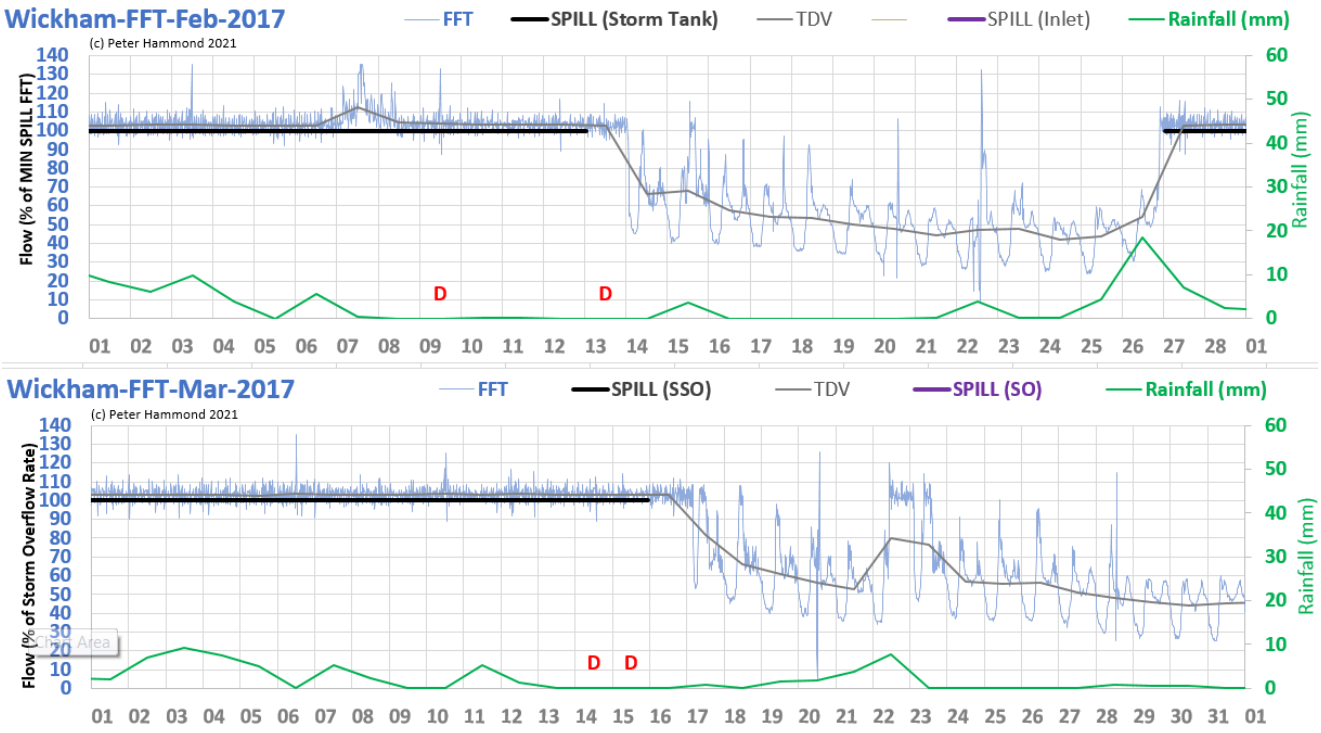
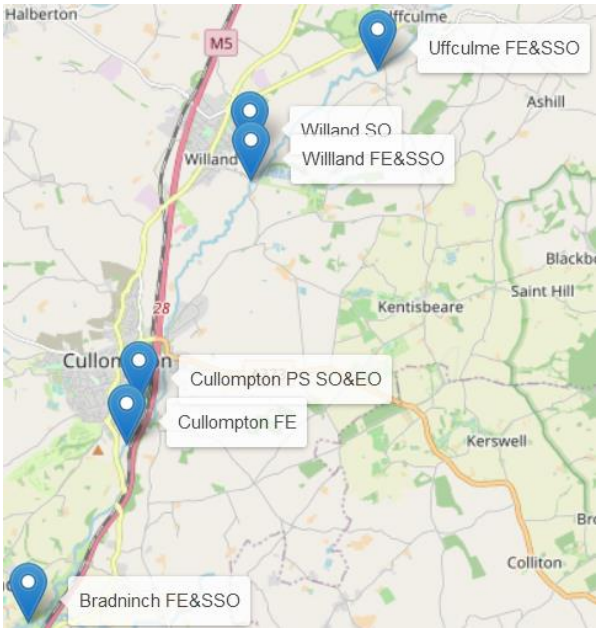


Figure 7: WASP believes there were 4 "early" spills in Feb-March 2017

SOUTH WEST WATER

During the production of the April 2021 BBC Panorama programme "The River Pollution Scandal", WASP collaborated closely on an analysis of the performance of Bradninch, Cullompton, Uffculme and Willand STWs, all of which discharge into the River Culm (see map below).



Map showing location of STWs studied that discharge to the River Culm

The Clyst and Culm catchment is east of the main River Exe. The Clyst rises in the Blackdown Hills and joins the Exe at Topsham, while the Culm converges with the main Exe near Stoke Canon, NE of Exeter. The catchment is mainly agricultural with some industry around Cullompton, Willand, and Uffculme.

Each year between 2013 and 2016, the Lower Culm received EA classifications of poor (ecological) and good (chemical). In 2019, the EA classifications were moderate (ecological) and fail (chemical).

Sewage Treatment point sources and Agriculture diffuse sources have both been cited as reasons for poor and failed classifications.

Source: Environment Agency[26]

According to the EU WWTD website, Uffculme and Cullompton have had a persistent, heavy loading in recent years. Bradninch's loading was at 100% capacity in 2014 but a 10% capacity increase has reduced that pressure. Willand has been seriously underloaded by comparison (**Table** 2).

	Bradninch			Cullompton			Uffculme			Willand		
Year	Capacity	Load	% Load	Capacity	Load	Load%	Capacity	Load	Load %	Capacity	Load	Load %
2012	-	-	-	10,809	9,244	85.5%	2,364	2,364	100%	5,068	3,388	66.9%
2014	2,093	2,093	100%	10,809	9,244	94.2%	2,443	2,443	100%	5,068	3,353	66.2%
2016	2,336	2,101	89.9%	10,809	9,244	93.2%	2,493	2,493	100%	5,068	3,559	70.2%
2018	2,336	2,038	87.2%	10,809	9,244	93.5%	2,493	2,475	99.3%	5,068	3,590	70.8%

Table 2: capacity and load history for the four STWs studied

These STWs measure and record treated effluent only. Initially, South West Water provided blocked spill start/stop times. The Panorama team held out for individual spill data and eventually South West Water did provide them but only for 2020.

Detailed results

In the charts below, the blue curve represents treated effluent rate as a proportion of the overflow setting or minimum flow to treatment during a spill. The red horizontal at 100% (left vertical axis) represents the overflow setting. The black horizontal segments represent spill intervals defined by the start/stop times of individual spill times. The green curve represents daily rainfall in mm. Flow and spill interval data were provided by South West Water and rainfall at Dunkeswell Airport was obtained from a free public source.

At small STWs with a simple treatment process, effluent rate is a good surrogate measure of FFT. A difference of 10% would be typical at uncomplicated works but the analysis here allows a generous difference of at least 25%. The EA allows an 8% meter error so spilling days are flagged here as "early" with an **E** annotation when the effluent rate does not stay above 67% of the minimum flow to full treatment for the entire spill. A **D** annotation denotes a "dry" spill when there is no rainfall on the spilling day or day before.

[26] https://environment.data.gov.uk/catchment-planning/WaterBody/GB108045014970

Bradninch

PE	2,038

TOTAL SPILLS	
dry	early
11	22

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO		SSO		SSO		SSO	
	NDA		NDA		1,274		1,978		NDA	
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	NDA	NDA	NDA	NDA		4	11	18	NDA	NDA

SSO=Settled Storm Overflow PE=Population Equivalent

2020

Examples of spills that WASP believes were unpermitted are shown in the charts in **Fig.** 2. The chart for Dec 2020, **Fig**. 3, is included for comparison as it shows spills, apart from 1, that appear to be compliant.

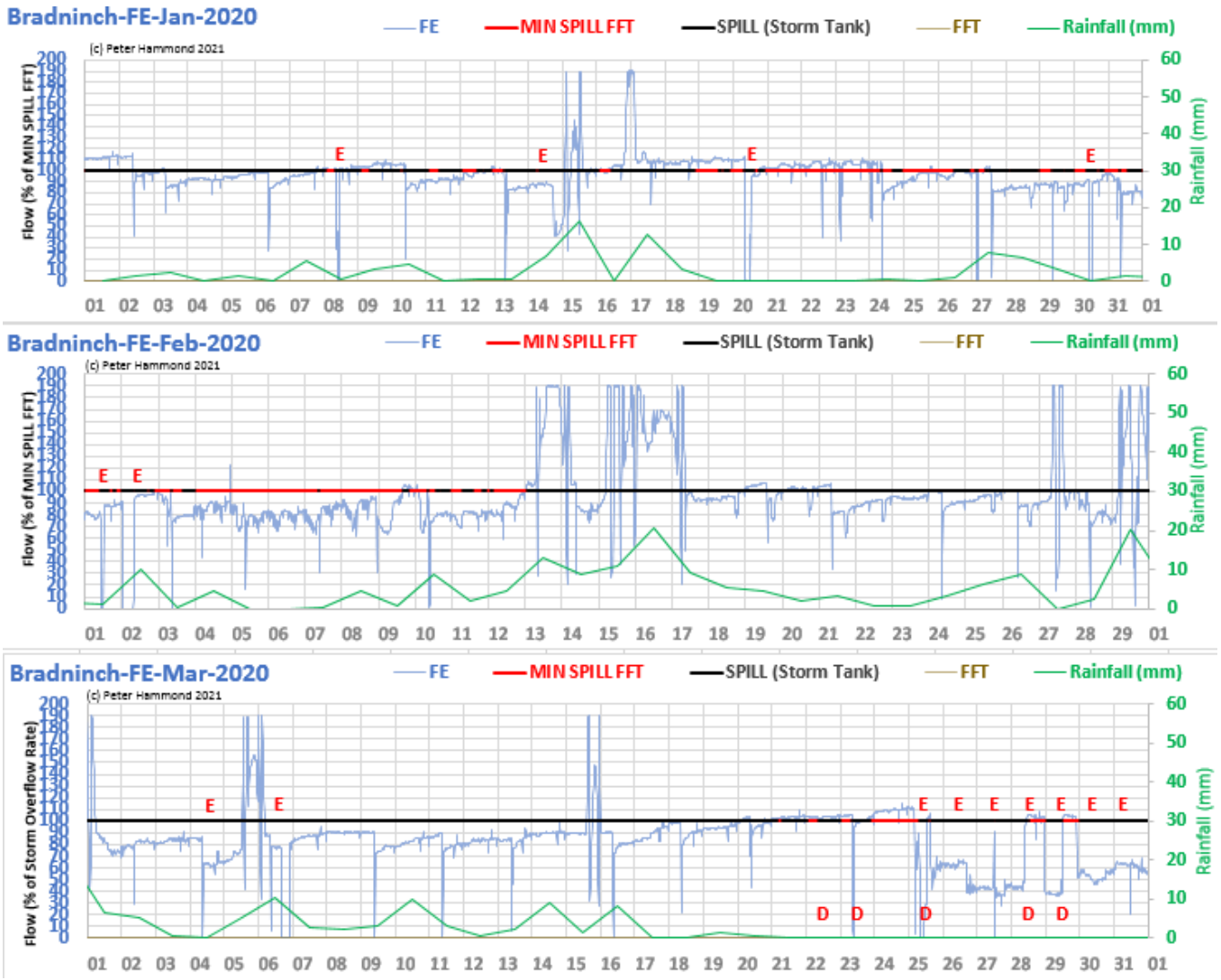


Figure 2: unpermitted spills of untreated sewage from Bradninch STW to the River Culm

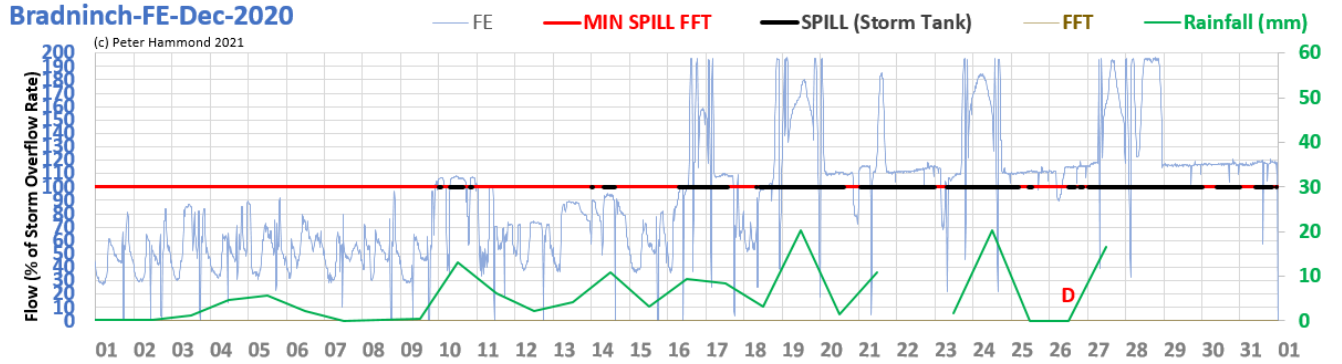


Figure 3: permitted spills of untreated sewage from Bradninch STW to the River Culm (apart from 26/12/21)

2019

In March 2019 there was a long spill over 12 days, with a block count of 12 meaning a spill occurred every day. On four days, the final effluent rate was less than 50% of the storm overflow rate, which WASP believes makes them “early” (**Fig.** 4).

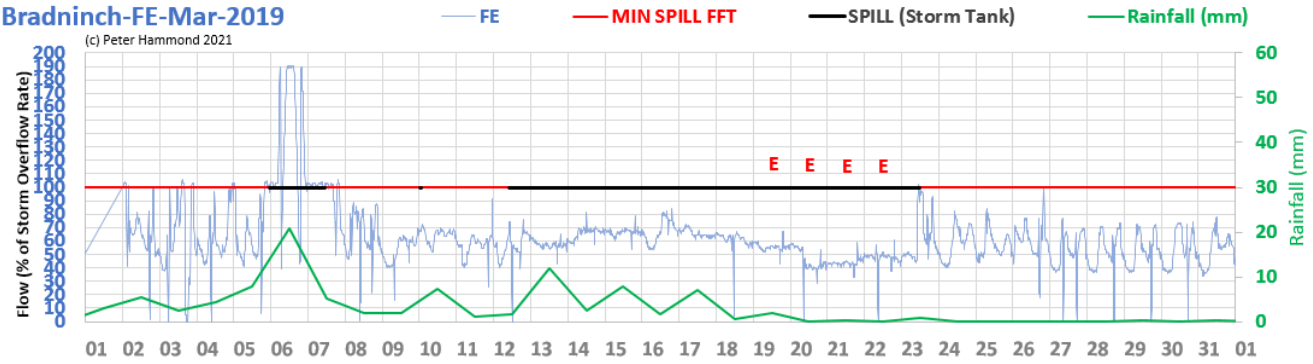


Figure 4: Four “early” spills in March 2019 at Bradninch STW

Cullompton

PE	9,244

TOTAL SPILLS	
dry	early
	24

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO		SSO		SSO		SSO	
	NDA		NDA		-				-	
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	NDA	NDA	NDA	NDA				24		

SSO=Settled Storm Overflow PE=Population Equivalent

Cullompton STW is different from the other 3 STWs analysed here in that it is expected to treat all sewage entering the works. It does not have a storm tank and should never spill untreated sewage. Instead, the feeder sewage pumping station (Duke St SPS) has an emergency overflow that in theory protects Cullompton STW from becoming overwhelmed in adverse weather conditions. However, the EA discharge permit conditions for Duke St SPS are very much like those of the other STWs in that storm discharge must be due to rainfall or snow melt and should not occur while the flow through the SPS is below 102 litres/sec. Moreover, when the Panorama team used an EIR to request flow data for the Duke St SPS the response was as follows:

> *There is no MCERT data for Duke Street as the meters related to the station are not required to be MCERT. Two flow meters are located just prior to the treatment works and therefore this data will be very similar to works' discharge data.* South West Water

Therefore, when checking compliance of spills at Duke St SPS, WASP used the Cullompton STW effluent flow data, the Duke St SPS spill start/stop times and 67% of the 102 litres/sec overflow setting. The Duke St SPS spilled untreated sewage to the River Culm for 900 hours over 58 days of which, WASP believes, **24 were "early"**. Examples of these "early" spills are given in **Fig**. 1.

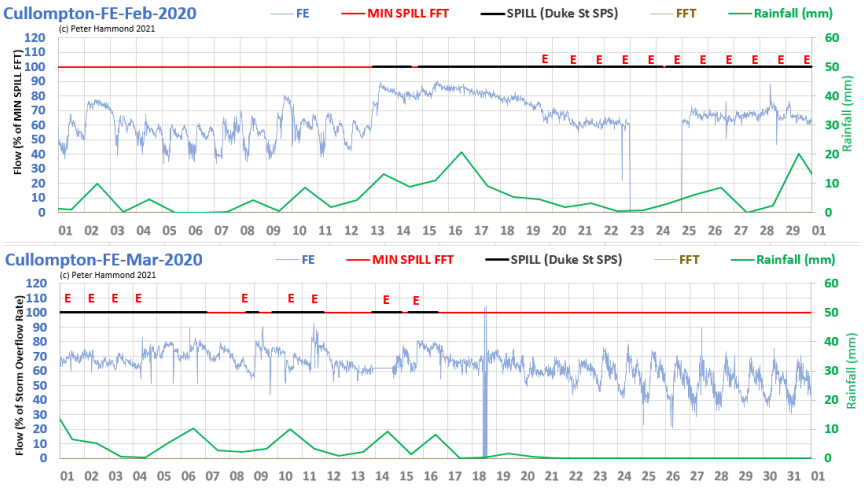


Figure 1: treated effluent flow at Cullompton STW, daily rainfall and spill intervals at Duke St SPS

Uffculme

PE	2,475
TOTAL SPILLS	
dry	early
5	40

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO		SSO		SSO		SSO	
	NDA				478.7		281		NDA	
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	0	0	0	7	1	22	4	11	NDA	NDA

SSO=Settled Storm Overflow PE=Population Equivalent

Uffculme STW and an upstrean feeder sewage pumping station (SPS) are permitted to discharge in a variety of ways via multiple outlets. Treated effluent and settled storm sewage via storm tanks are discharged from separate outlets at the STW. Screened but untreated storm sewage and emergency uncreened storm sewage are discharged via separate outlets at the SPS. WASP only had access to flow data at the STW.

Despite Uffculme STW being fully loaded for many years, its permitted storm tank size (40 cu m) is less than 25% of the required capacity for coping with its storm overflow rate (19 litres/sec) for 2 hours (136.8 cu m). Insufficient storm tank volume inevitably means more frequent discharges of untreated sewage.

2020

In 2020, Uffculme spilled for 281 hours over 50 spilling days, **11 of which WASP believes were "early"** and **4 "dry"** (Examples in **Fig**. 1).

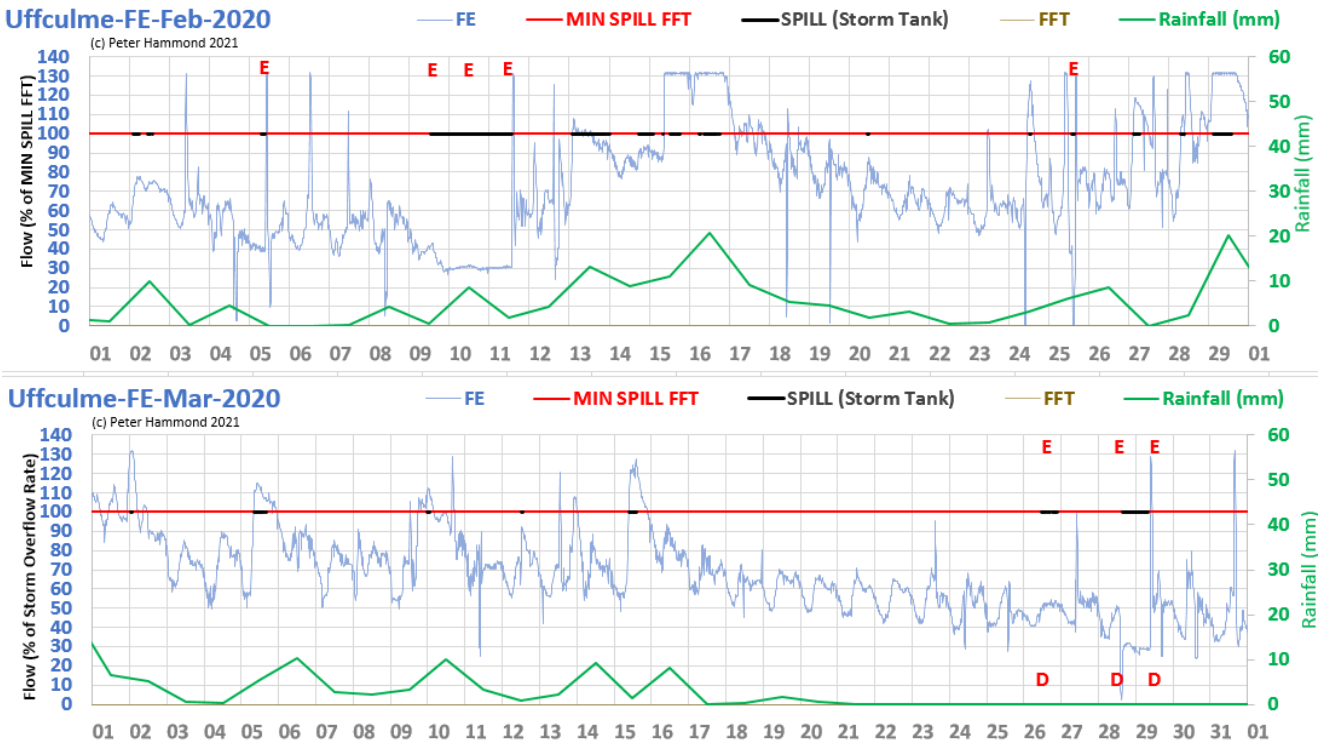


Figure 1: spills of untreated sewage from Uffculme STW to the River Culm believed by WASP to be unpermitted

2019

There appears to be some inconsistency or typographical error in South West Water's 2019 EDM return to the EA for Uffculme STW. The declared spilling hours are set against a storm overflow for the STW when it doesn't have one. The second part of the return refers to the emergency overflow at the SPS, so it may be that both should be assigned there. Putting that to one side, WASP believes made at least 22 "early" spills at Uffculme STW in 2019.

WASP believes Uffculme made "early" spills on at least two days in June 2019 (**Fig**. 2).

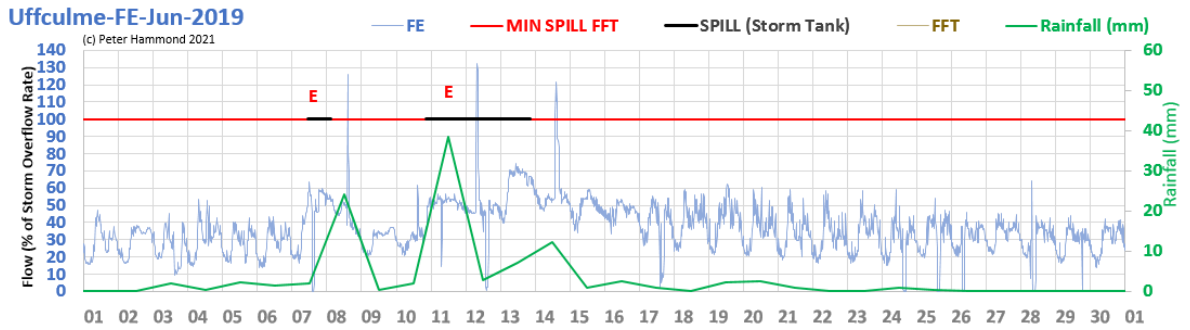


Figure 2: WASP believes the final effluent flow was only 50% of the strom overflow rate on 2 days in Jun 2019

In August and September 2019, WASP believes there were at least 7 "early" spilling days (**Fig**. 3)

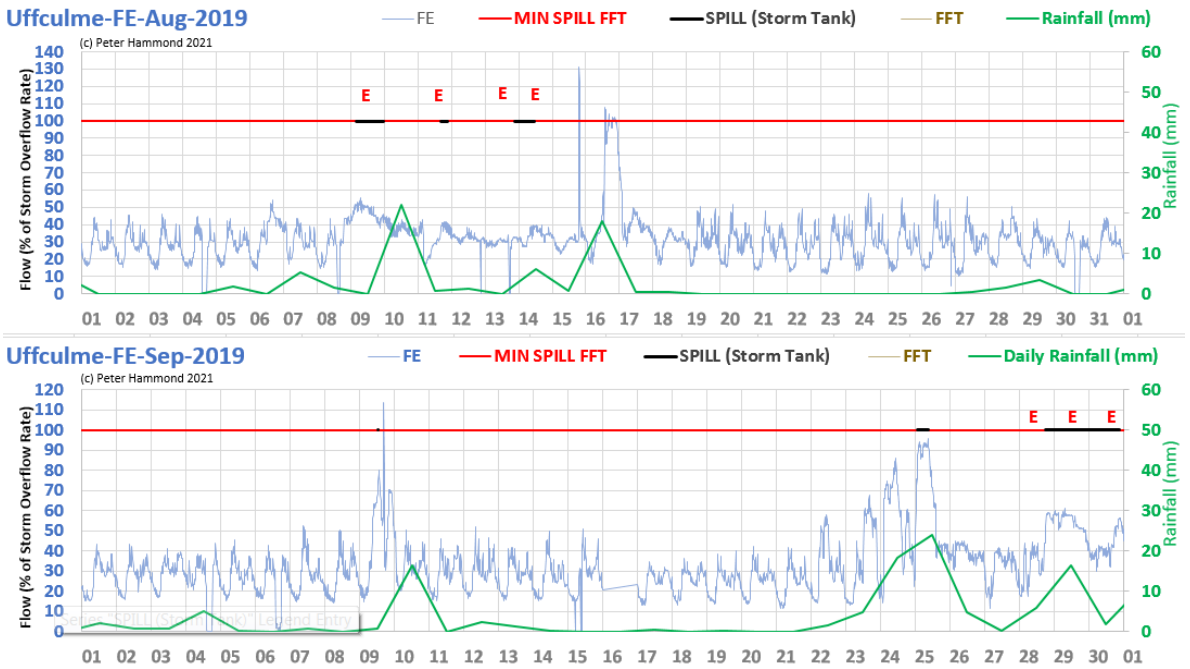


Figure 3: WASP believes there were at least 7 spilling days in August (9,11,13,14) and September (28-30)

The worst "early" spilling, WASP believes, occurred in November and December 2019.

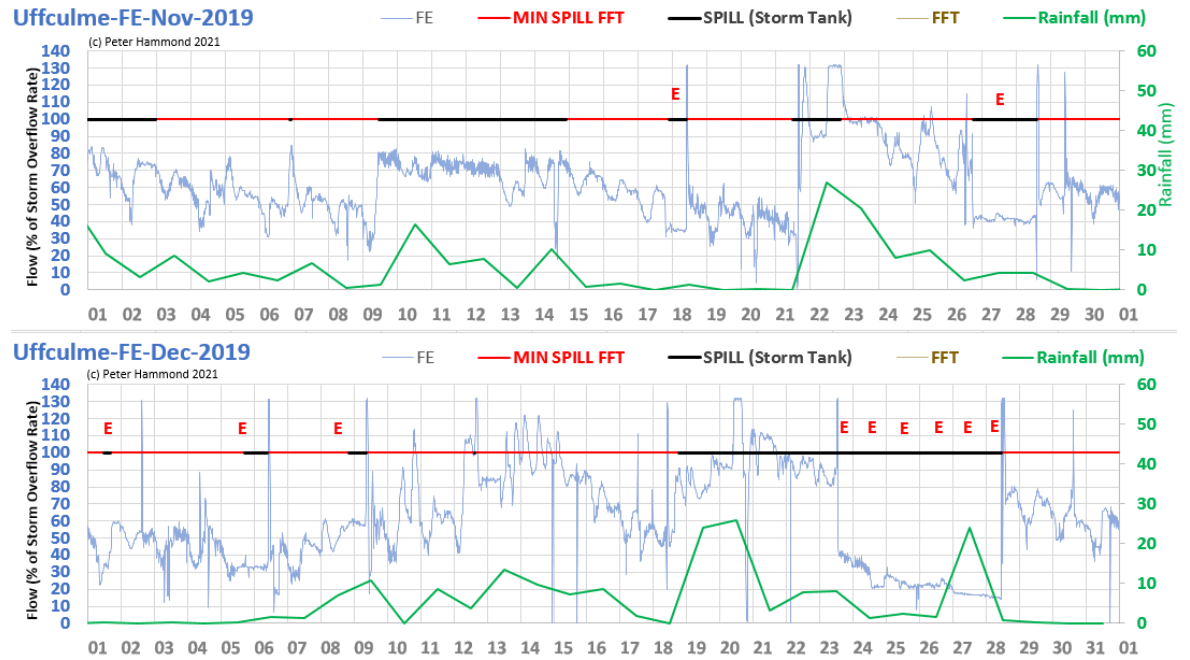


Figure 4: WASP believes there were at 11 "early" spilling days in November and December 2019

2018

In response to an EIR, South West Water provided EDM data corresponding to total spilling of 158 hours over 10 spilling days during Nov and Dec. WASP believes there was no return of spill data to the EA for 2018 and that there were at least 7 "early" spilling days (examples in **Fig**. 5)

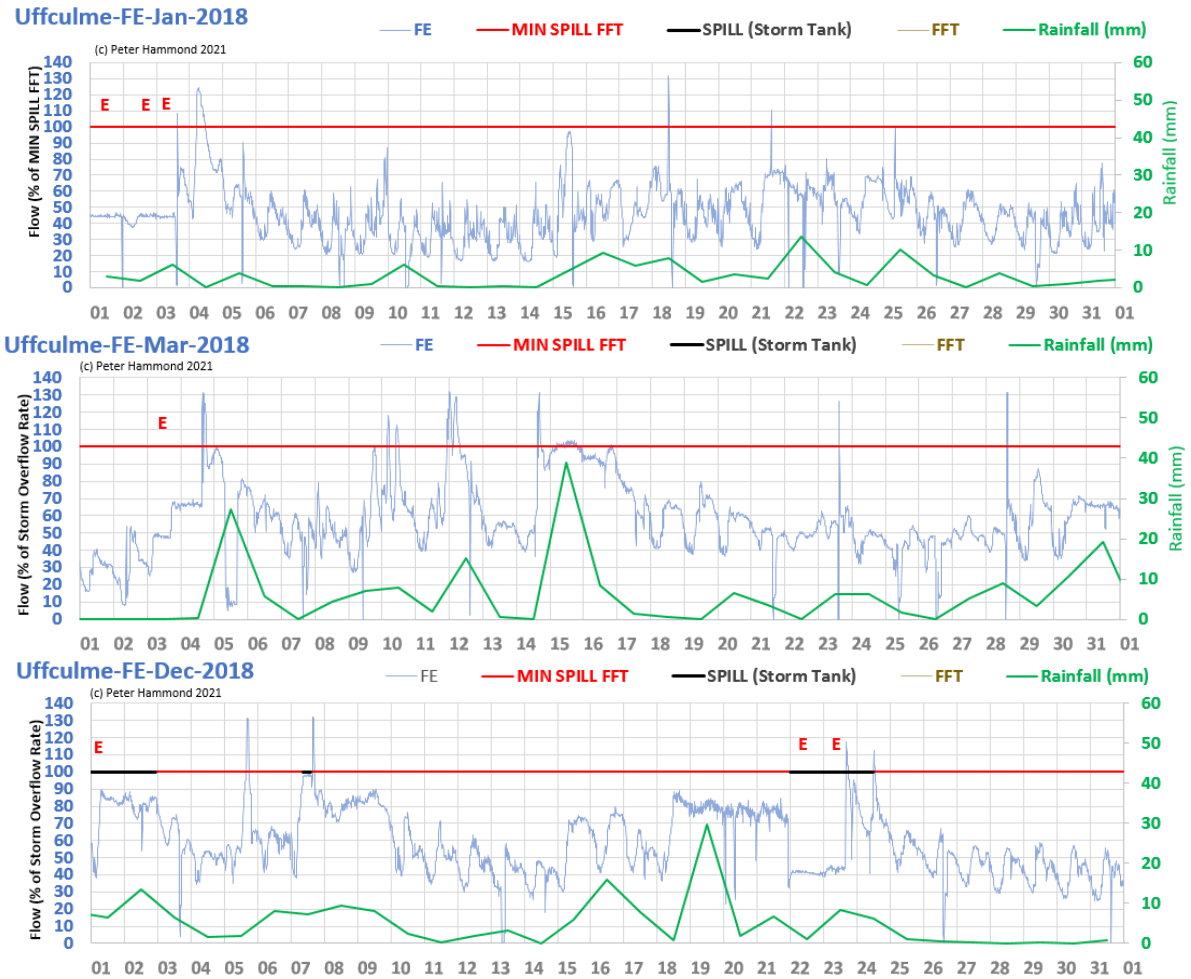


Figure 5: WASP believes there were at least 7 spilling days in January, March and Decenber 2018

In addition to the "early" spills, there is a series of 8 zero flows to treatment in June 2018 when there was no or little rainfall. WASP believes these could be associated with some kind of equipment failiure and spill of ntreated sewage – undetected as there was no EDM device in place until much later in 2018.

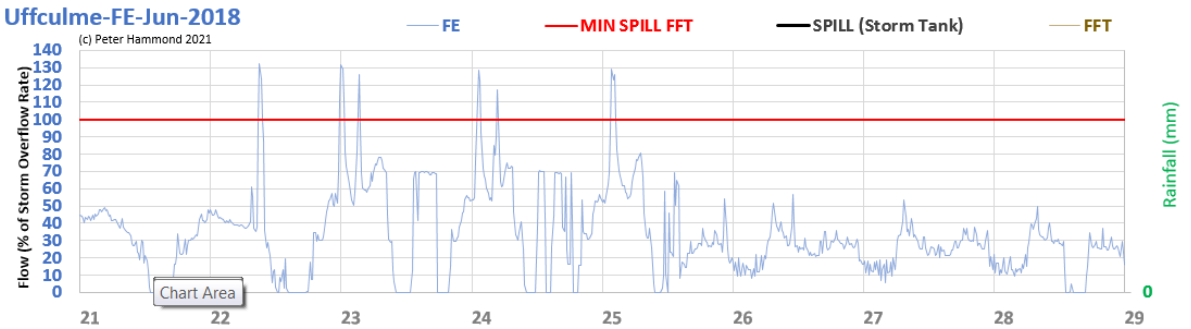


Figure 6: WASP believes 8 zero flows in June 2018 might be indicative of equipment failure and undetected spills

2017

There is no EDM spill data available for 2017. The flow data suggests the works was relatively well behaved apart from a suspicious, large 40-day gap in flow to treatment from the beginning of a week of sustained rainfall. This would need further investigation using telemetry alarm data to check for permit breaches.

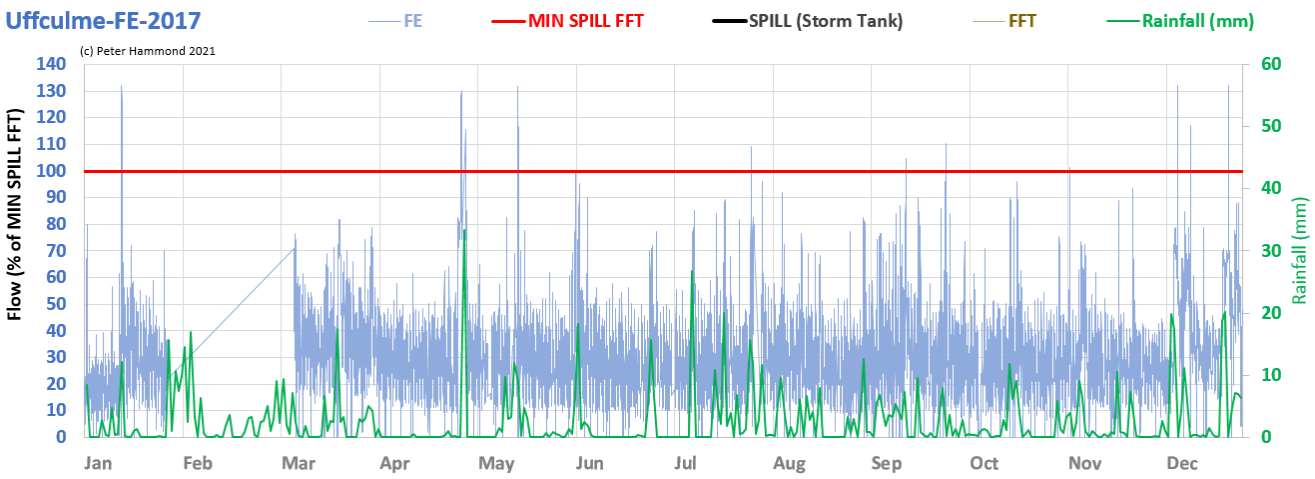


Figure 7: WASP a 40-day zero flow in 2017 might be indicative of equipment failure and undetected spills

Willand

PE	3,590
TOTAL SPILLS	
dry	early
2	25

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO		SSO		SSO		SSO	
	NDA		NDA				1,233		NDA	
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	NDA	NDA	NDA	NDA			2	25	NDA	NDA

SSO=Settled Storm Overflow PE=Population Equivalent

2020

Willand STW's spills occurred over 80 days, **25 of which, WASP believes, involved "early" and 2 involved "dry" breaches of its permit**. Willand STW also has a storm overflow at the inlet designed to limit the flow entering the works to 55 litres/sec while any excess above that is diverted to the river after screening. When the storm inlet overflow is spilling but allowing 55 litres/sec to be passed on to full treatment. the difference, 18 (55 – 37) litres/sec, is diverted to the storm tank. Once the storm tank is full, we can estimate that continued spilling at the inlet also involves 18 litres/sec of untreated sewage being discharged to the River Culm. For example, during the 216 hours when both the inlet and storm tank overflows were spilling simultaneously, an estimated 14,000 tonnes (or 14 million litres or 5.6 Olympic pools) of untreated sewage was dumped into the River Culm, much of it in breach of permit.

Many of the unpermitted, "early" permit breaching spills occur between January and March 2020 as is shown in **Fig.** 7. The February Chart in **Fig**. 7 includes spills that are possible permit breaches (Feb 13th to Feb 19th).

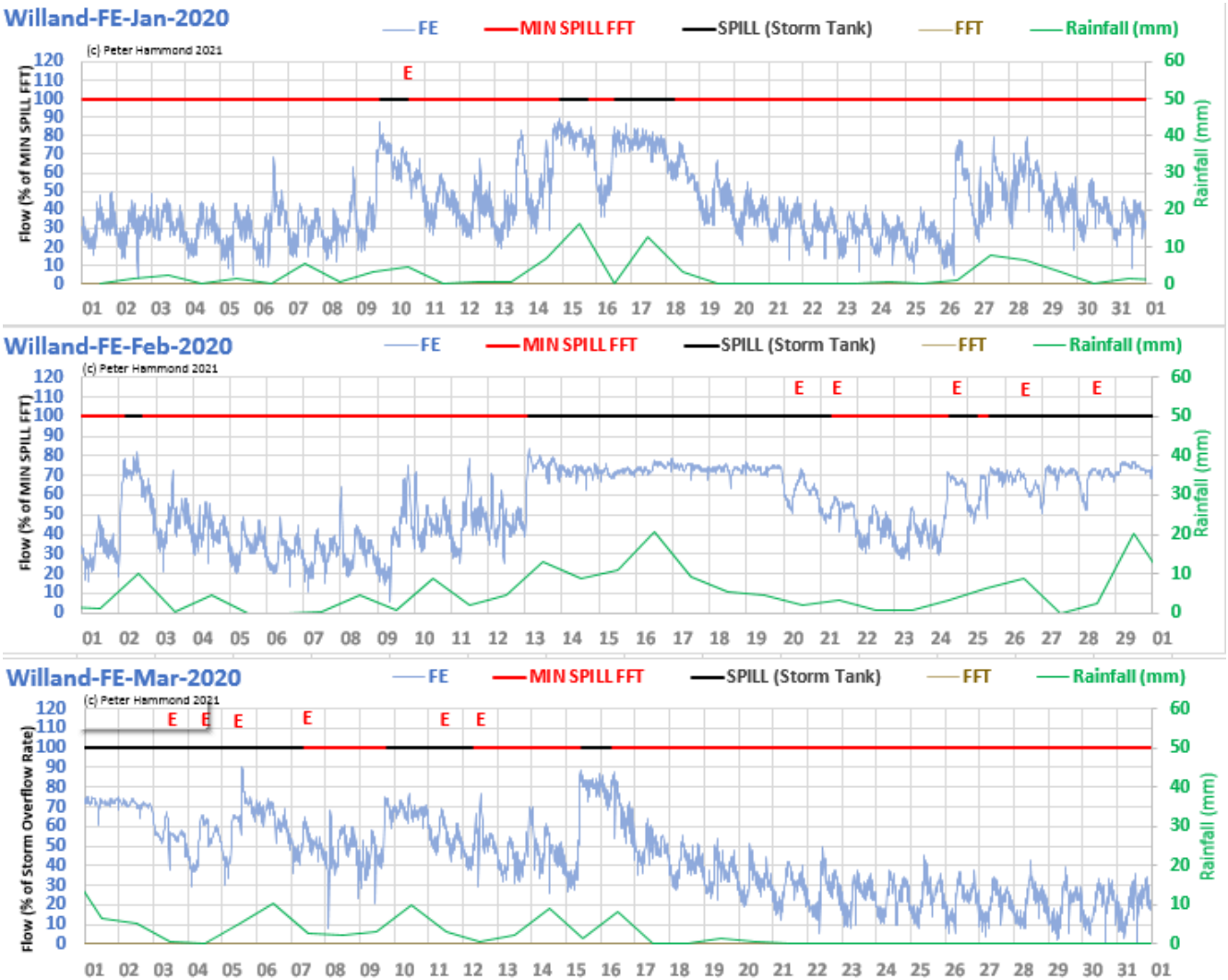


Figure 7: 12 spills of untreated sewage from Willand STW that WASP believes were in breach of permit

THAMES WATER

Thames Water was the focus of Part 1 of WASP's review of unpermitted spills at STWs. There the focus was on STWs that were fitted with an FFT meter to enable "early" spill detection. Here, the scope is broadened to include STWs with no FFT meter but an effluent meter as well as the detection of "dry"spills.

Bentley

PE

TOTAL SPILLS	
dry	early
34	159

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO		SSO		SSO		SSO	
			NDA		344		1,666		*600*	
Unpermitted spills	dry	early	dry	early	dry	early	dry	early*	dry	early
					0	12	20	85	14	62

* effluent rate hardly ever reaching more than 50% of the storm overflow rate

Bentley STW was brought to WASP's attention by a river conservationist with a particular interest in aquatic insects who witnessed a spill during a period of "dry" weather in the summer of 2020. It has proven to be one of Thames Water's worst illegal spillers and since it does not have a storm tank for temporary holding of excess flow to settle solids before spilling, it is likely to be one of the worst polluters. Bentley STW discharges into the River Wey, a chalk stream in Hampshire.

WASP estimates that **Bentley STW made illegal discharges of untreated sewage into the River Wey on more than 147 days between 2018 and 2020**. A summary of illegal discharges at Bentley STW was presented in person to the Thames Water CEO, Sarah Bentley, on July 9th 2021.

According to its EA discharge permit (see *Table S1.1 Activities* below), Bentley STW first discharges untreated sewage directly into the River Wey (North) and only when that rate of discharge is above 20 litres/sec does it divert further excess to a "land treatment area" which itself appears to drain to the River Wey. The "land treatment area" is essentially scrubland to the right of the works in the Google Earth figures below (**Fig**. 1).

Table S1.1 Activities		
Activity reference	**Description of activity**	**Limits of specified activity**
A1	Discharge of secondary treated sewage effluent via Outlet 1	N/A
A2	Discharge of storm sewage via Outlet 1	N/A
A3	Groundwater activity: discharge into land of storm sewage	Via an infiltration system (land treatment area) at NGR SU 7900 4367. The discharge shall only occur when the rate of flow of storm sewage to the River Wey, Activity A2 on this permit, exceeds 20 litres per second due to rainfall and/or snow melt.

Fig 1: Google Earth images of Bentley STW on June 23rd 2018 and April 15th 2020

In July 2021, Thames Water published an updated *Groundwater Infiltration System Management Plan*[27] in which they admit that groundwater infiltration is a major cause of problems at Bentley STW and described plans to address this and other issues:

> *In conclusion, we believe it is likely that groundwater infiltration in the Bentley catchment is the most probable cause of incidences where the sewage treatment works has not been able to cope with all incoming flows, triggering spills to the storm tanks in periods of dry weather. On occasions, in sustained wet periods, the storm treatment area has become overloaded and spill to river has occurred on both wet and dry days.* Thames Water

In response to a follow up query by WASP, Thames Water offered a response on 8th October 2021 that had not been volunteered previously:

> *We would also note that the MCERTS flowmeter, whilst accurate and recording the effluent being discharged via the outfall pipe, does not represent the entirety of flows either being passed to full treatment or ultimately discharged to the environment. This is due to the outfall pipe being partially blocked, causing localised site flooding.*
>
> **Thames Water**

Unfortunately, there appears to be no way to verify this statement. The "early" spilling that WASP believes it has detected at Bentley STW appears to be present from 2018 onwards. Surely, a partially blocked outfall pipe spilling onto gorund within the STW would have been noticed in a 4 year period of such chaotic flow data.

2021

The EDM spill data provided in response to an EIR suggests that Bentley STW had already spilled for over 600 hours by 9th August 2021. During spills, the final effluent (FE) rate was frequently below 50% of the storm overflow rate. Examples are shown in **Fig**. 1.

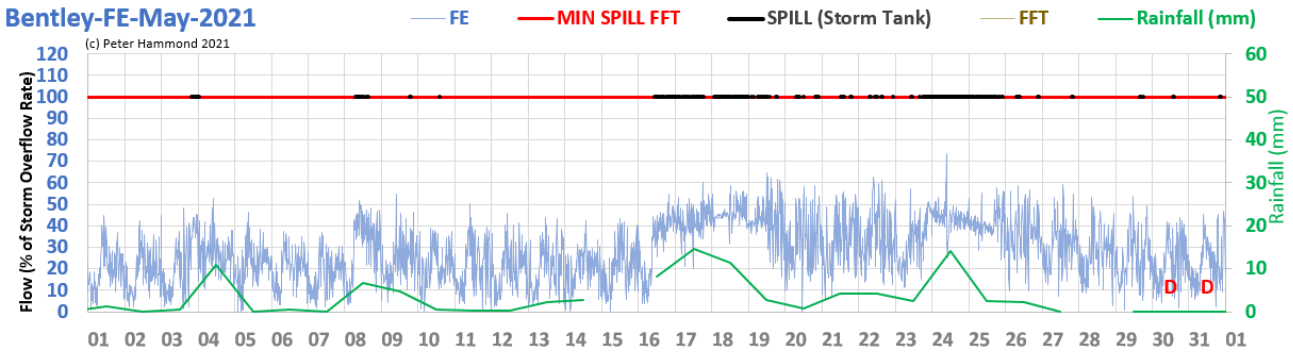


Figure 1: Multiple spills in May 2021 with the effluent rate frequently below 50% of the storm overflow rate

2020

WASP believes Bentley STW discharged untreated sewage for 146 days of which 49 (34%) involved at most 2 mms of rainfall.

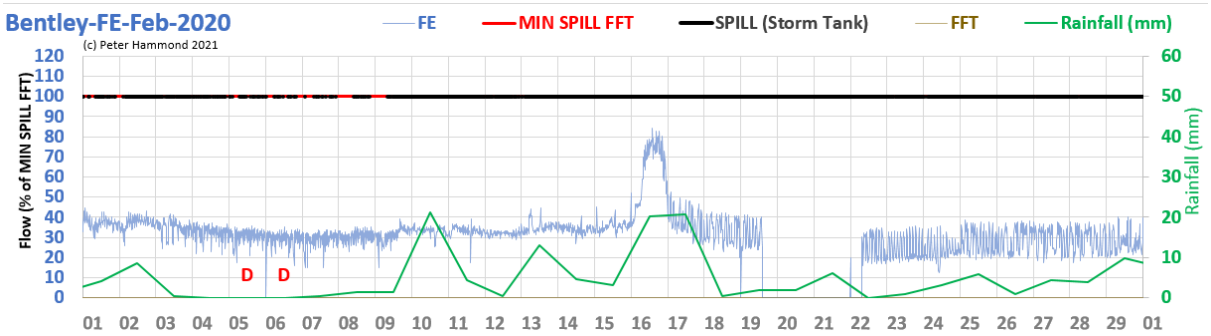


Figure 2: Bentley STW spilled every day in Feb 2020 with "early" spills on most days and double breaches on some

[27] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-reports/groundwater-infiltration-management-plans/bentley-groundwater-infiltration-management-plan.pdf

2019

According to EDM spill data provided to WASP, Bentley STW spilled for 41 days of which, WASP believes, at least 12 involved "early" spills . Fig. 3 demonstrates examples spilling untreated sewage when the treated effluent rate was below the permissible rate.

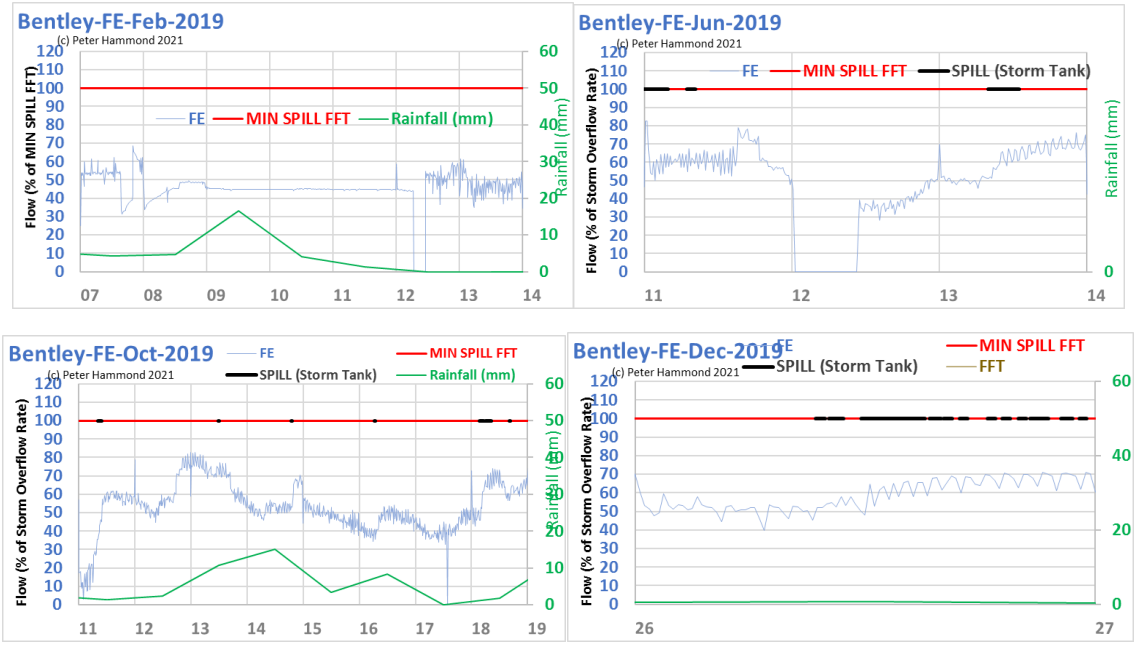


Figure 3: WASP believes there were "early" spills in Februrary (8-12); June (11,13); October (11,14,16,18); Dec 26

2018

Thames Water made no spill return in 2018 as no EDM device was in place. Nevertheless, throughout the year WASP believes that Bentley STW spilled for long periods. Fig. 4 illustrates a significant loss of flow data in November 2018 as well as **consecutive days of likely "early" spilling** in December 2018.

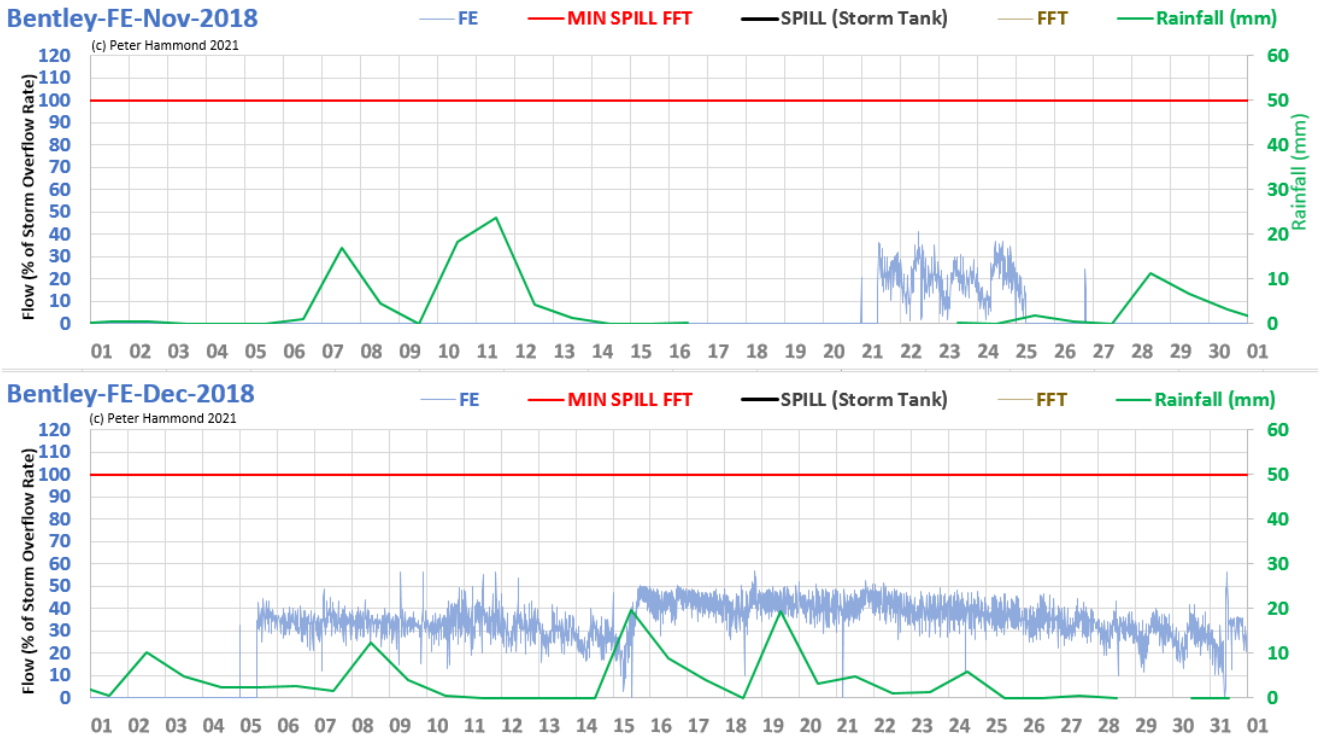


Figure 4: WASP believes Bentley STW has lost flow in Nov and spilled "early" in December, even on rainless days

Bledington

PE	600
TOTAL SPILLS	
dry	early
14	2

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO		SSO		SSO		SSO	
			NDA		1,642		1,536		*860*	
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
					5	2	6		3	

SSO=Settled Storm Overflow PE=Population Equivalent

Bledington STW serves a small population equivalent of 600 and discharges into the Bledington Brook which subsequently joins the River Evenlode.

2021

By mid-October 2021, Bledington STW had spilled over 50 days of which, WASP believes, 3 involved "dry" spills (**Fig**. 1)

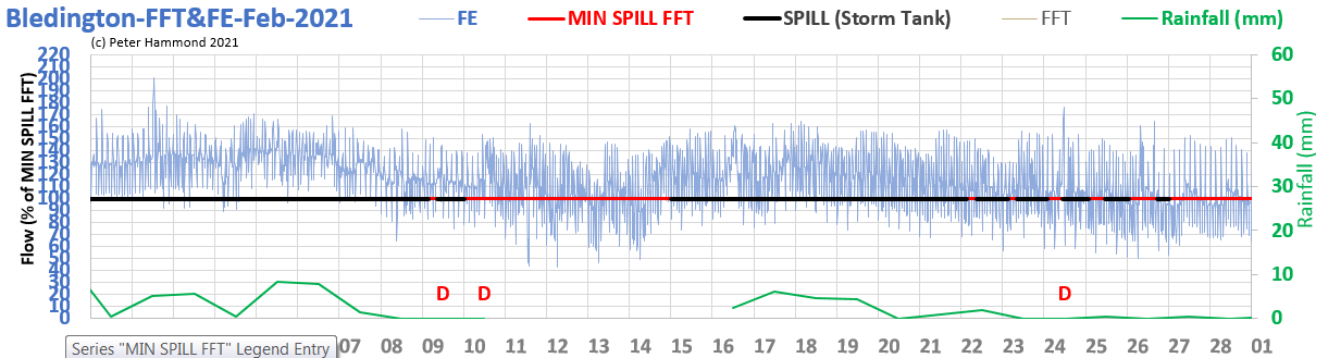


Figure 1: WASP believes there were 3 "dry" spills at Bledington STW in Feb 2021

2020

In 2020, Bledington STW spilled on 92 days of which WASP believes 6 included "dry" spills (examples in **Fig**. 2).

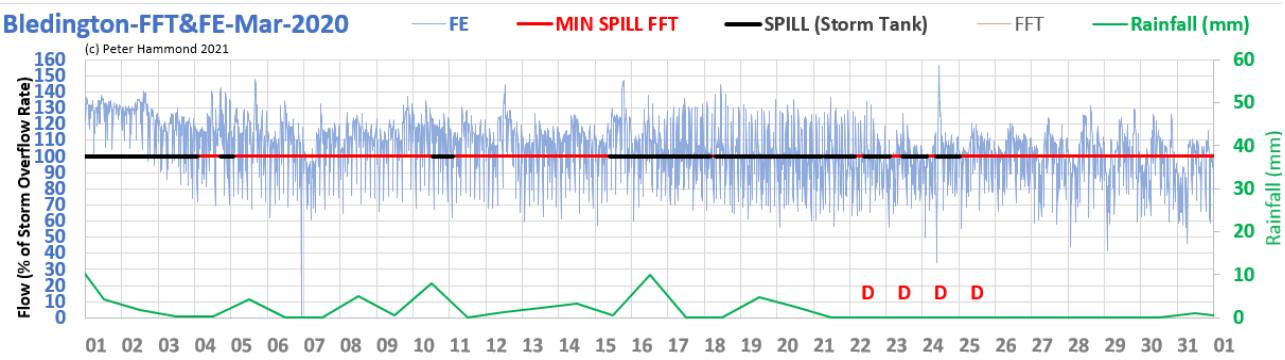


Figure 2: WASP believes there were 4 "dry" spills at Bledington STW in March 2020

2019

Bledington STW spilled for 1,642 hours over 91 days in 2019. Two days involved "early" spills and 5 days involved "dry" spills (examples in **Fig**. 3). As many as 16 spilling days involved at most 1 mm of rain on the day and day after.

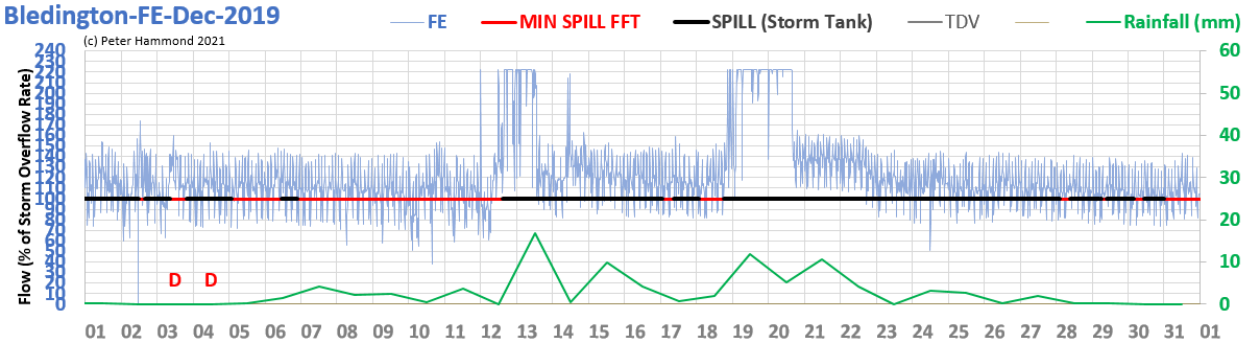


Figure 3: WASP believes there were 2 "dry" spills in December 2019 at Bledington STW

Chesham

PE	34,601
TOTAL SPILLS	
dry	early
46	0

Spilling hours	2017		2018		2019		2020		2021	
	SSO		SSO		SSO		SSO		SSO	
	NDA		186		3		963		1,808	
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	NDA	NDA	NDA	NDA	NDA	NDA	18		28	

SSO=Settled Storm Overflow PE=Population Equivalent

Chesham STW discharges to the River Chess, a chalk stream that rises in Chesham in Buckinghamshire. It experiences low flows due to abstraction as well as significant sewage and agricultural pollution[28]. Chesham STW has been functioning close to, or at, full capacity for the past 12 years. Thames Water has admitted that groundwater infiltration is a major issue with Chesham STW. The tables below show the number of spills for different limits of rainfall on the day of the spill and the day before. For example, in 2021, by October, there had been 112 spilling days of which, WASP believes, 28 were "dry" (no rainfall on the day or day before) and 48 involved at most 1 mm of rainfall on the day and day before. In 2020, the corresponding figures were 18 "dry" spills and 26 involving at most 1 mm of rainfall.

Chesham dry spill 2020	Rain on day of spill (mm) 0	1	2	3	4	
Rain on day of spill (mm) 0	18					
1		26				
2			32			
3				34		
4					35	
Total spilling days						59

Chesham dry spills 2021	Rain on day of spill (mm) 0	1	2	3	4	
Rain on day of spill (mm) 0	28					
1		48				
2			53			
3				57		
4					61	
Total spilling days						112

2021

Figure 1 gives an overview of the 112 spilling days for 2021 at Chesham STW.

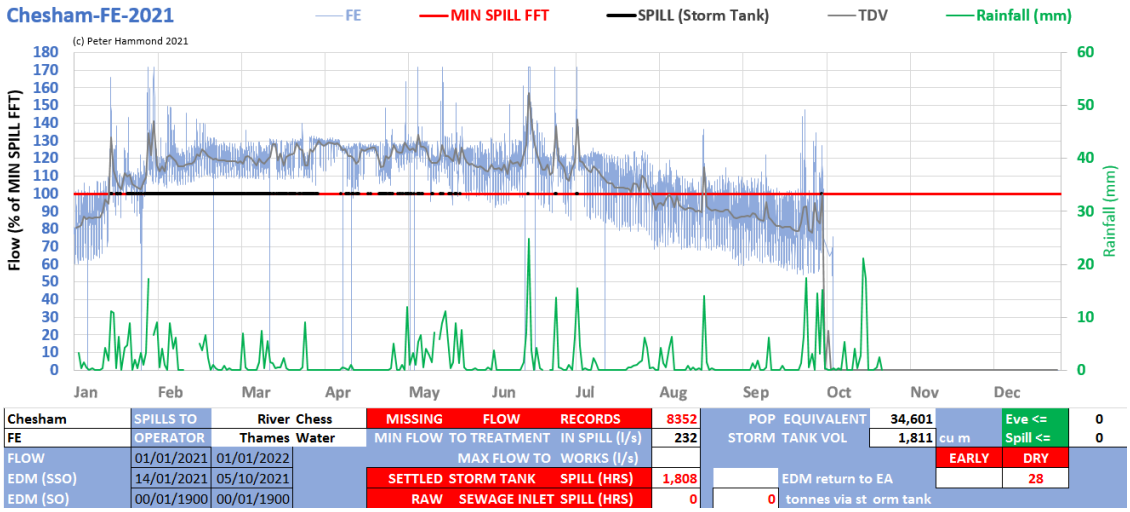


Figure 1: overview of rainfall, flow and spill data for 2021 at Chesham STW

Chesham STW does not spill "early" but makes a large number of "dry" spills as is illustrated by the 13 illegal "dry" spills WASP believes occurred in March 2021 (**Fig**. 2).

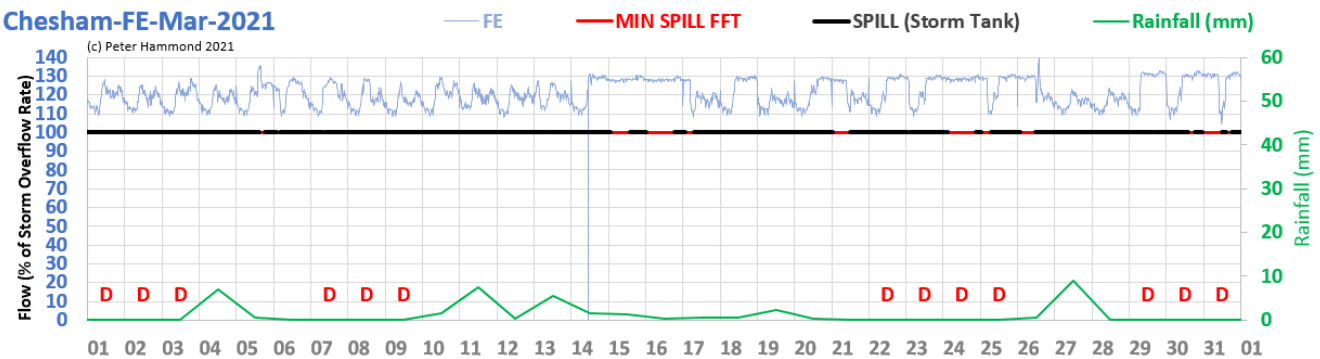


Figure 2: 13 illegal "dry" spills in March 2021 at Chesham STW

[28] https://www.riverchessassociation.co.uk/

2020

Figure 3 gives an overview of the 59 spilling days for 2020 at Chesham STW.

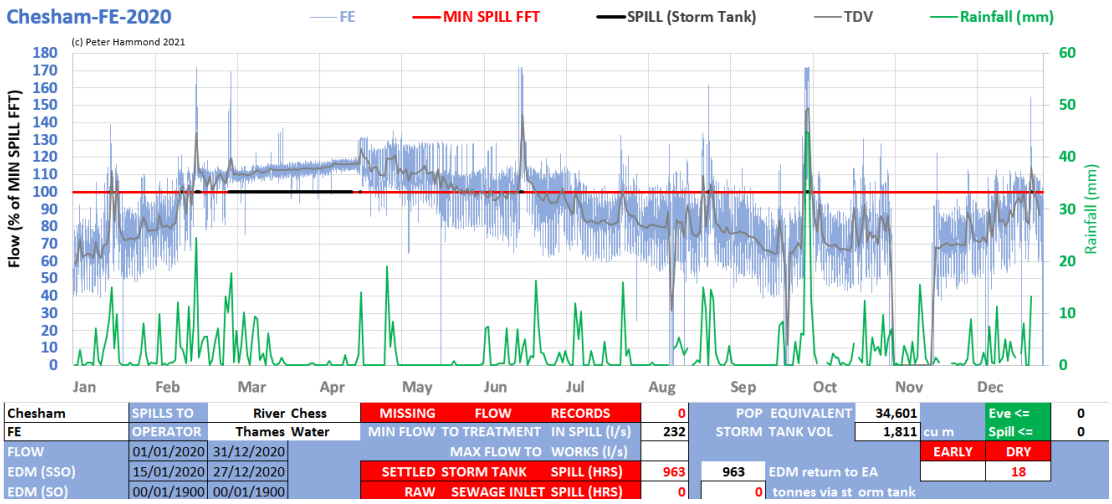


Figure 3: overview of rainfall, flow and spill data for 2020 at Chesham STW

There appears to be a significant hiatus in the flow data in November 2020 (**Fig**. 4) that is also reflected in the total daily volume (TDV) returned to the EA. Such "zero" flows often herald an equipment failure so this event would need to be investigated further by requesting telemetry alarm data for the period in question.

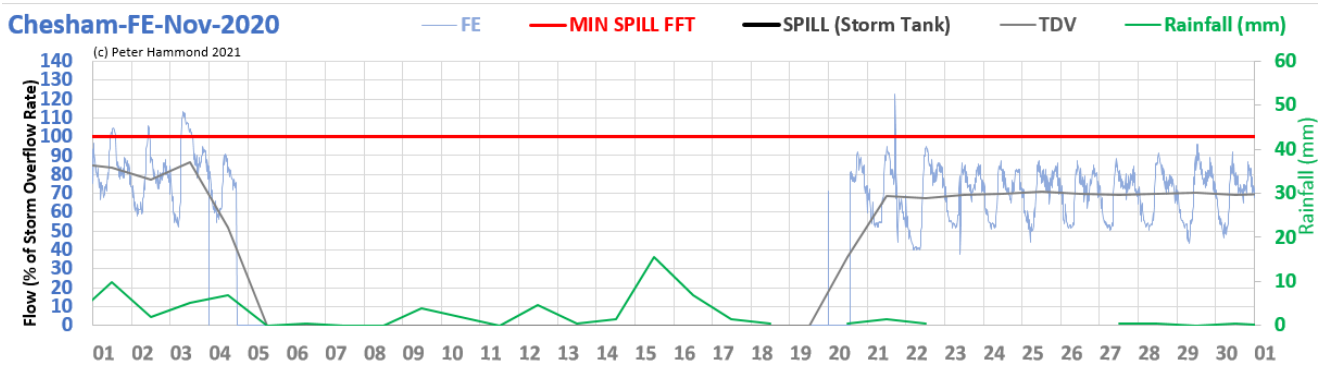


Figure 4: 15 day flow data hiatus in November 2020

The gap corresponds to an unaccounted 209,630 tonnes or 210 million litres or 84 Olympic swimming pools.

2019

For 2019, Thames Water's EDM return to the EA was just 3 hours of spilling at Chesham STW. This is certainly consistent with the overview chart (**Fig**. 5). WASP does not have the 2019 EDM data for Chesham STW.

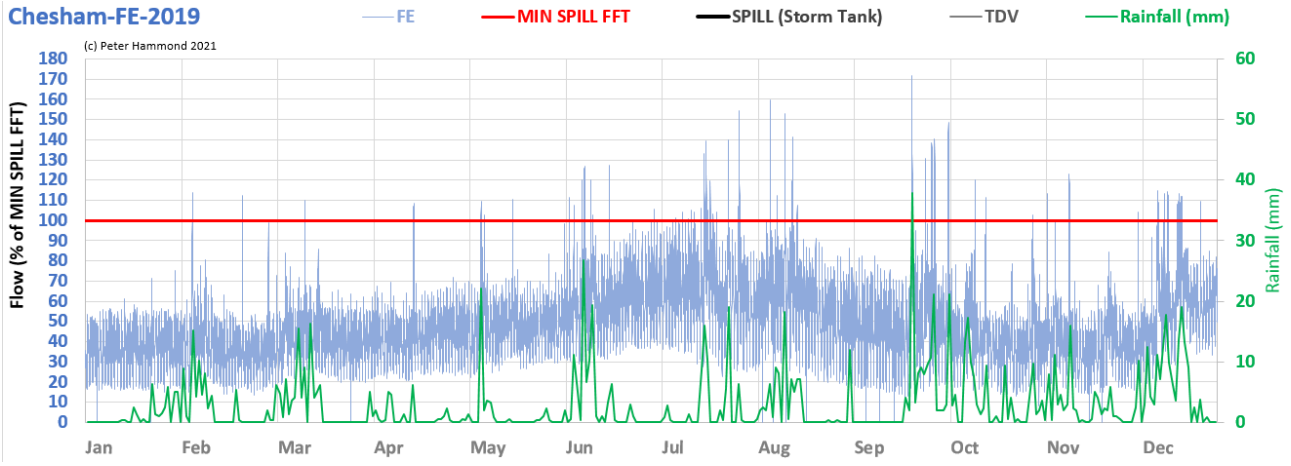


Figure 5: overview of rainfall, flow and spill data for 2019 at Chesham STW

Chinnor STW

PE	7,090
TOTAL SPILLS	
dry	early
0	38

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO		SSO		SSO		SSO	
	NDA		NDA		478		601		*342*	
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	NDA	NDA	NDA	NDA		20		15		3

SSO=Settled Storm Overflow PE=Population Equivalent

Chinnor STW was brought to WASP's attention by a member of the River Thames Conservation Trust. Chinnor STW discharges to the Henton Stream which joins the Kingsey Cuttle Brook and thereafter the River Thame. The Environment Agency has classified overall biological quality elements of the Kingsey Cuttle Brook and linked tributaries as poor for the past 8 years (**Table** 1).

Classification Item	2013	2014	2015	2016	2019
Ecological	Moderate	Poor	Poor	Poor	Poor
Biological quality elements		Poor	Poor	Poor	Poor
Fish		Moderate	Moderate	Moderate	Poor
Invertebrates		Poor	Poor	Poor	Poor
Macrophytes and Phytobenthos Combined		Good		Moderate	Moderate

Table 1: Ecological classification of Kingsey Cuttle Brook and tributaries at Thame Water Body (March 2021)[29]

A recent groundwater impacted system management plan for Chinnor included the following comment:

> *In recent years the foul sewerage system in the Chinnor catchment has become overwhelmed, following prolonged and heavy rainfall and raised groundwater levels.* Thames Water[30], March 2021

More specifically, on 23/02/2021, Thames Water admitted there had been a problem at Chinnor STW in 2019:

> *In late November 2019, the site was passing forward flow of 47l/s (its permitted FTFT) before using the onsite storm tanks. In December 2019, we discovered an issue with pump efficiency and at times have only been passing 42l/s. After a great deal on investigation on site at Chinnor. We have found that the pump invertors were not reaching required output, this has since been resolved and the pump and invertor are now working correctly.*

2019

Figure 2 shows a fairly constant level of final effluent at 90% of the storm overflow rate from mid-November to mid-December. WASP believes the reduction in FFT mentioned in Thames Water's email occurred for the last 8 days of December which should be counted as involving "early" spills.

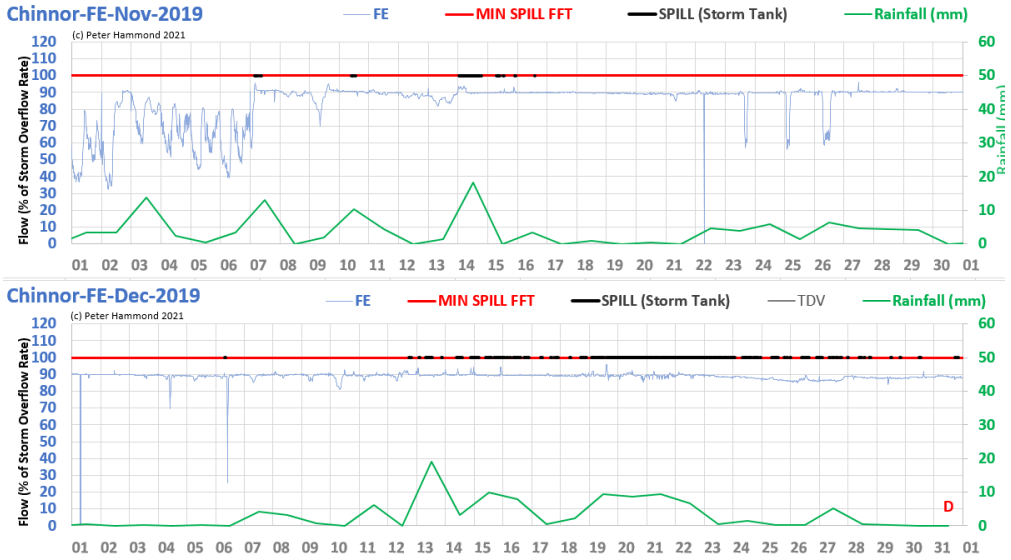


Figure 1: flow and spill data confirming the Thames Water account of issues in November/December 2019

[29] https://environment.data.gov.uk/catchment-planning/WaterBody/GB106039030200?cycle=2

[30] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-reports/groundwater-infiltration-management-plans/chinnor-groundwater-impacted-system-management-plan.pdf

WASP also believes that a similar issue occurred during intermittent spilling on 12 consecutive "early" spilling days between February 4th and February 16th 2019 (**Fig**. 2).

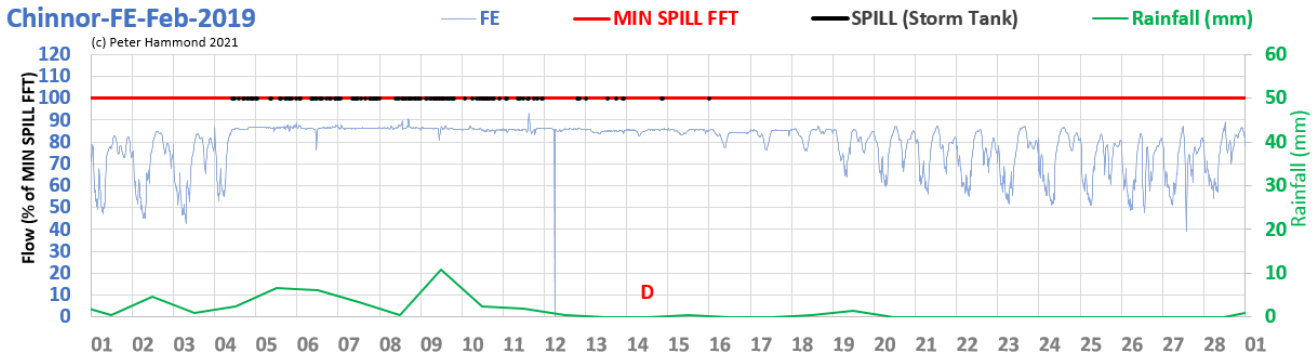


Figure 2: WASP believes the flow and spill data above suggest the Dec 2019 problem also occurred in Feb 2019

2020

The flow and EDM data shown in the two charts in Figure 3 (now with inlet pumping station flow – brown curve) suggest the December 2019 issue of "early" spilling continued until February 6th which is consistent with the email from Thames Water on February 23rd admitting the problem and confirming it had been fixed. WASP believes an additional 15 "early" spilling days occurred during this time.

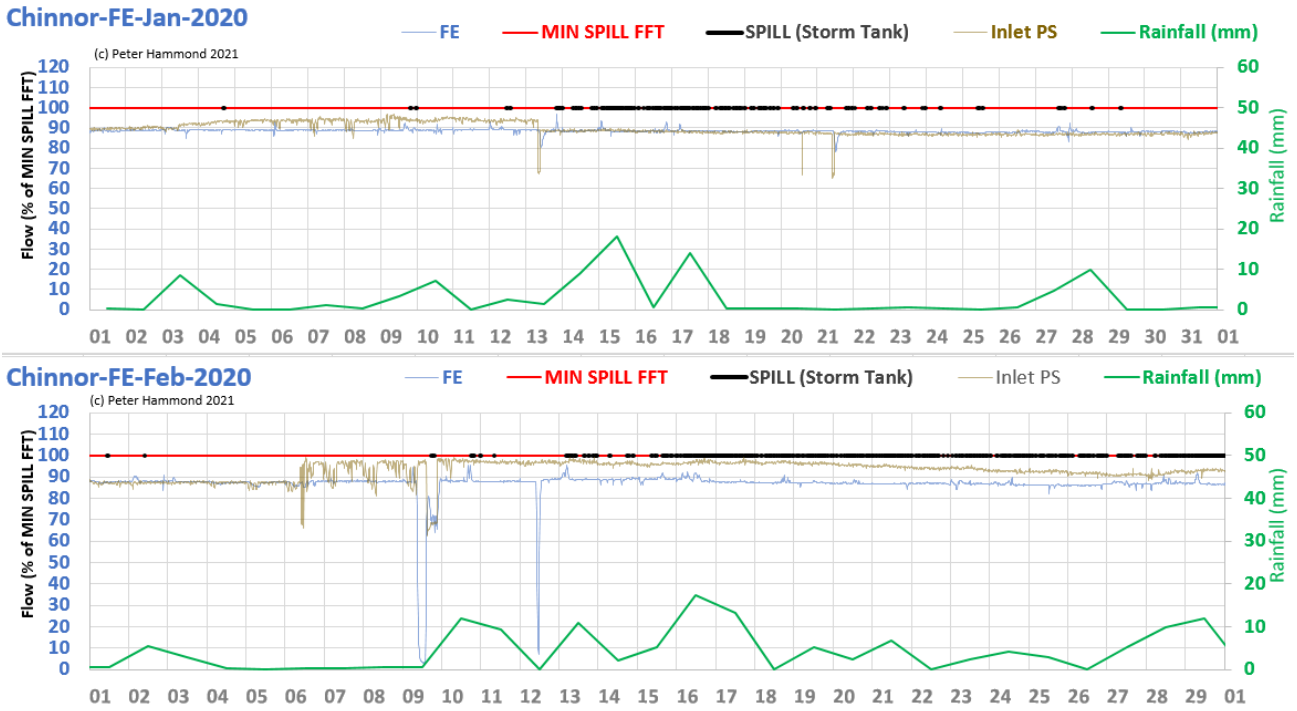


Figure 3: WASP believes there was a continuation of the Dec 2019 problem into 2020, ending in early Feb

Apart from some considerable inconsistencies in May 2020 (**Fig**. 4), the final effluent and inlet pumping station flows are remarkably in harmony (**Fig**. 5).

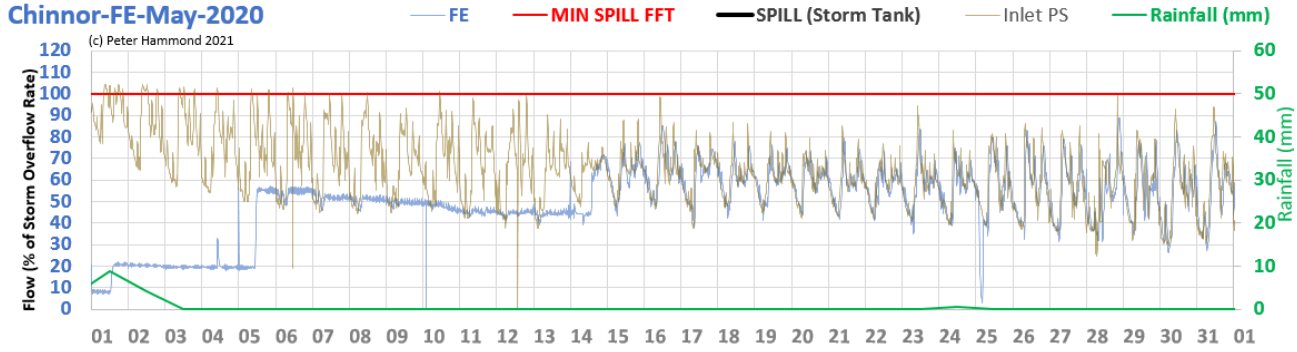


Figure 4: strange disharmony of inlet flow from pumping station and final effluent until close harmony post 14th Feb

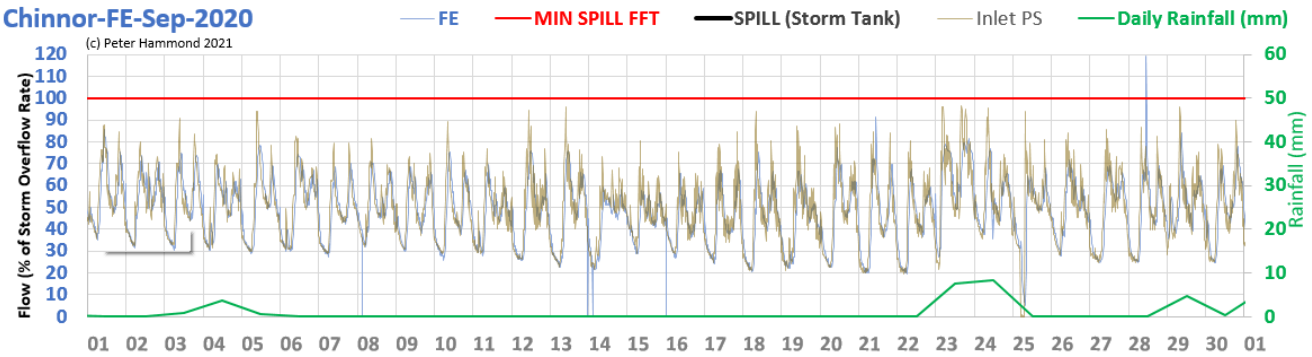


Figure 5: close harmony of inlet pumping station and final effluent flow in September 2020 onwards

2021

In just the first two months of 2021, Chinnor STW had spilled for more than 350 hours on 37 spilling days of which, WASP believes, 3 included “early” spills.

Church Hanborough

PE 8,926

TOTAL SPILLS	
dry	early
10	15

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO		SSO		SSO		SSO	
	NDA		NDA		478		899		*773*	
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	NDA	NDA		12	8	3	NDA	NDA	2	

SSO=Settled Storm Overflow PE=Population Equivalent

Church Hanborough STW discharges to the Hanborough Stream, a tributary of the River Evenlode in West Oxfordshire. WASP can now reveal that Church Hanborough is WWTP1 in the study[31] where machine learning algorithms were trained to detect historic spills of untreated sewage using flow and spill data already confirmed by EDM detection. The other STW in the study, referred to as WWTP2, is Witney STW which is also included in this review. The study used flow and EDM data from April 2018 to March 2020. None of the machine learning identified spills are included in this review.

The "early" spilling in 2018 and 2019 identified at Church Hanborough STW was reported to the OFWAT CEO and Head of Compliance in November 2019 and to the Environment Agency shortly before.

2021

By the end of May 2021, Church Hanborough STW had already spilled for 773 hours over 44 spilling days. Updated flow data has yet to be requested from Church Hanborough. But the EDM spill and rainfall data suggest there were two "dry" spills in February 2021 (**Fig**. 1).

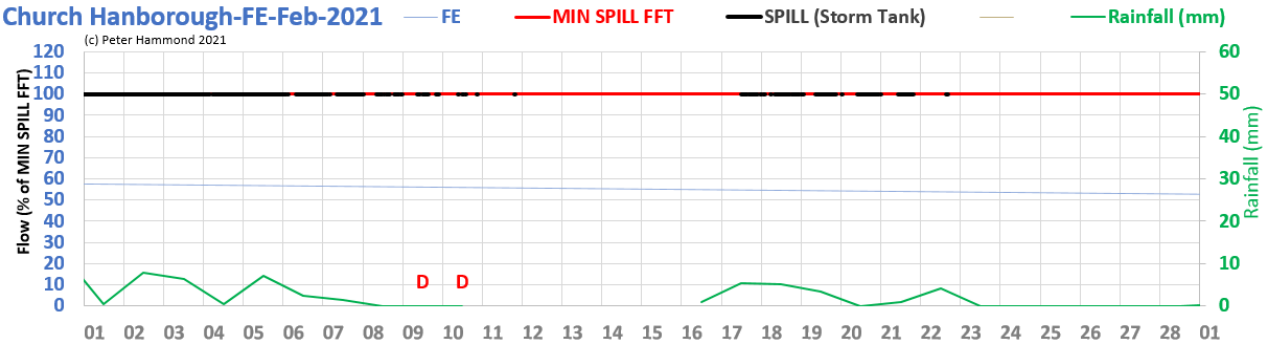


Figure 1: WASP believes there were 2 "dry" spills in February 2021

2020

In 2020, Church Hanborough spilled for 899 hours over 77 days. Since the reporting of "early" spills in 2019, Thames Water made changes at Church Hanborough in order to improve its performance. Unfortunately, these do not seem to have had a sustained impact in 2020 as can be seen by the anomalous flow between March and August (**Fig**. 2). During that gap it is impossible to check spill compliance.

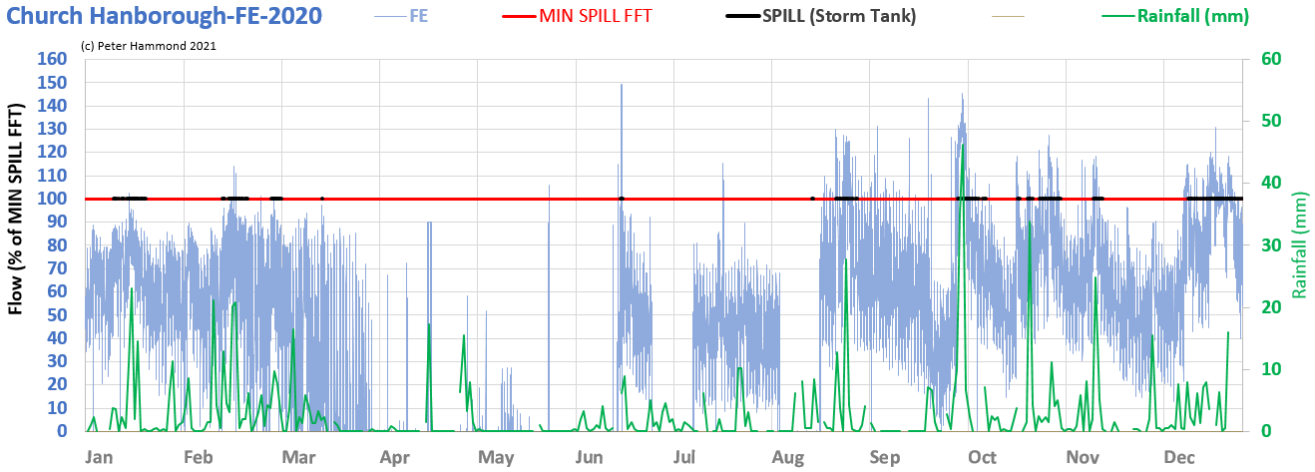


Figure 2: flow anomalies at Church Hanborough STW between March and August 2020

[31] Detection of untreated sewage discharges to watercourses using machine learning P Hammond et al NPJ Clean Water 4 (1), 1-10, 2021

2019

Church Hanborough STW spilled for 1,183 hours over 77 spilling days of which, WASP believes, 8 involved "dry" spills and 3 "early spills (examples in **Fig**. 3).

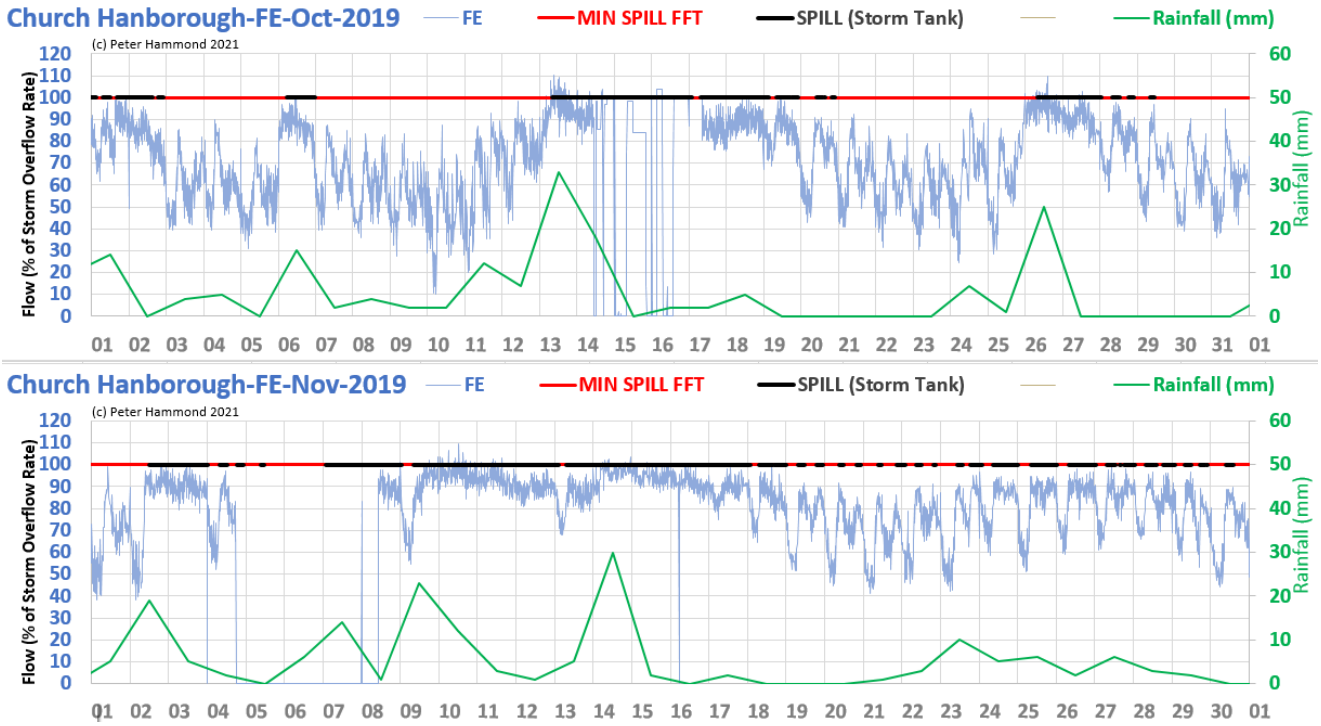


Figure 3: WASP believes there were 5 "dry" and at least 3 "early" spills (14th-17th) in November 2019

2018

An EDM device was installed at Church Hanborough in December 2018 (**Fig**. 4) and detected **12 "early" spilling days** where the final effluent flow (FE) was between 40%-70% during spilling.

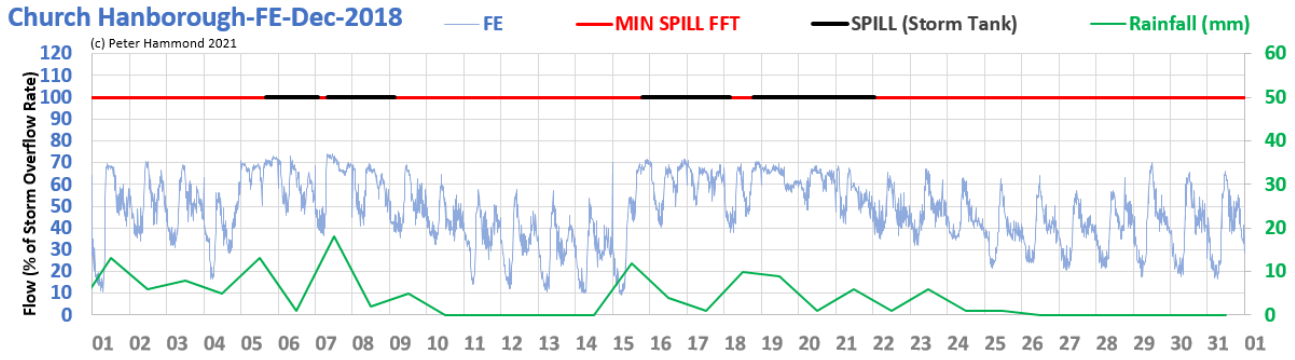


Figure 4: "early" spilling days in December 2018 at Church Hanborough STW detected by EDM (6th,7th,8th,16th-21st)

Dorking

PE	28,905
TOTAL SPILLS	
dry	early
8	215

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO		SSO		SSO		SSO	
	NDA		NDA		1,118		2,102		*532*	
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	NDA	NDA		22		63		116	8	14

SSO=Settled Storm Overflow PE=Population Equivalent

Dorking STW discharges into the River Mole via a settled storm overflow (SSO) located about halfway along the section from Horley to Hersham. The physico-chemical status of this stretch of the River Mole has deteriorated significantly in recent years (**Table** 1)[32].

Classification Item	2013	2014	2015	2016	2019
Physico-chemical quality elements	Moderate	Moderate	Moderate	Moderate	Moderate
Acid Neutralising Capacity			High	High	High
Ammonia (Phys-Chem)	High	High	Good	Good	Poor
Biochemical Oxygen Demand (BOD)	Good	Good	Moderate	Poor	
Dissolved oxygen	High	High	High	High	Good
Phosphate	Poor	Poor	Poor	Poor	Poor

Table 1: EA classification of the physico-chemical state of the River Mole (Hurley to Horsham)

WASP was so surprised by the total of 223 spilling days during the period of the review, estimates were made of illegal spills from 2009 to 2016 i.e., from the start of operator-self monitoring. An additional 280 or so spilling days were identified but detailed analysis of them has been omitted from this report and may be included in the next one.

2021

By mid-October 2021, Dorking STW had spilled on 59 days of which, WASP believes, **8 were "dry" and 14 were "early"** (examples in **Fig**. 1).

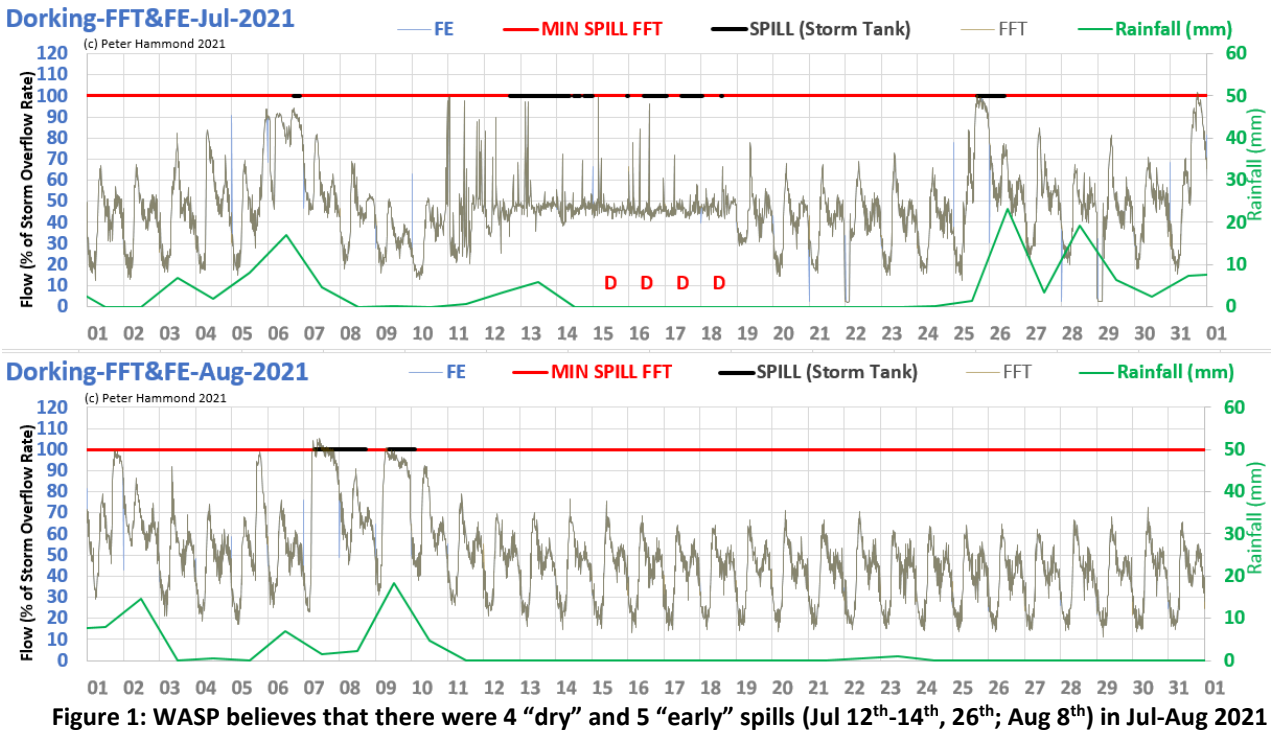


Figure 1: WASP believes that there were 4 "dry" and 5 "early" spills (Jul 12th-14th, 26th; Aug 8th) in Jul-Aug 2021

[32] https://environment.data.gov.uk/catchment-planning/WaterBody/GB106039017621

2020

Each of the EDM detected spills in 2020 declared by Thames Water to the EA was "early" (**Fig**. 2). Even the spills in December 2020 which were close to being compliant had some period of flow to full treatment below the 92% threshold (the storm overflow rate less the 8% meter error allowance).

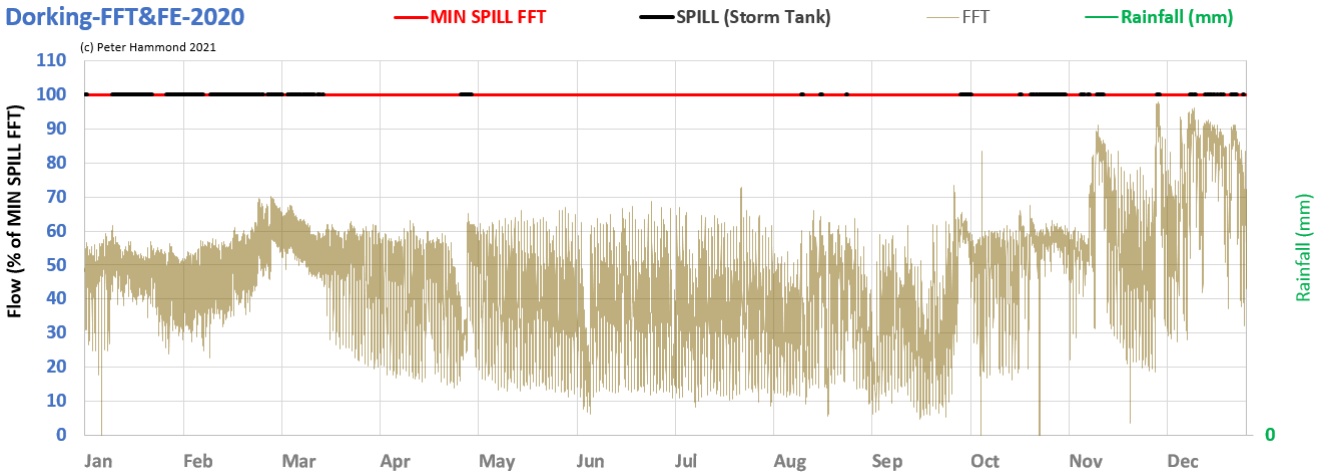


Figure 2: annual overview chart for 2020 for Dorking STW – WASP believes all 116 spills were "early"

2019

As with 2020, WASP believes all spills in 2019 were "early" (**Fig**. 3) – some 63 in all.

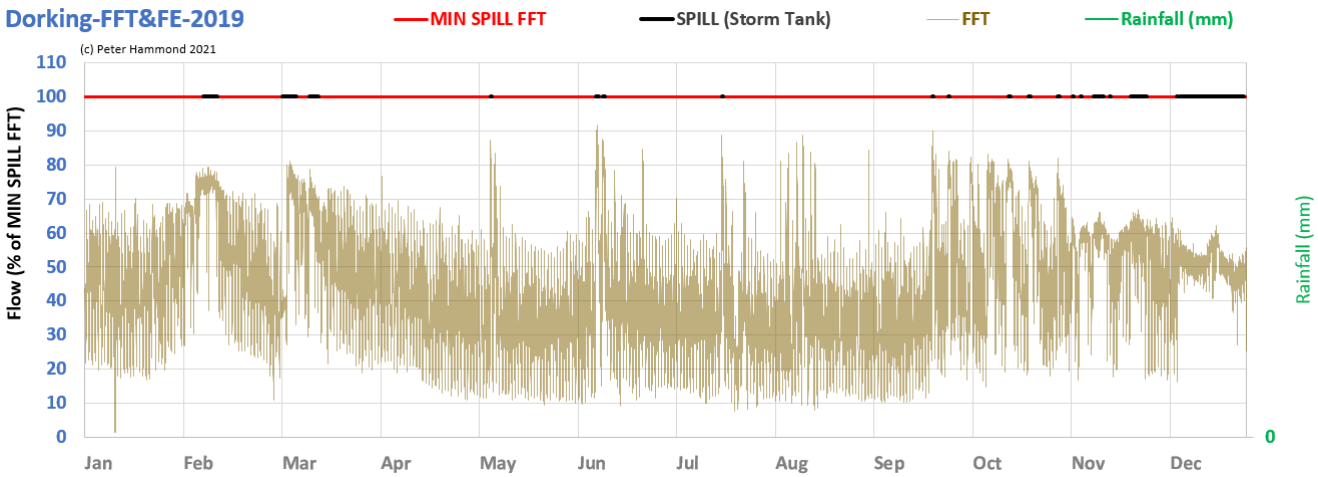


Figure 3: annual overview chart for 20190 for Dorking STW – WASP believes all 63 spilling days involved "early" spills

East Shefford

PE	5,432
TOTAL SPILLS	
dry	early
65	14

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO		SSO		SSO		SSO	
	NDA		NDA				2,753		1,424	
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	NDA	NDA	NDA	NDA			47		18	14

East Shefford STW is located to the north east of Newbury in Berkshire. It serves a population equivalent of 5,432 with a current loading of about 90% of its full capacity[33]. East Shefford STW's discharge outlet is to the River Lambourn, a chalk stream with a moderate to high set of ecological ratings by the EA[34] (**Table** 1).

Classification Item	2013	2014	2015	2016	2019
Ecological	Moderate	Moderate	Moderate	Moderate	Moderate
Biological quality elements	Moderate	Moderate	Moderate	Moderate	Moderate
Fish	Moderate	Good	Moderate	Moderate	Moderate
Invertebrates	High	High	High	High	High
Macrophytes and Phytobenthos Combined	Moderate	Moderate	Moderate	Moderate	Moderate
Physico-chemical quality elements	Good	High	Good	Good	High
Ammonia (Phys-Chem)	High	High	High	High	High
Dissolved oxygen	High	High	Good	Good	High
Phosphate	Good	High	Good	Good	High

Table 1: EA ecological ratings of the River Lambourn (from source to Newbury)

Although this report is focussing on post 2017 flow and spill data (the earliest EDM devices were fitted), having access to earlier years occasionally brings some interesting data to light. For example, there was clearly a series of illegal "early" spills on 17 consecutive days in April 2009 (**Fig**. 1).

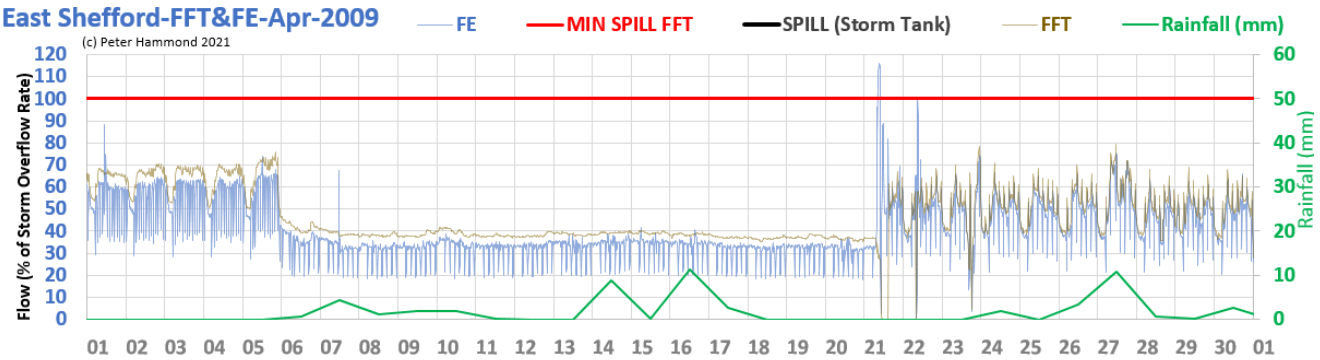


Figure 1: a series of "early" spilling days in January 2009 at East Shefford STW

A more troubling pattern occurs at the beginning of 2015 when there are very regular losses of both flow to treatment and final effluent – often ending at 02:45 am precisely for ten days on the run (**Fig**. 2). The extract is an expansion of a ten day or so period, but it happens for four months (see **Fig**. 2 all of January). Is this loss of flow an accidental data issue or a planned actual spilling of untreated sewage? Four months seems a long time to have a technical issue that is not attended to.

[33] https://uwwtd.eu/United-Kingdom/treatment-plant/ukenthtwutp000059/history

[34] https://environment.data.gov.uk/catchment-planning/WaterBody/GB106039023220?cycle=2

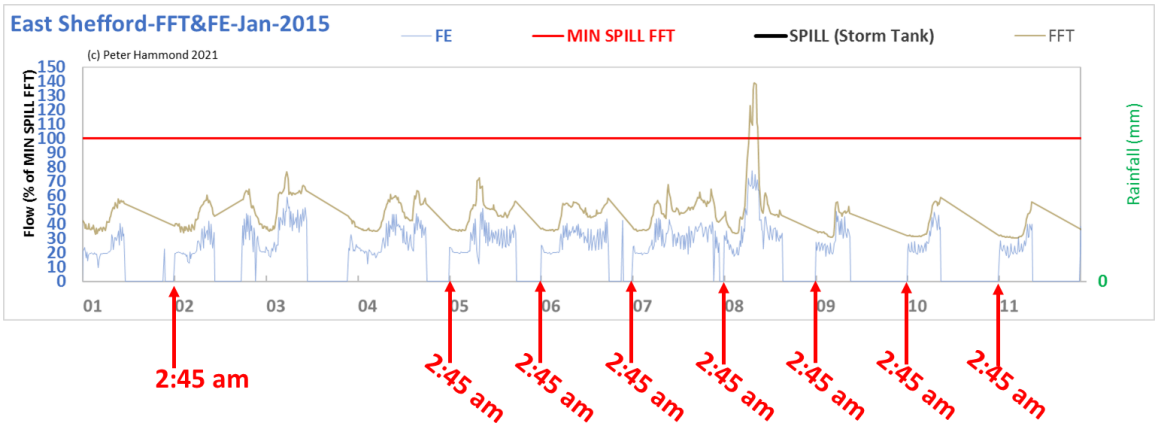


Figure 2: 10 day period in Jan'15 when there is a daily loss of both flow series picking up again at 02:45 am every day

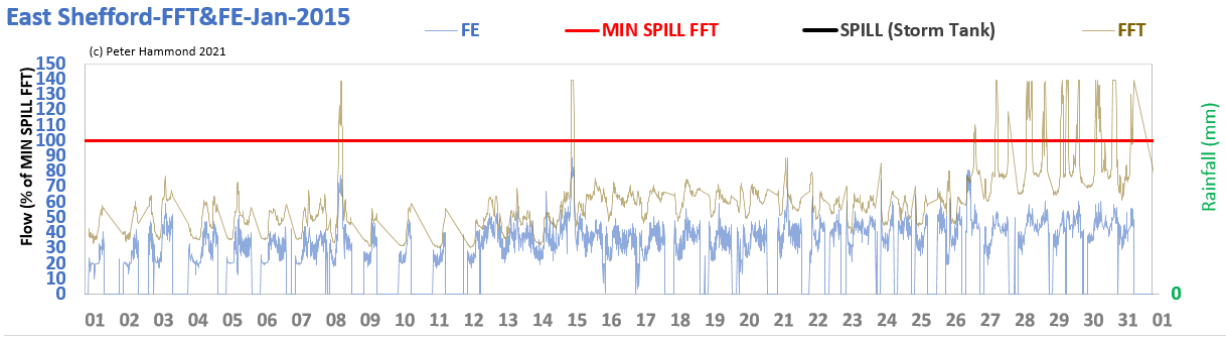


Figure 3: daily loss of both flows in similar repeating pattern from Fig. 1 over four months: accidental or planned?

2021

The spill data provided in response to an EIR suggest East Shefford STW spilled for 1,424 hours by mid-October 2021. During those 66 spilling days, WASP believes they included **18 "dry" and 14 "early"**. See **Fig**, 4 for 12 "dry" spilling days and at least 9 "early" spilling days.

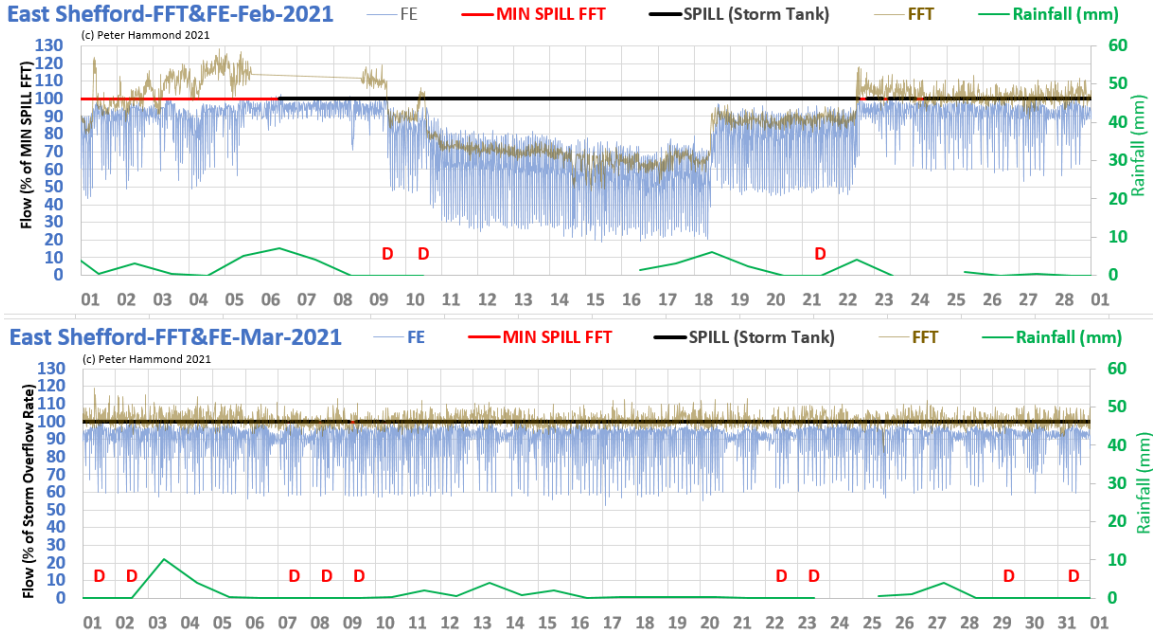


Figure 4: 12 "dry" spills and 9 "early" spills (Feb 10th-18th)

2020

For 2020, Thames Water returned a total of 2,753 spilling hours over 122 spilling days of which, WASP believes, 47 involved "dry" spills with no rain on the day of the spill or day before (**Fig**. 5, for examples).

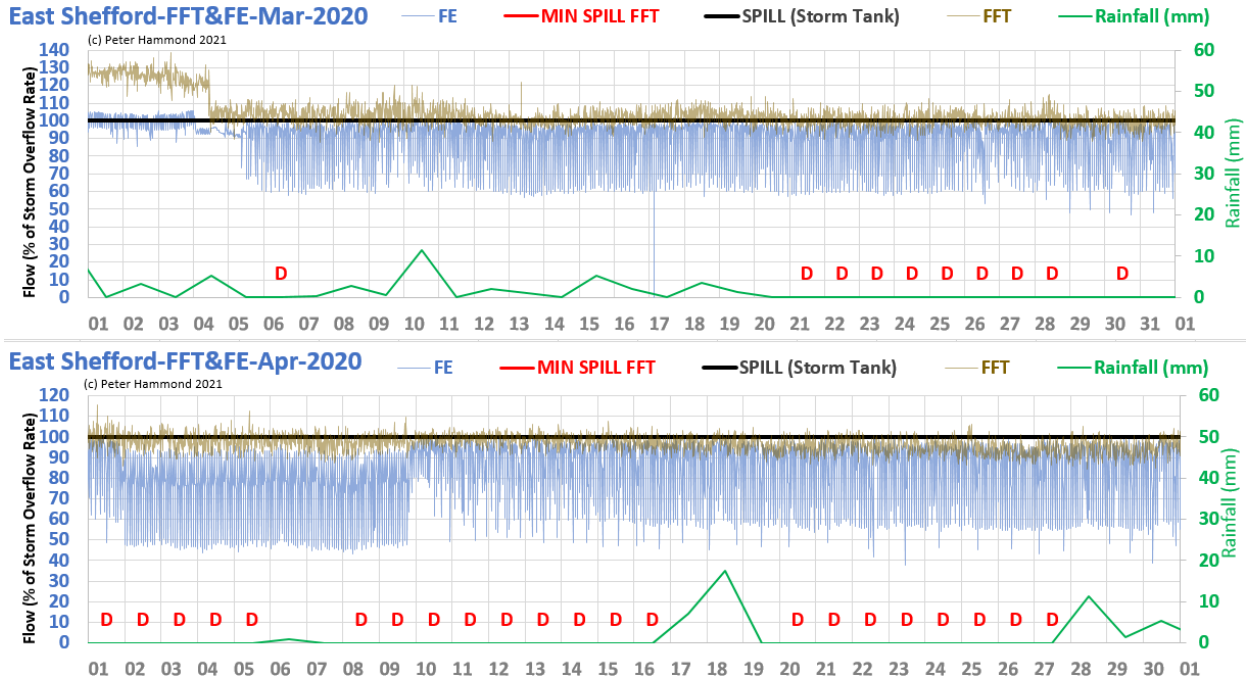


Figure 5: 32 days in March/April 2020 involving "dry" spills

2017-2019

The two datafiles for 2017 and 2018, supposedly with flow to treatment data, were entirely full of zero entries.

The effluent flow data for 2017 has many anomalies of losses of flow, sudden dramatic increases and decreases and potential "early" spills. These suggest that East Shefford needs closer scrutiny when WASP has more data.

Maple Lodge

PE	506,028
TOTAL SPILLS	
dry	early
0	24

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO		SSO		SSO		SSO	
	NDA		NDA		*247*		1,110		NDA	
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	NDA	NDA	NDA	NDA	0	7	0	17	NDA	NDA

Maple Lodge STW serves a large population of over half a million and has been close to or at its full loading for the past 10 years. It discharges to the Grand Union Canal close to where it interacts with the River Colne. As long ago as 1993, a study by the National Rivers Authority[35] concluded that Maple Lodge STW was having a detrimental effect on the fauna found downstream of the works:

> *Canals are slow flowing and do not have the re-aerating riffle sections found in most rivers ... Any effluent discharged into a canal will not be transported away very quickly due to the flow regime. This means that the effluent will become concentrated and the effects on the macroinvertebrates more pronounced.*
>
> National Rivers Authority, 1993

In early March 2013, a pumping station failure at Maple Lodge STW caused severe sewage pollution in the vicinity of the works[36]. The flow data for the first three months of 2013 reveals chaotic management of sewage treatment with extended periods of missing flow data – several permit breaches in their own right.

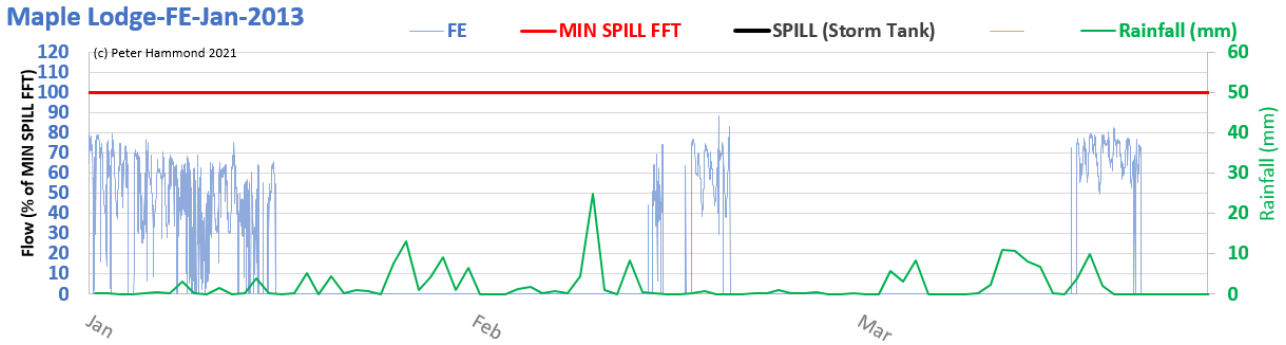


Figure 1: chaotic flow management at Maple Lodge STW in Jan-Mar 2013 including incident in 1st week of March

It is inevitable to wonder if the pollution incident that was witnessed and reported might have not been the only polluting discharge in the first 3 months of 2013. Compare **Fig**. 1 with **Fig**. 2 which shows a more typical diurnal pattern at Maple Lodge STW during relatively dry weather in the first half of July 2019. Who knows what happened at Maple Lodge in 2013?

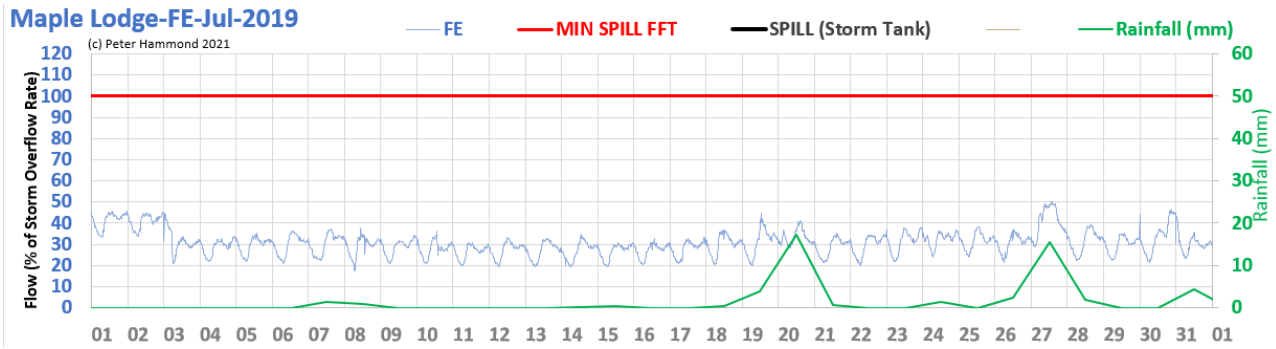


Figure 2: typical diurnal flow treatment management at Maple Lodge in a dry period of 2019

2019

In 2019, Thames Water did not submit spill data to the EA. However, WASP was provided by Thames Water with spill start/stop times equivalent to 247 hours of spilling in the last 3 months of the year. WASP believes these included 7 days involving "early" spills. A number of "early" spilling days are shown in **Fig**. 3.

[35] http://ea-lit.freshwaterlife.org/archive/ealit:3599/OBJ/20001612.pdf

[36] https://www.watfordobserver.co.uk/news/10296532.thames-water-issues-apology-after-maple-lodge-sewage-leak/

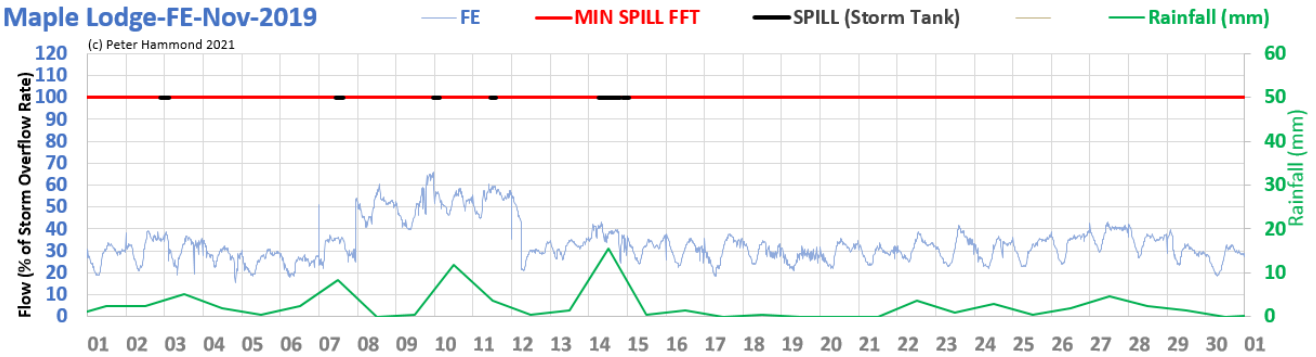


Figure 3: WASP believes several "early" spills occurred at Maple Lodge STW in November 2019

2020

The spills at the end of 2020 occur when the final effluent rate looks quite reasonable at just above 80% of the storm overflow rate, allowing for something like a 10 % difference from flow to full treatment and an 8% meter error allowed by the EA (**Fig**. 4)

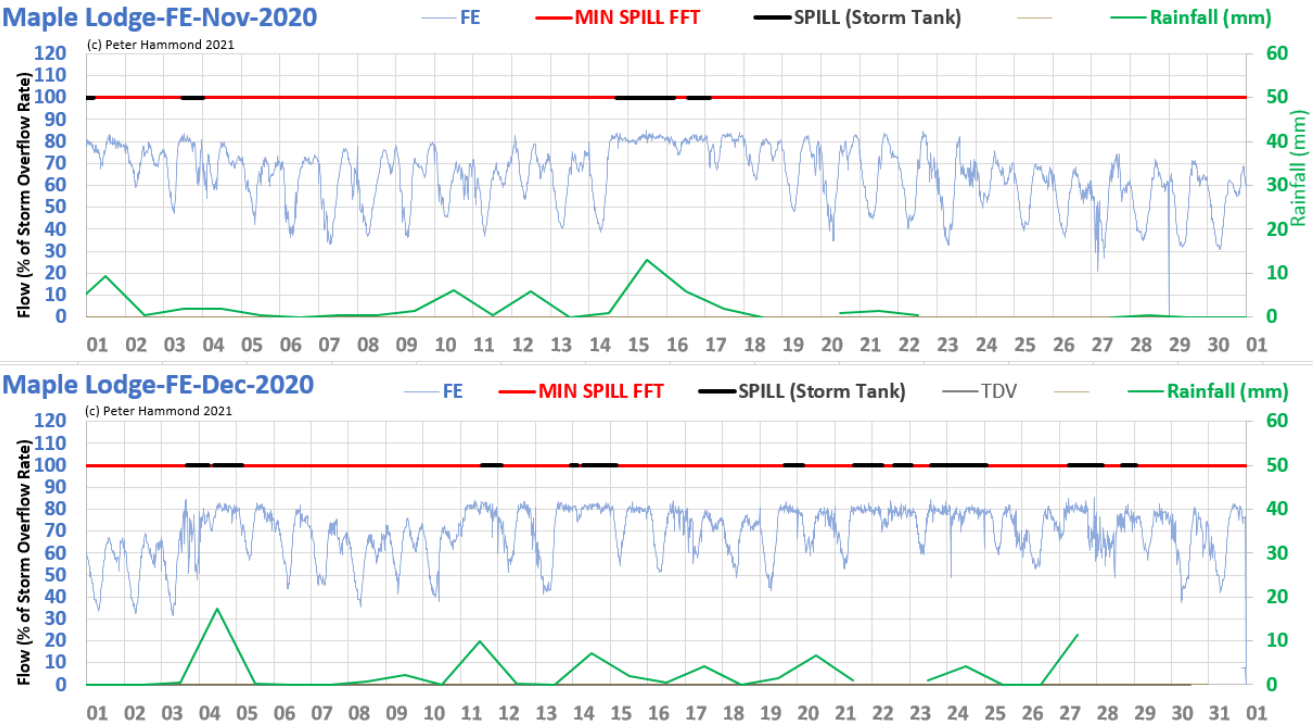


Figure 4: 20 compliant spilling days in 2020 when the effluent rate is just above 80% of the storm overflow rate

Earlier in the year, the management of the flow looks very suspicious and anomalous. For example, in January 2020 the flow pattern is regularly flattened outside EDM detected spills (6th-11th) and during the identified spills the effluent rate is less than 50% of the storm overflow rate (17th-18th). It is even as low as 30%.

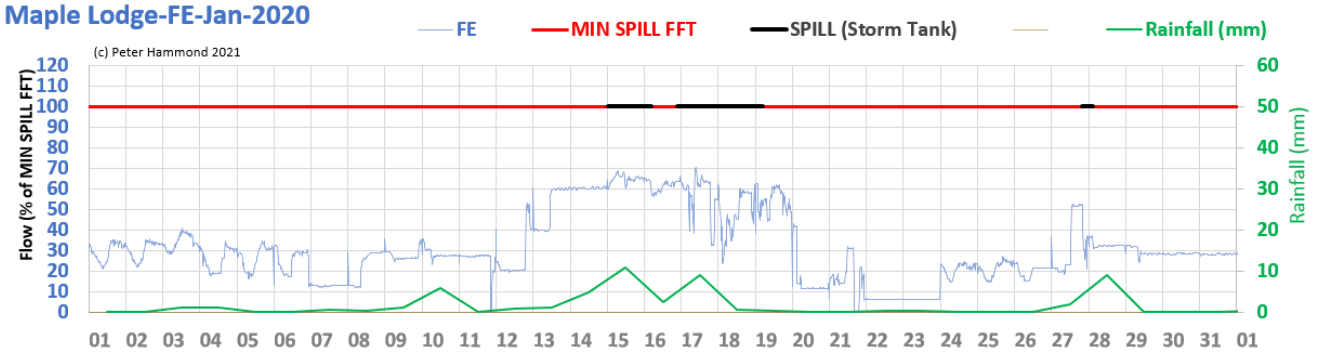


Figure 5: anomalous flows and EDM detected spills when the final effluent trat is 30%-50% of the storm overflow rate

February 2020 is just as bad, maybe even worse with very low effluent flows occurring during EDM detected spills (**Fig**. 6).

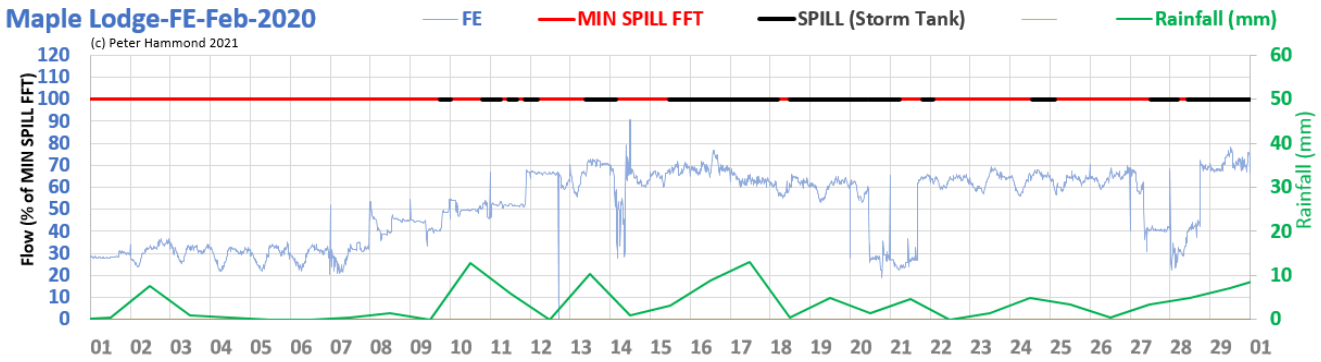


Figure 6: more examples of low effluent flows during EDM detected spills at Maple Lodge STW (9th, 20th, 21st,27th, 28th)

WASP believes there were 17 “early” spilling days in 2020.

Marlborough

PE	10,213
TOTAL SPILLS	
dry	early
67	

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO		SSO	EIR	SSO		SSO	
	NDA		NDA		988	*654*	2,872		406	
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	NDA	NDA	NDA	NDA	18		44		5	

Marlborough STW serves a population of about 10,000 and discharges to the River Kennet, a celebrated chalk stream in the North Wessex Downs. It has functioned at about 90% of capacity for the past 10 years[37].

Groundwater infiltration through leaking joints and cracks in sewerage pipes significantly increases sewage flows in the Marlborough area, as is acknowledged in Thames Water's most recent GISMP report for Marlborough[38]:

> *In recent years the foul sewerage system in the Marlborough catchment has become overwhelmed in some locations for weeks and even months, following prolonged heavy rainfall. This has resulted in some properties suffering from sewer flooding and restricted toilet use. We believe that the system has surcharged predominantly due to a combination of groundwater infiltration into both public and private foul drainage networks, groundwater run-off, surface water inundation from highways, public spaces and properties, surface water misconnections (i.e. downpipes from roofs), and river water overflowing from the Rivers Kennet and Og.*

2021

In 2021, Marlborough STW's 406 spilling hours were confined to 41 spilling days from late Jan to mid-March. WASP believes that there were 5 "dry" spilling days (**Fig**. 1) without rainfall on the day or day before but 17 spilling days involved up to 1 mm of rainfall on the day or day before.

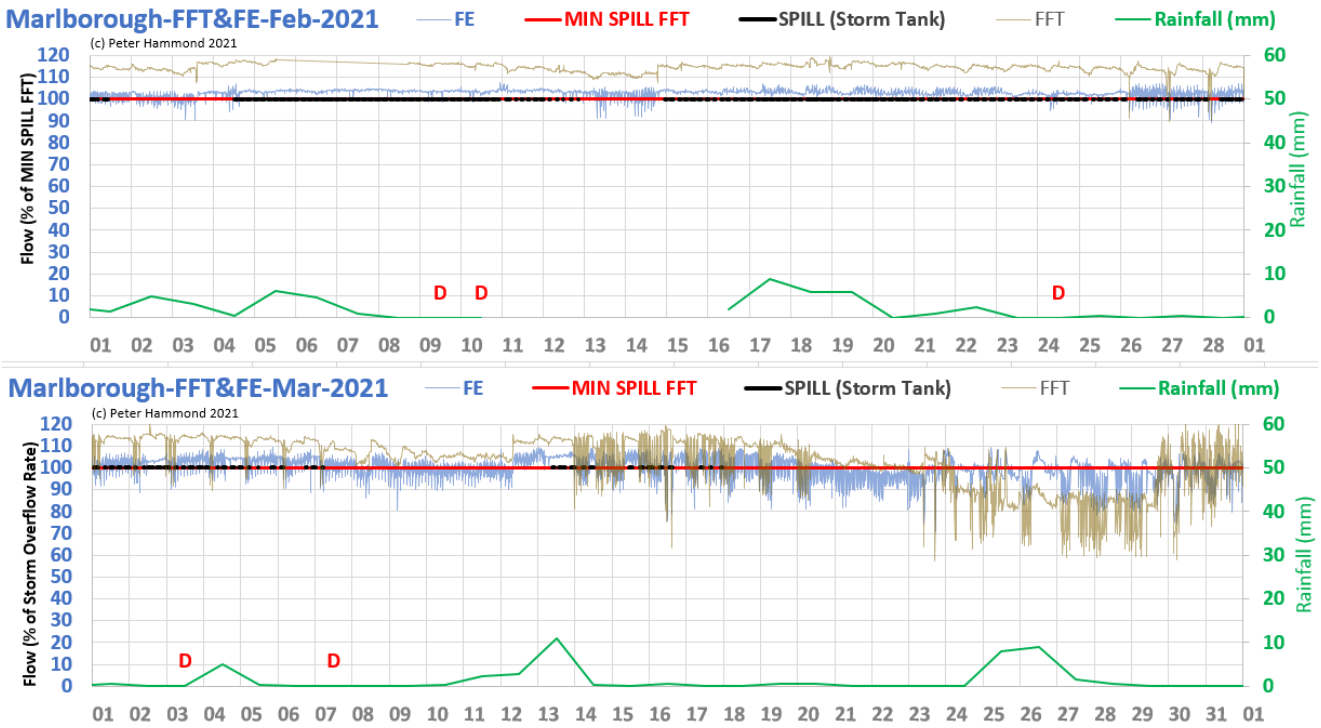


Figure 1: WASP believes there were 5 "early" spilling days in Feb-Mar 2021

2020

The spilling hours in 2020 were especially high at 2,872 when Marlborough STW spilled every day for the first 4 months of the year at an average of almost 23 hours per day.

[37] https://uwwtd.eu/United-Kingdom/treatment-plant/ukenthtwutp000108/history

[38] https://www.thameswater.co.uk/media-library/home/about-us/regulation/drainage-reports/groundwater-infiltration-management-plans/marlborough-groundwater-infiltration-management-plan.pdf

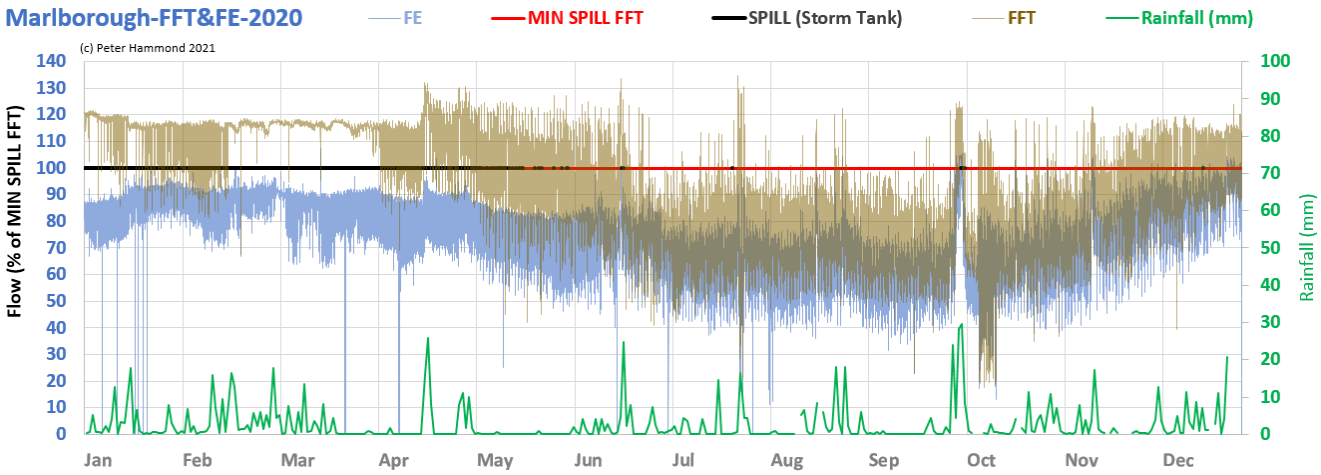


Figure 1: overview for 2020 at Marborough STW showing over 4 months of almost continuous spilling

WASP believes that **44 of the 150 spilling days in 2020 involved "dry" spills** with no rainfall on the day or day before and as many as 73 involved at most 1 mm of rainfall on the day and day before. Figure 2 shows 27 "dry" spilling days in March and April alone.

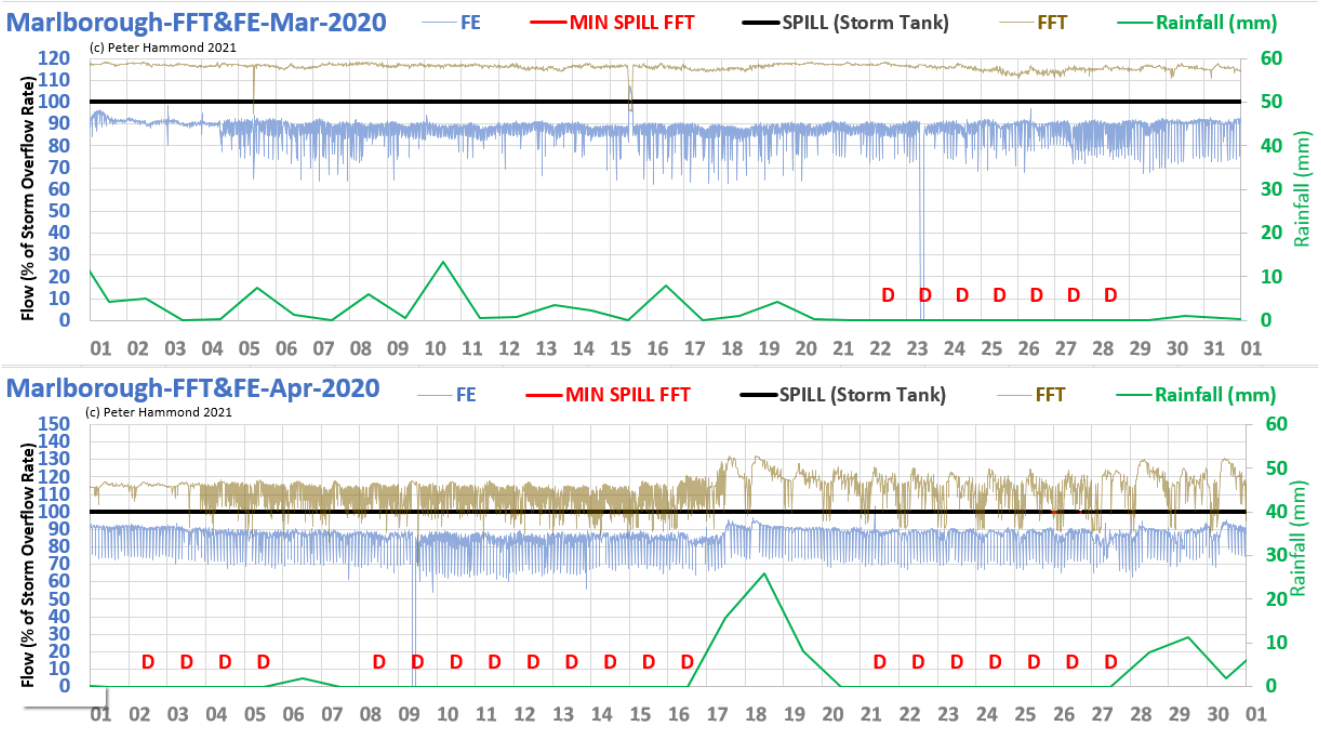


Figure 2: WASP believes March and April 2020 involved 27 "dry" spilling days

2019

Although Thames Water returned 988 spilling hoursat Marlborough STW for 2019 to the EA, the EIR response to WASP was for only 654 hours. So, some spills have been declared to the EA but not to WASP.

The overview chart for 2019 (**Fig**. 3) demonstrates the importance of the spilling season and the error the EA has made in restricting spill reporting to the calendar year. In the last two months of 2019, there were 51 spilling days averaging 11 hours per day. Add this to the front of 2020 and you have six months of almost continuous spilling on almost every day.

The 334 spilling hours not declared to WASP may have occurred during the massive 52 day hiatus (Fig. 3) in the flow data from July 1st to August 22nd when there were two significant rainfall events.

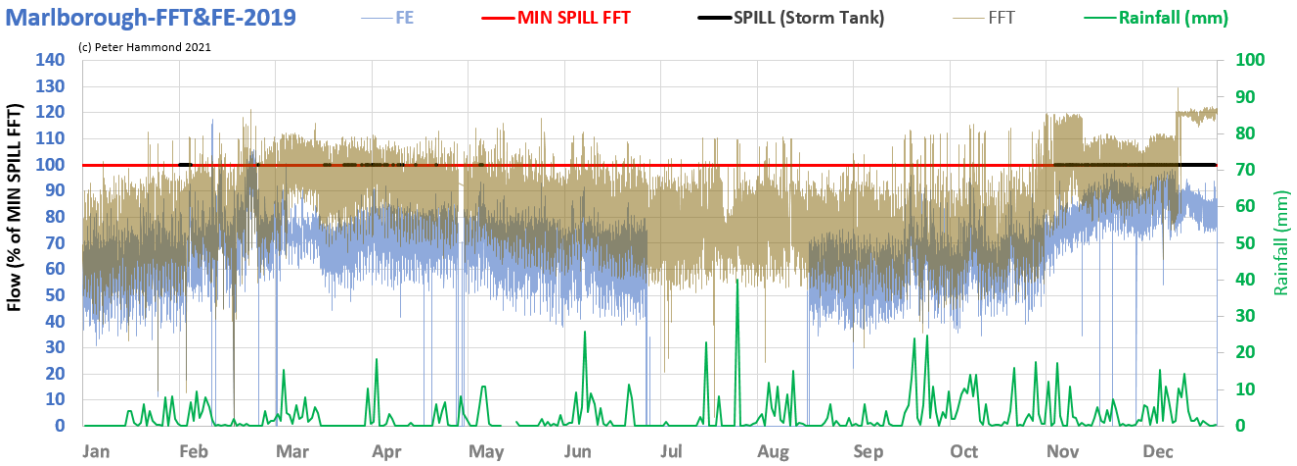


Figure 3: overview chart of flow and spill data for 2020 for Marlborough STW

WASP believes there were 18 "dry" spilling days in 2019 with 11 occurring in Feb/Mar 2019 (**Fig**. 4).

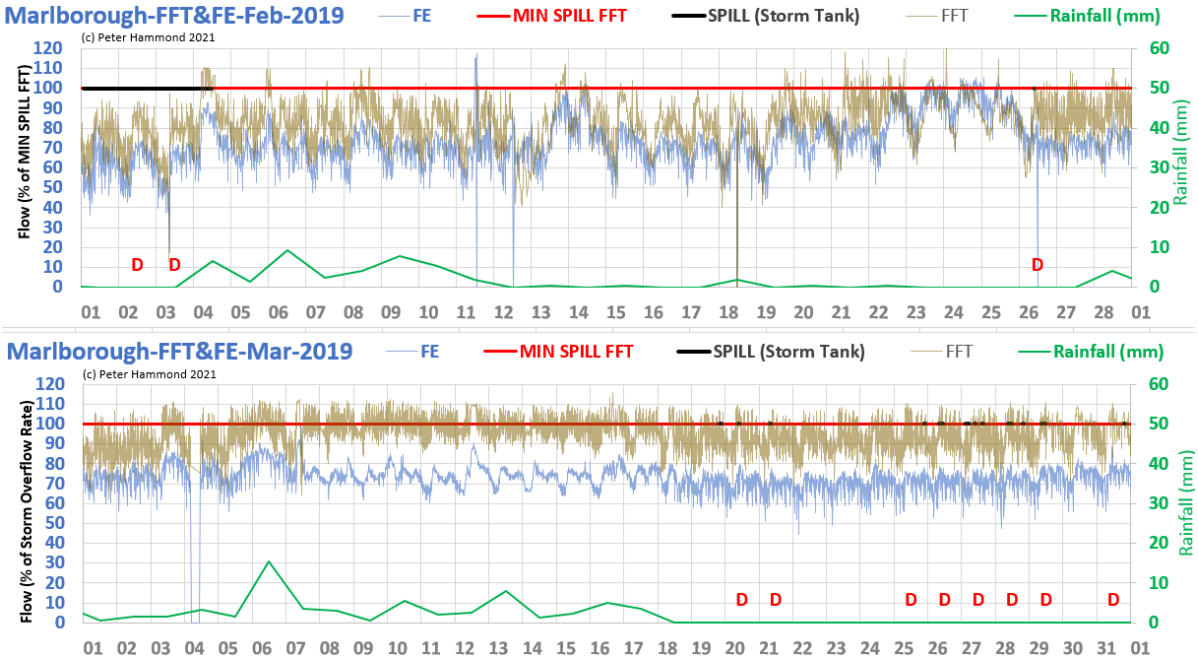


Figure 4: WASP believes there were 11 "dry" spilling days in Feb and Mar 2019

2018

In 2018, the EDM monitor was only in place at Marlborough STW for a short time (7.3%) and so the return to the EA was for 0 hours. Without EDM detected spill data it is difficult to comment on the treatment performance. However, the overview chart for 2018 clearly shows another large gap in flow to treatment and effluent data (**Fig**. 5).

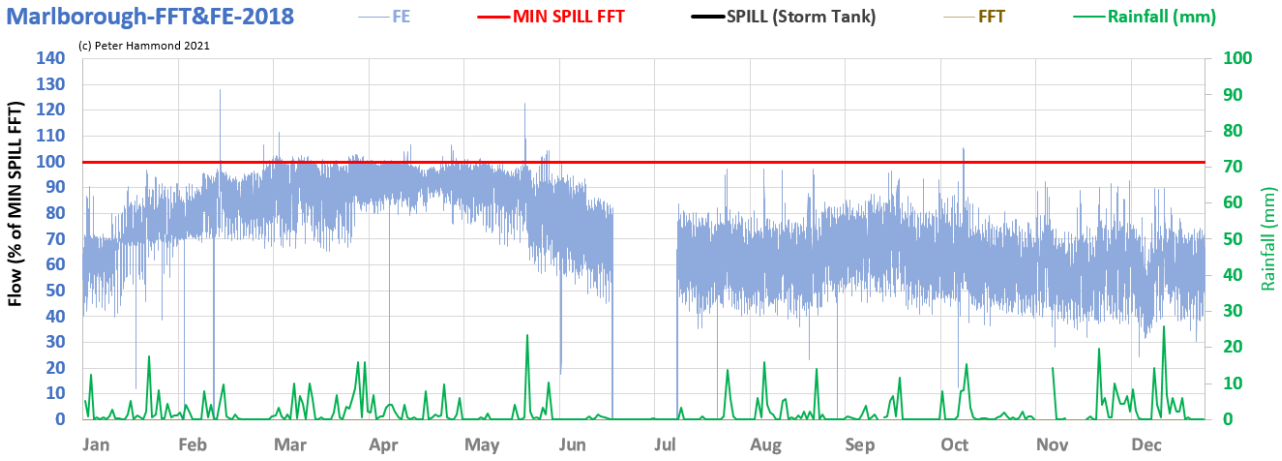


Figure 5: overview chart for 2018 for Marlborough showing yet another gap in flow data

By zooming in on April 2018, it is possible to identify a likely series of spilling days, some of which would have been labelled as “dry” had they been detected (**Fig**. 6).

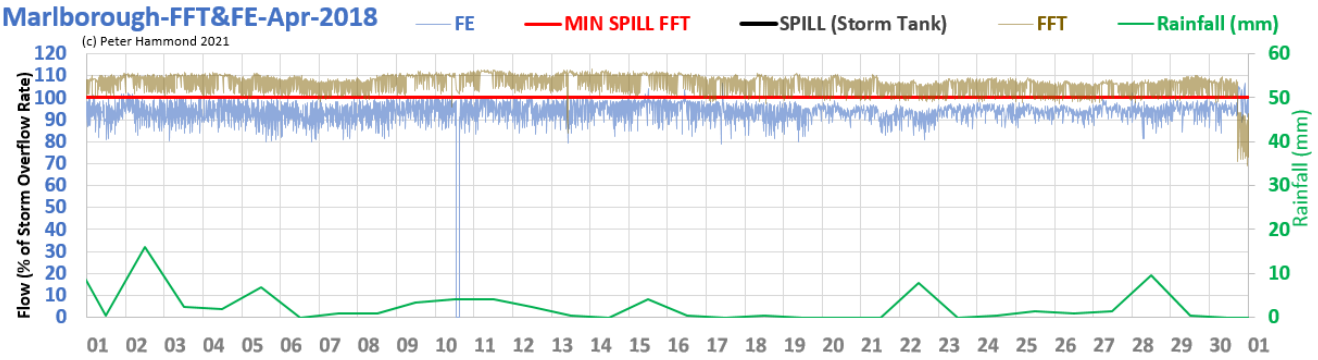


Figure 6: flow data for April 2018 showing potential spilling days

Witney

PE 49,297

TOTAL SPILLS	
dry	early
21	

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO		SSO	EIR	SSO		SSO	
	NDA		NDA		1,396		1,563		1,728	
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	NDA	NDA	NDA	NDA	11		7		3	

Witney STW, which discharges to the River Windrush, is WWTP2 in WASP's machine learning study published in early 2021. Whereas WWTP1 in that study, Church Hanborough, has been an extensive "early" spiller, Witney rarely if ever spills "early". However, it does suffer from groundwater infiltration and spills "dry".

Witney STW often receives untreated sewage from pumping stations and other STWs where there is a threat of overloading. This has often been when Witney itself was already spilling. WASP believes that at times Thames Water has used tankering to transfer sewage to Witney STW to focus spilling at one STW rather than breach permits at multiple local pumping stations and STWs. This raises the further issue of the use of tankering resulting in an increased carbon burden while failing and/or inadequately managed assets require investment and modernisation.

2021

According to data provided by Thames Water, by mid-October 2021 it had spilled for over 44 spilling days of which, WASP believes, **3 were "dry"** in that there was no rainfall on the day or day before and 9 involved at most 2 mm of rainfall on the day or day before. Since the spilling season typically begins in October, WASP anticipates these figures will be substantially larger by the end of 2021.

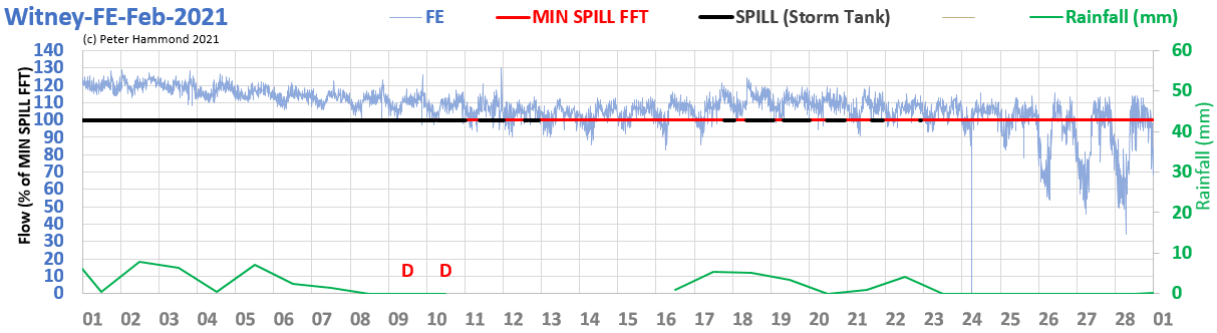


Figure 1: examples of "dry" spills at Witney STW in February 2021

2020

For 2020, Thames Water's EDM return to the EA recorded over 93 spilling days of which, WASP believes, **7 involved "dry" spills** where there was no rainfall on the day or day after as well as 26 when there was at most 2 mm of rain on the day or day before (examples of the latter in **Fig**. 2).

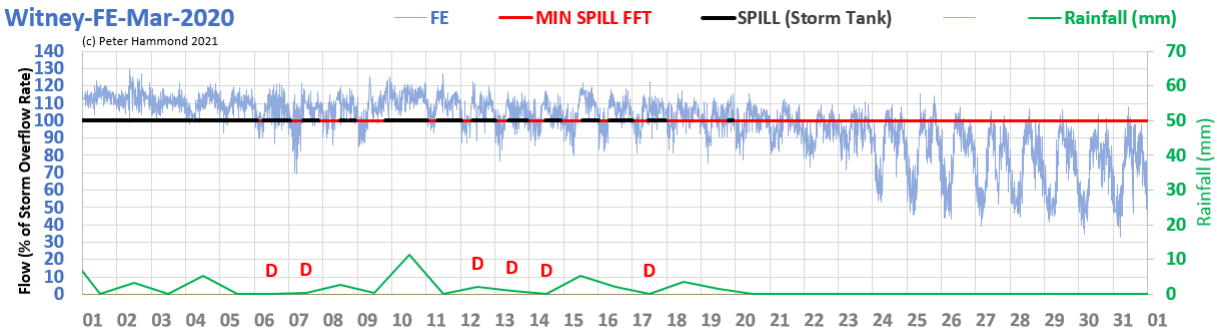


Figure 2: examples of spills at Witney STW in March 2020 with less than 2 mm of rain on the day and day before

2019

The EDM return for Witney STW was over 71 spilling days of which, WASP believes, **11 were "dry"** with no rain on the day/day before and 21 with at most 2 mm of rainfall on the day/day before (**Fig**. 3).

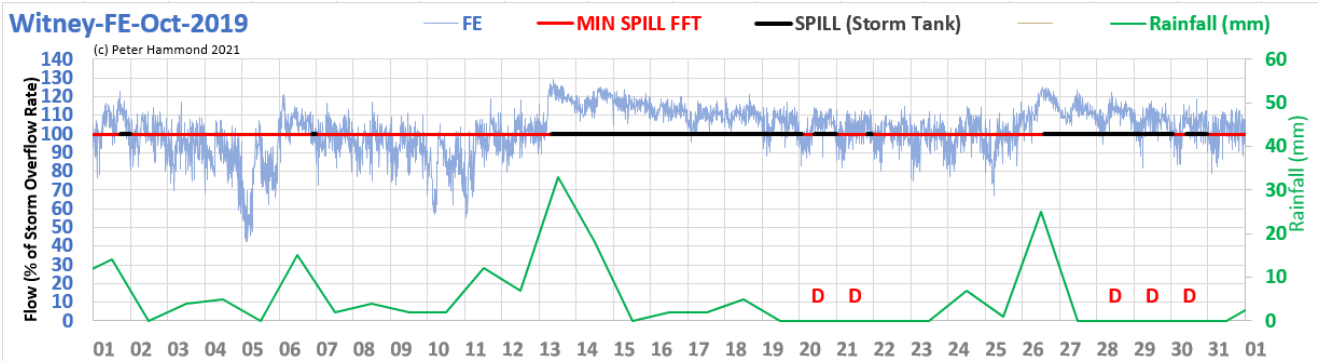


Figure 3: examples of "dry" spilling days at Witney STW in October 2019 with no rain on the day and day before

2018 and 2017

Without EDM data for 2017 and 2018, it is not possible to make a reliable interpretation of effluent flow data at Witney STW and decide if there were "early" or "dry" spilling days.

October 2016 : 1,700 fish kill in Colwell Brook and Emma's Dyke to which Witney STW discharges

Although this part of WASP's review covers 2017 to 2021, WASP believes that an incident in October 2016 should be brought to the reader's attention as it involved a large fish kill and is only 3 months prior to the report's focus. WASP believes the investigation by the EA was not thorough enough and should be revisited.

On October 11th 2016 Thames Water reported to the EA that a pollution incident had occurred on the previous day at Witney STW. The extract below is taken from EA report NIRS 1477795:

> *Following a report of elevated ammonia levels on 11 October 2016, officers attended site to carry out inspections of the sewage treatment works (STW), as well as the Curbridge Ditch, Colwell Brook and Emma's Dyke downstream of the STW.*
>
> *No sample of final effluent could be taken as all effluent had been diverted to the storm tanks and both outfalls had been blocked to prevent any discharge taking place. The sewage from the storm tanks was being tankered to various STW's.*
>
> *An ammonia reading of 15mg/l had been taken on site at 8am on 11 October alerting staff to the issue. The final effluent ammonia probe was out of action; and one of the aeration lanes was nearly empty as it had been out of service for maintenance. The told us that the SCADA system showed DO (oxygen) in the aeration lanes had gone abnormally high on the afternoon of the 10th October, and he believed this was due to something knocking out the organisms involved in the biological treatment process. Thames Water staff were taking samples throughout the STW process and exploring the network for possible sources.*
>
> *YSI readings and samples were taken of the Colwell Brook and Emma's Dyke downstream of the Witney STW outfall and confirm levels of ammonia in the stream exceeded the permit upper tier limit of 20mg/l. >1,700 dead fish were also observed in the streams.* *NIRS 1477795*

Through EIR requests, WASP has acquired effluent quality, final effluent flow and telemetry alarm data for October 2016. Figure 4 below summarises much of the data between October 1st and October 20th 2016.

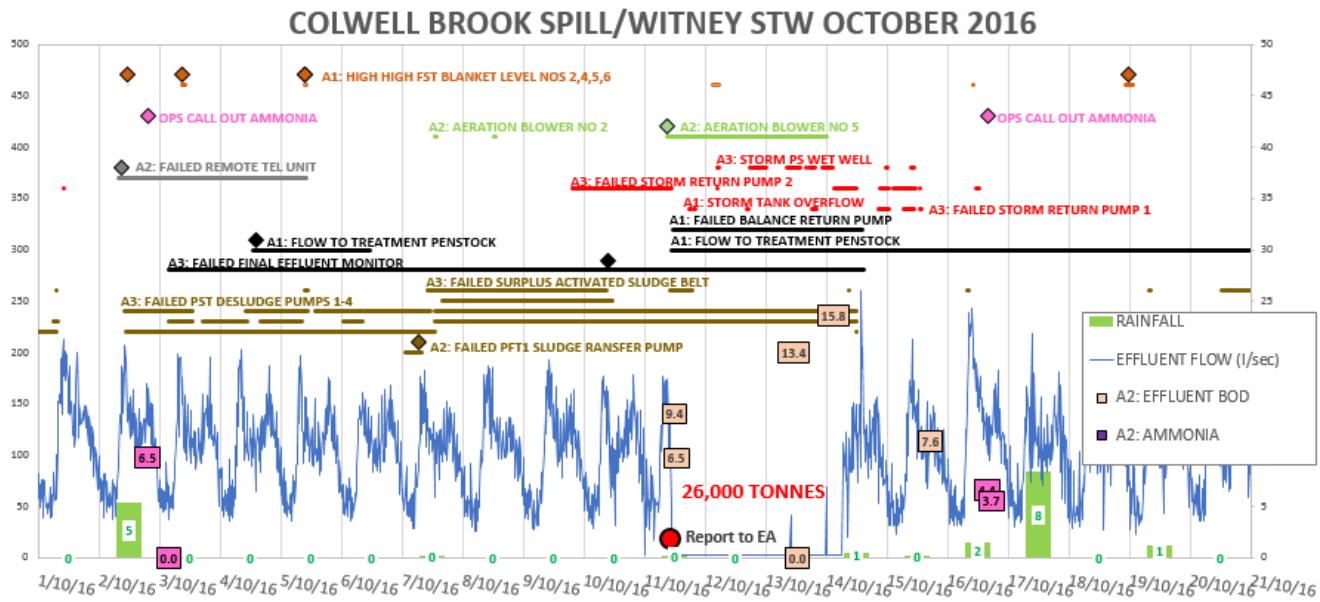


Fig 4: summary of effluent parameters, flow and telemetry alarm data for Oct 1st-20th at Witney STW

It is clear that a high ammonia (6.5) on October 2nd initiated a site visit later the same day. Although WASP made an EIR request for all logbook entries for the month of October 2016, Thames Water provided photocopies of only 6 logbook pages for October 5th-10th. Therefore, the use of the penstock on October 4th to divert flow away from treatment remains unexplained.

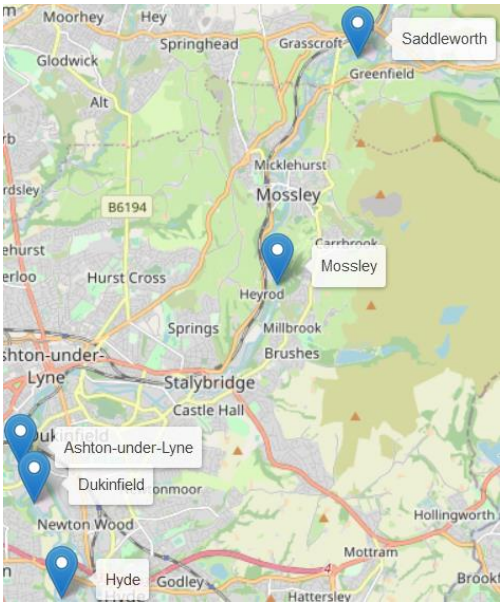
WASP believes that this brief reanalysis of the incidet just scratches the surface and that the EA's investigation should itself be the focus of a review.

UNITED UTILITIES

For 2018/2019/2020, United Utilities' EDM returns to the EA in terms of thousands of spilling hours at STWs were approximately 133/349/350 relative to totals for all CSOs of 260/692/720. Thus, across all United Utilities' CSOs, STWs accounted consistently for about 50% of all spilling hours declared. The other 50% arises from storm overflows on the sewerage network and emergency overflows at sewage pumping stations (SPSs). Two of the the United Utilities' STWs considered here were selected because they are of direct relevance to a recent study of microplastic pollution of the River Tame undertaken by the University of Manchester[39], the river to which each discharges both treated effluent as well as untreated and partially treated sewage. WASP's analysis and that of The University of Manchester strongly support each other in concluding that illegal, and especially "dry", spills are a major source of microplastics pollution in rivers.

Microplastics in the River Tame due to untreated sewage spills from United Utilities' STWs

STWs and CSOs in the Manchester Area has been shown to be a major source of microplastics found in the River Tame - currently the world's most microplastics polluted river. Professor Jamie Woodward of The University of Manchester published evidence in May 2021 demonstrating that the River Tame receives large volumes of microplastics from untreated or partially screened sewage discharged into low river flows along a 16 km stretch of river. Ashton under Lyne, Dukinfield and Hyde STWs are located in the most heavily contaminated stretch of the River Tame.



Professor Woodward's research demonstrates how untreated wastewater containing microplastics and ra sewage is being routinely discharged into rivers and o during periods of no or low rainfall when river flows a too low to disperse the microplastics downstream.

Such "dry" spills result in severe microplastic contamination of riverbeds where fauna feed. All microplastic types accumulate to high concentrations on the riverbed until flushed downstream by floods.

Proper treatment of the wastewater would remove this major source of microplastic fragments and microbeads in rivers and prevent their transport to seas and oceans where they further endanger marine ecosystems.[40]

Figure 1: a) locations of STWs studied **b) summary of microplastics study**

In anticipation of its review of these STWs, WASP submitted an environmental information regulation (EIR) request to United Utilities on May 13th 2021 asking for sewage treatment flow data from 2009 and start/stop times of untreated sewage spills detected by event duration monitors (EDMs) since installation. Typically, an EIR request is fulfilled within 20 working days. United Utilities responded to WASP's EIR on June 11th 2021 saying that a further 20 working days were required before the data could be provided. United Utilities provided some of the data requested on July 13th 2021. Unfortunately, when inspected it was clear that some of the flow data were provided only from 2015 and not 2009 and further that there were some large gaps of several months in some time series. When this was pointed out to United Utilities they replied as follows:

- Ashton 2009: There is no data for 2009, flow data at Ashton begins in 2010
- Saddleworth 2018 data gap - as per our commentary in our regulatory flow returns to the EA for that year, there was a Flow Monitoring PLC Fault.
- Saddleworth 2020 data gap - as per our commentary in our regulatory flow returns to the EA for that year, there was a Rotok failure on FTFT penstock

[39] Woodward, J.C. *et al.* (2021) Acute riverine microplastic contamination due to avoidable releases of untreated wastewater. *Nature Sustainability* 4, 793–802.

[40] United Utilities released the following statement on this microplastics research on 13 May 2021: https://www.unitedutilities.com/corporate/newsroom/latest-news/united-utilities-statement-on-microplastics-research/

WASP replied that it was totally unacceptable that for 6 months, in 2020, United Utilities did not repair or replace equipment that records data required as part of its statutory duty at Saddleworth STW and extraordinary that the EA accepted 50% of the yearly flow to be missing. WASP added that, according to the EDM data provided by United Utilities, during the data gap there were considerable spills of untreated sewage, none of which WASP and the EA could now check for permit compliance.

Previous reporting of "early" spills by WASP appears to have stimulated an offensive defence in United Utilities' eventual response to the EIR request. Each dataset provided for the STWs was accompanied by a file entitled *<STW name> WwTW Spill Guidance* that included content in the generic format:

> *Due to the location and type of the EDM spill monitors the only method of measuring a true spill to water course is by monitoring the flow into the storm tanks and the EDM spill, and only when the 2 coincide can it be said the WwTW is discharging storm sewage to the water course, and for these spills to be considered non-compliant the spills must be occurring when the FTFT (*flow to full treatment) *is less than* ***<AMOUNT1>*** *l/s.*
>
> *The EDM spills currently recorded on the STS system only measure when the storm tanks are at storm tank weir level, however the storm tanks can remain at this weir level without spilling to water course (no spill in=no spill out)*
>
> *Once a storm abates the storm tanks will only start to empty once the FTFT is measured below a predetermined level* ***<AMOUNT2>***

The first 2 paragraphs are inconsistent with the spirit of the EA's programme to monitor and record spills of untreated sewage. They are not in line with individual discharge permits which clearly say United Utilities should report start and stop times of diversion of flow to storm tanks and also start and stop times of settled storm discharges, not when storm tanks are full as suggested (**Fig**. 2)

Table S4.1a Reporting of monitoring data
Effective up to and including 31/03/2020

Parameter	Monitoring point reference	Reporting period	Period begins
Overflow to storm tank start and end times	Overflow To Storm Tanks Start and End Times	Reports to be provided to the Environment Agency upon request Report to be submitted within 28 days unless otherwise specified in writing by the Environment Agency	Upon request by the Environment Agency

Table S4.1b Reporting of monitoring data
Effective from 01/04/2020

Parameter	Monitoring point reference	Reporting period	Period begins
Overflow to storm tank start and end times	Overflow To Storm Tanks Start and End Times	Reports to be provided to the Environment Agency upon request Report to be submitted within 28 days unless otherwise specified in writing by the Environment Agency	Upon request by the Environment Agency
Settled storm sewage discharge start and end times	EDM Monitoring Point (Settled Storm Overflow)	Reports to be provided to the Environment Agency upon request Report to be submitted within 28 days unless otherwise specified in writing by the Environment Agency	Upon request by the Environment Agency
Settled storm sewage discharge start and end times	EDM Monitoring Point (Settled Storm Overflow)	Annually	1 January

Figure 2: extracts from Dukinfield STW's discharge permit describing data to be reported to the EA

Most water companies have provided WASP with start/stop times of spills with an assumed interpretation that they define intervals when rivers receive discharges. For United Utilities to say these times only refer to a storm tank being at its filled weir level is at best disingenuous and at worst dishonest. In determining whether declared or detected spills are "early", WASP has decided to cover 2 interpretations of the "guidance" on start/stop times provided by United Utilities

Guidance1 Start/stop times define when the storm tank level is at the weir overflow level;
Guidance2 Start/stop times define when discharges are made to watercourses.

Dukinfield

PE 80,000

TOTAL SPILLS	
dry	early
52	116

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO		SSO	SO	SSO		SSO	SO
	NDA		NDA		2,938	2,938	3,639		564	950
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
		4		0	33	70	12	30	7	12

Dukinfield STW is the 4th most downstream of the United Utilities STWs in The University of Manchester study of microplastic pollution of the River Tame.

Entering load vs Physical Capacity			
Year	Entering (p.e.)	Capacity (p.e.)	Load rate
2012	78,360	88,861	**88.2 %**
2014	80,058	88,861	**90.1 %**
2016	79,637	88,861	**89.6 %**
2018	77,083	88,861	**86.7 %**

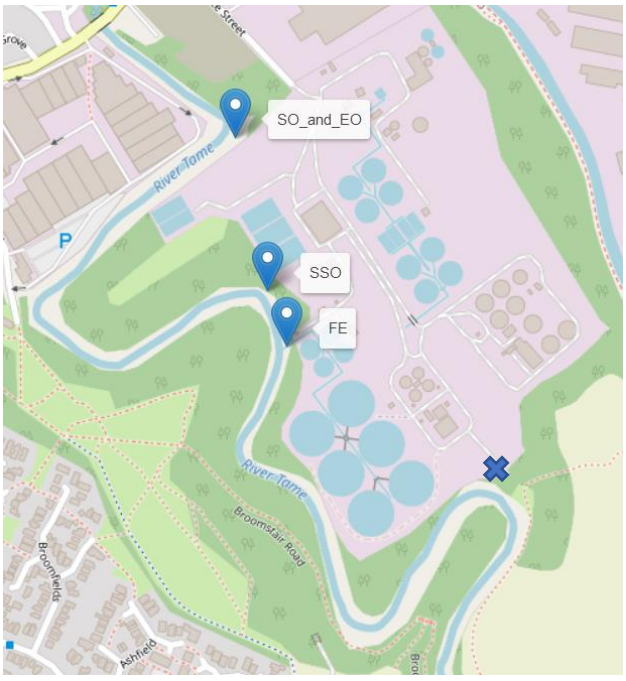
(p.e. = population equivalent)

Table 1: loading of Dukinfield STW (2012-2018)

Source: https://uwwtd.eu/United-Kingdom/treatment-plant/ukennwuutp000044/history

Dukinfield STW makes **4** discharges to the River Tame via **3** physical outlets (**Fig**. 3).

1 The final effluent (**FE**) is fully treated and is discharged furthest downstream.
2 The settled storm overflow (**SSO**), next upstream, releases the contents of storm Diversion to/overflow from storm tanks should not occur until the treatment flow rate reaches 735 litres/sec.
3 At the inlet to Dukinfield STW, furthest upstream, the storm overflow (**SO**) controls the maximum rate of flow at which sewage can enter the works (1,447 litres/sec) and in theory protects the works from being completely overwhelmed. Before discharge, the sewage is screened for "rags" and solid objects. When the **SO** and **SSO** overflows are both in operation we know that 1,447 l/s is entering the works and of that 735 l/s is passed into the treatment process. Therefore, the excess, 712 l/s, when the storm tanks are full, is being released to the River Tame – just like the overflow in a domestic bath.
4 Dukinfield STW has an inlet pumping station which has an emergency overflow (**EO**) to be used only if there is a power supply or pump failure. The Dukinfield STW permit does not indicate if the **EO** is screened for rags and solid objects before discharge.



Key

FE final effluent which is **fully treated**

SSO **settled** storm overflow from storm tanks which is **screened** for "rags" and solid objects allowing solid waste to settle prior to the tank contents being pumped back into the treatment process

SO **screened** storm overflow at inlet

EO **untreated** emergency overflow at inlet pumping station only during electrical supply or pump failure

SO and **EO** discharge through the same outlet

✖ Edward St CSO connected to network storm tanks, not related directly to Dukinfield STW, and an outlet for a continuously flowing culverted stream

https://gridreferencefinder.com/osm/

Figure 3 Dukinfield STW with 4 partially/fully treated sewage discharges connected to 3 physical outlets

Under the first of the two assumptions outlined above, **SSO** start/stop times alone may not indicate an actual spill. However, as has been already explained, if both the **SSO** and the **SO** overflows are in operation, a full storm tank will inevitably overflow at 712 l/s. So not only do we know that there is a spill to the River Tame, we can estimate the volume of that spill, as well as determine if it is an illegal "dry" or "early" spill.

In article in The Times newpaper on 20/11/2021[41], reference was made to WASP's detection of illegal spills at Dukinfield. By way of a right to reply, United Utilities said that the spill data that WASP had used (the data that United Utilities supplied) was incorrect and that they had correct data that contradicted what was published. WASP asked for the correct spill data but United Utilities said it was not in a format that could be shared. Subsequently, United Utilities offered WASP the chance to discuss spill data provision but, when WASP accepted, United Utilities retracted the offer (10/12/2021). The grounds for the refusal were that the newly announced EA/OFWAT investigation of water companies meant they *will be unable to provide or discuss with you information relating to discharges to the environment at this stage until investigations are fully concluded*. Therefore, WASP has had no alternative but to complete its analysis using the data United Utilites have provided.

2021

The spill data provided by United Utilities suggests that, by late May, Dukinfield STW's SSO, SO and SPS_EO outlets had already spilled for 564, 950 and 201 hours respectively.

The overview for 2021 shows the 200+ hours when the EDM for the inlet pumping station emergency outlet (EO) detected spills as a result of power or pump failure, assuming the spills were compliant with the conditions of the permit. This seems rather excessive to WASP and requires additional investigation of telemetry alarm data.

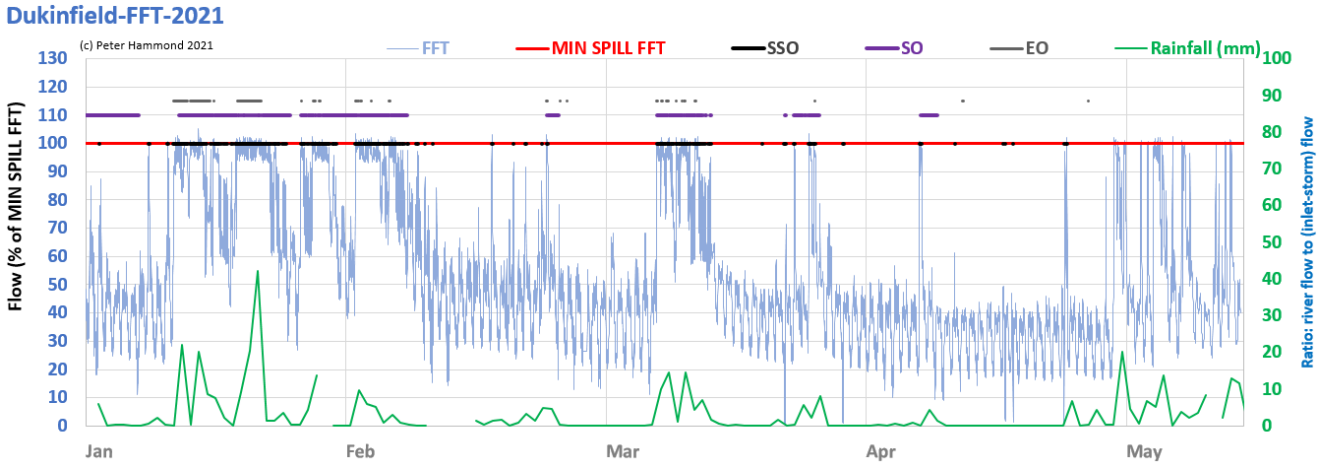


Figure 4: overview of 2021 flow, rainfall and EDM detected spills for the SSO, SO and SPS_EO outlets at Dukinfield STW

WASP believes the 55 spilling days detected by the SSO EDM device between January and May 2021 included both "dry" and "early" spills (examples below in **Fig**. 5).

[41] https://www.thetimes.co.uk/article/illegal-sewage-spills-into-river-tame-linked-to-worlds-highest-concentration-of-microplastics-jjsc770cc

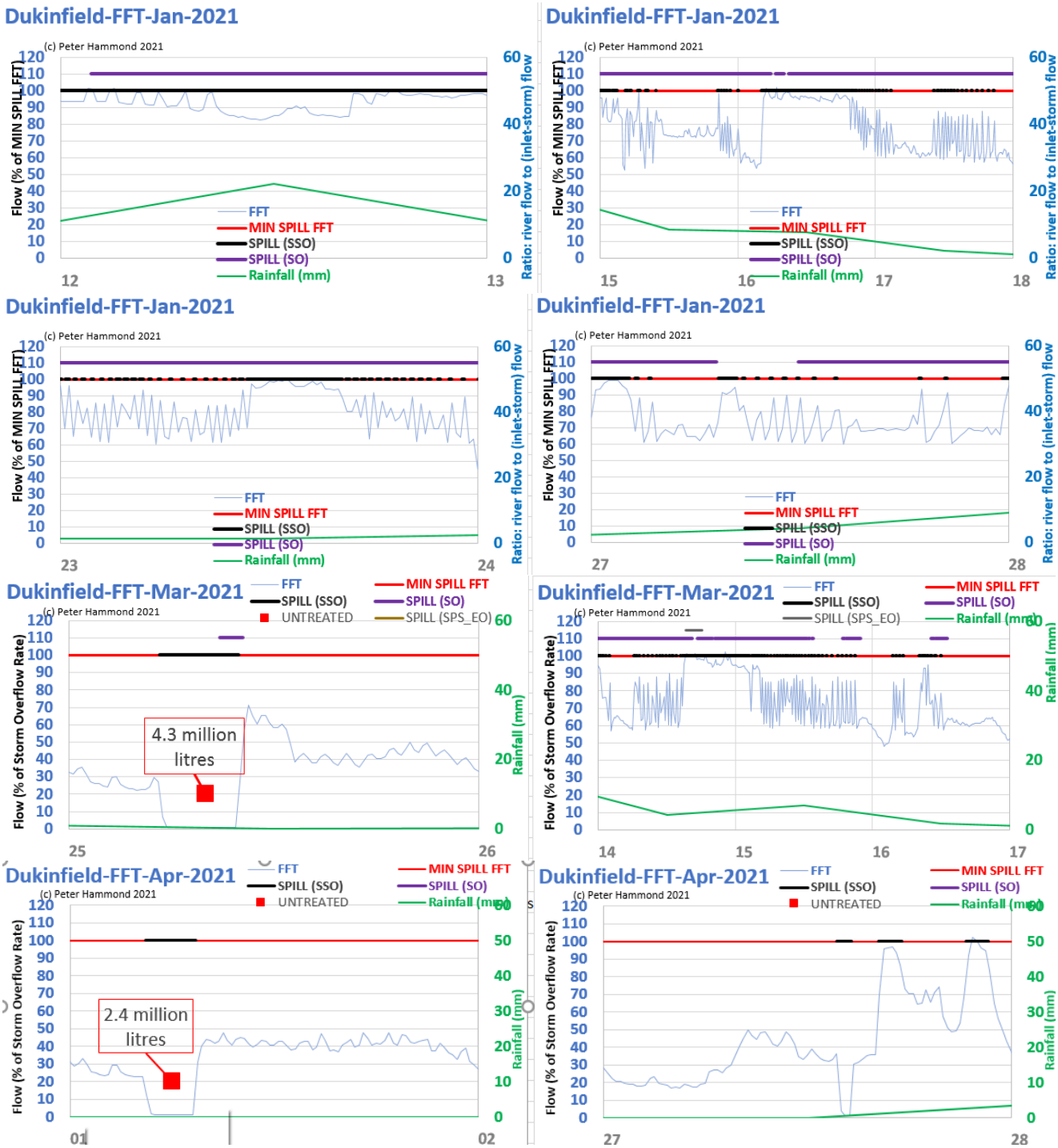


Figure 5: WASP believes there were at least 10 "early" spilling days (Jan 12,15-17,27; Mar 14-17, with Mar 25 and Apr 1 respectively losing 4.3 M litres and 2.4 M litres of untreated sewage (Mar 25th)

2020

In the 2020 EDM return to the EA, United Utilities declared 208 spilling days of which, WASP believes, between **19 (Guidance1)** and 81 (Guidance2) were **"early" illegal spills**, **12 were "dry" illegal spills** involving no rainfall on the day or day before and 44 involved at most 2 mm of rain on the day or day before. It is not stated in the return to the EA if these spills were from the **SSO** connected to the storm tanks. The EDM data for 2020 supplied to WASP suggests that in total there were 4,316 spilling hours attributed as follows to the different overflows:

SSO : 2,959 hrs **SO** : 1,129 hrs **EO** : 228 hrs

The total of 228 hours of electrical power failure and/or pump failure seems rather large and needs to be pursued further with United Utilities to determine if the EO spills were within permit.

The **SSO** and **SO** appear to have been in operation simultaneously for a total of 978 hours so **an estimate for the spilled volume from the SSO during these overlapping periods in 2020 is approximately 2.5 million tonnes** (712*60*60*978/1000) or 2.5 billion litres or 1000 Olympic sized pools.

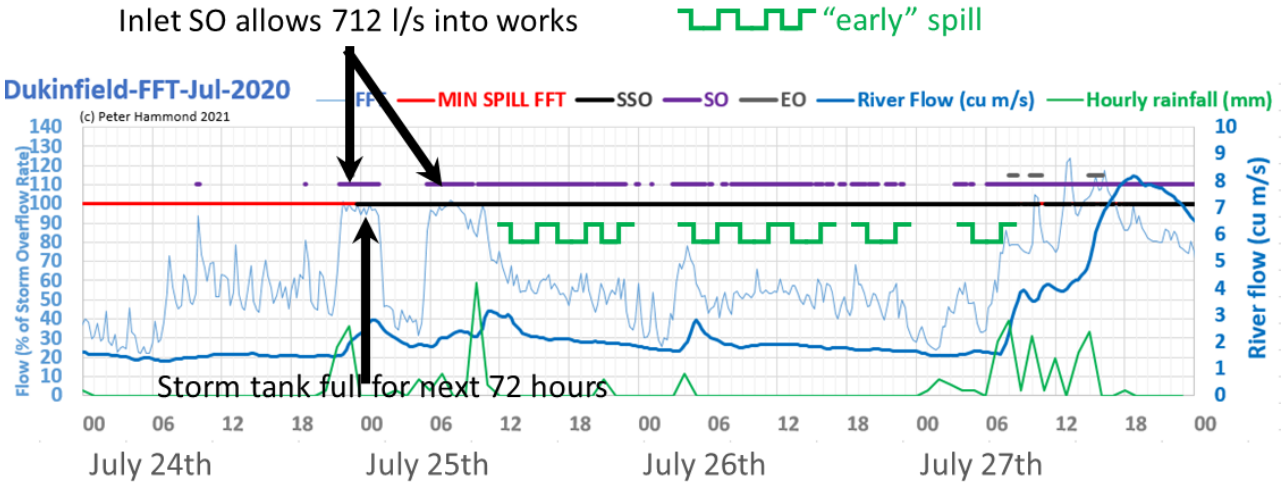


Figure 6: sewage flow, EDM and River Teme flow data for Dukinfield STW between July 24th and July 27th 2020

The black arrows indicate (Fig. 6) where the inlet **SO** and storm tank **SSO** were initially triggered late on July 24th and then subsequently in an intermittent fashion. The heavy green corrugations indicate where the **SO** and **SSO** were simultaneously active and where spills from the storm tanks occurred (regardless of assumptions A and B mentioned earlier). These spills were "early" because the flow to treatment (pale blue curve) was below 92% of the minimum required by the EA permit (100% less the accepted 8% meter error). Moreover, the spills lasted about 33 hours and so an estimate of the screened but untreated sewage discharged illegally via the **SSO** is 85,000 tonnes (33 * 60 * 60 * 712/1000) or 85 million litres or 24 Olympic sized pools. Finally, for much of the duration of these spills the River Tame flow (dark blue curve) was as low as 1.5 to 2 m^3/s as measured about 2 km downstream of the overflows. Of course, by the time the River Tame received spills from Dukinfield it had already accumulated untreated sewage spills from upstream STWs at Saddleworth, Mossley and Ashton-under-Lyne as shown earlier.

For July 2020, Dukinfield STW has a large hiatus in flow to full treatment. As a result, it is not possible to check if any spills in that gap were "early".

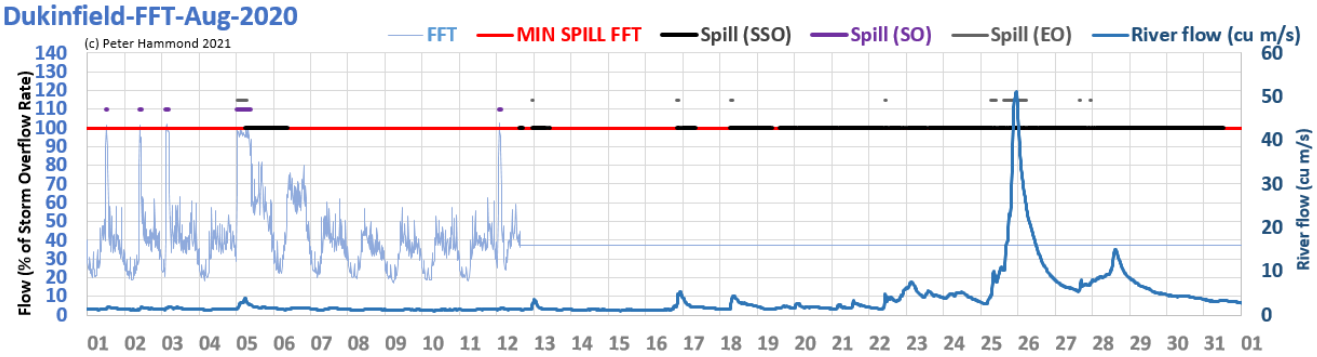


Figure 7: FFT stops at Aug 12th and 6 days later a long spill ensues with a peak of a 40 fold increase in river flow – but spills on Aug 1,2,3,12,19-22 are into low river flows that can occur in dry weather

2019

The microplastics study by The University of Manchester involved extensive sampling on the Tame in the summer of 2019 so these spill data are especially relevant to that research.

For 2019, United Utilities declared to the EA 2,938 spilling hours (for both SSO and SO outlets) over 173 spilling days. In response to WASP's EIR request, the SSO data provided correspond to 1,301 hours over 147 spilling days. Of the latter, WASP believes there were 33 "dry" and 70 "early" spilling days. Examples of both are shown in **Fig**. 8.

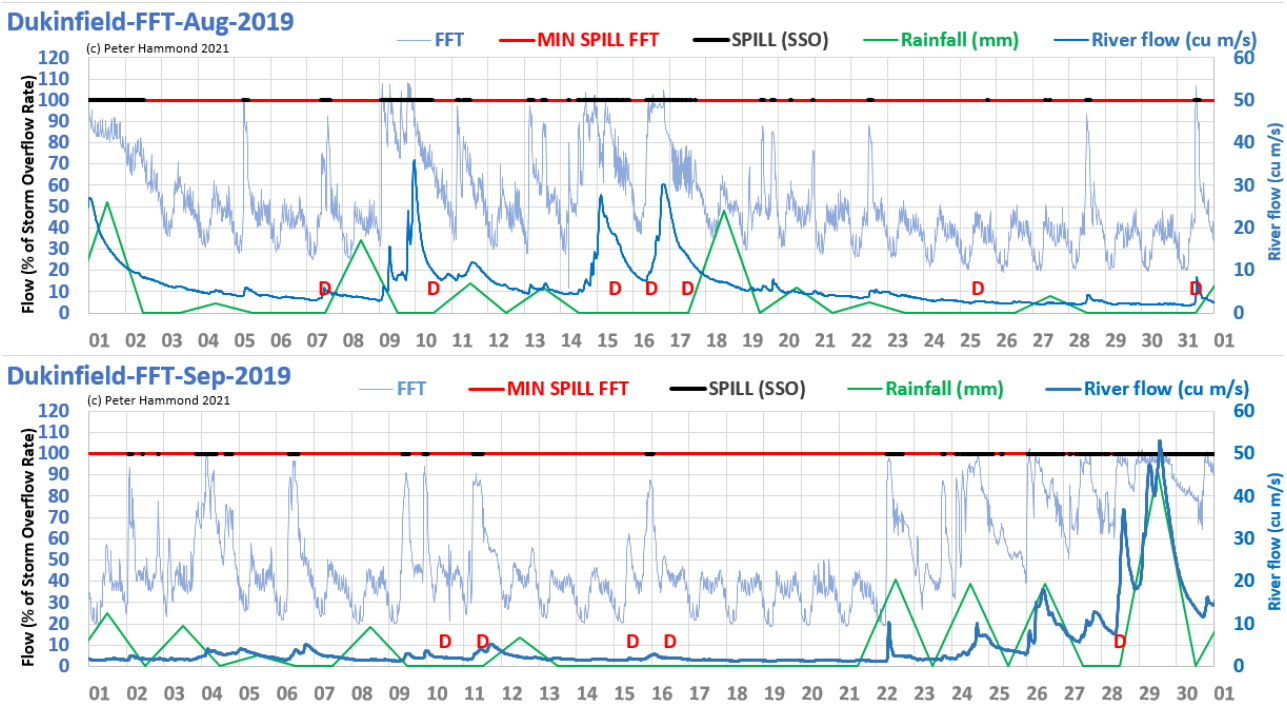


Figure 8: WASP believes there were 12 "dry" and at least 18 "early" spilling days in Aug/Sept 2019 at Dukinfield STW

2018

There is no spill data for 2018 as the EDM device was not installed until mid-2019. It is possible to identify occasions when the works spilled via the SSO but the adherence to the FFT minimum rate throughout 2018 appears to be almost always compliant (**Fig**. 9).

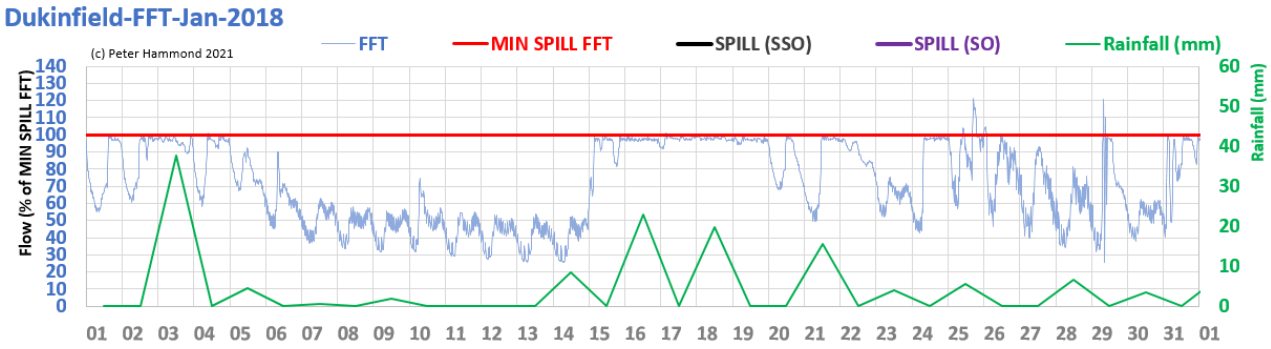


Figure 9: WASP believes Dukinfield STW spills were FFT compliant e.g. Jan 1-4, 15-21, 24,29 and 31

2017

There is no available EDM spill data for 2017 but WASP believes there were 4 "early" spills in Nov 2017.

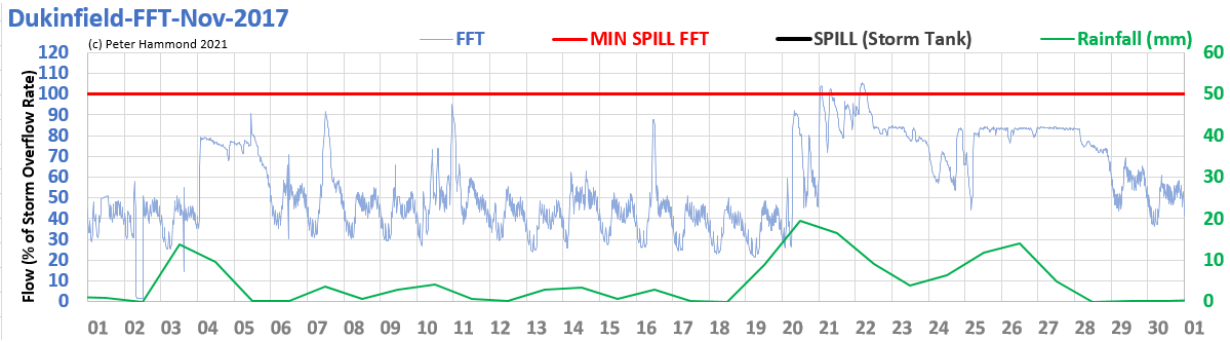


Figure 5: WASP believes there were 4 "early" spills in November 2017 (25th-28th)

Otherwise the spills in 2017 appear to be FFT compliant. It might be worth pursuing the 2 month's worth of suspicious FFT data loss in January, February and September 2017.

Hyde

PE	80,000

TOTAL SPILLS	
dry	early
48	92

	2017		2018		2019		2020		2021	
Spilling hours	SSO	SO	SSO	SO	SSO	SO	SSO	SO	SSO	SO
	NDA		959	272	1,954	1,954	586	1,103	*454*	*261*
Unpermitted	dry	early	dry	early	dry	early	dry	early	dry	early
spills	NDA	NDA	9	20	36	49		22	3	1

Hyde STW serves a population of 80,000+ and for 10 years has been working at, or close to, capacity (**Table** 1).

Entering load vs Physical Capacity			
Year	Entering (p.e.)	Capacity (p.e.)	Load rate
2012	84,540	84,540	**100.0 %**
2014	82,189	84,540	**97.2 %**
2016	83,512	84,540	**98.8 %**
2018	82,977	84,540	**98.2 %**

(p.e. = population equivalent)

Table 1: loading of Hyde STW (2012-2018)

Source: https://uwwtd.eu/United-Kingdom/treatment-plant/ukennwuutp000067/history

In response to WASP's EIR request for flow and spill data, United Utilities said that there had been issues with the EDM installation and admitted that they had made non-compliant spills:

> *Ultrasonic level detectors located at the inlet of the flow through storm tanks, although installed in April 2018 were not working reliably until July 19.*
>
> *The main reason for the non-compliant spills to water course from 2018 to mid 2020 was due to the inability to pass forward the FTFT, a hydraulic survey was commissioned to ascertain the reason for the non-compliance, and FTFT compliance was achieved again in August 2020.* **United Utilities**

Hyde STW has a storm overflow (SO) at the inlet that restricts the flow entering the works to 1,158 litres/sec so that any excess above that is discharged to the River Tame after being screened for "rags" and other solid objects. This excess at the inlet is not measured. The works is also permitted to divert any excess over 722 litres/sec to storm tanks that are large enough to hold 2 hours' worth of sewage at 722 litres/sec. The contents of the storm tanks should be pumped back for treatment as soon as possible or when full are permitted to spill via the settled storm overflow (SSO) to the River Tame. Both the SO and SSO overflows are fitted with monitors to record when they start and stop being used. United Utilities claim that their SSO monitoring devices continue to be set even if the storm tanks are full but not spilling to the river.

If the monitoring devices confirm that both SO and SSO overflows are simultaneously in use, 1,158 litres/sec is entering the works and, given that the storm tank is full (and overflowing), 722 litres/sec will be passed into the treatment process and the difference (436 litres/sec) must be overflowing the storm tanks and spill to the river. So when both the SO and SSO are in use it is possible to estimate the volume being discharged via the storm tanks by multiplying 436 by the number of seconds for which both are operating.

2021

By 17th May 2021, the SO and SSO had been simultaneously in operation for 211 hours. So, an estimate of the volume spilled during this time period is 331,567 tonnes i.e. 331 million litres or 132 Olympic sized swimming pools. Moreover, WASP believes that the SSO spilled **"early" on at least 1** and "dry" on 3 of the 36 spilling days.

2020

The SO and SSO were in simultaneous use for 567 hours so WASP estimates the volume of spill during their simultaneous operation to be 889,272 tonnes (889 million litres or 356 Olympic sized swimming pools). Moreover, WASP believes **22 of the spilling days involved "early" spills**. **Fig**. 1 Illustrates seven "early" spilling days where the flow to full treatment (blue curve) is always below 92% of the storm overflow rate and both the SO and SSO were in operation.

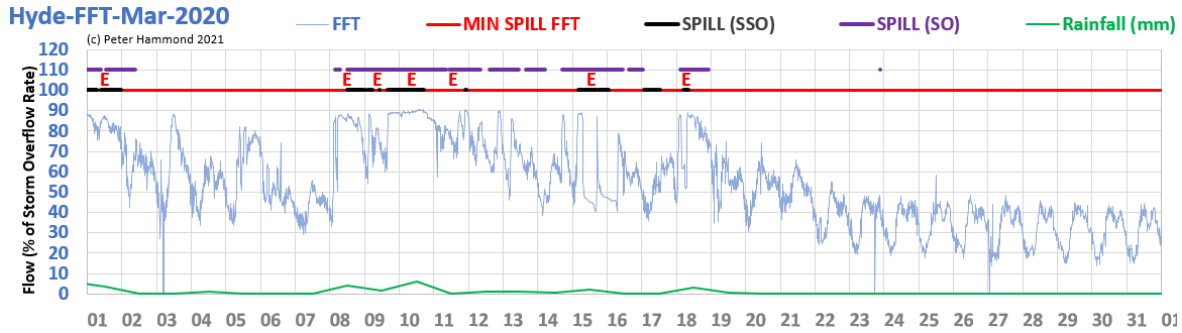


Figure 1: example of 7 days involving "early" spills at Hyde STW in March 2020

In contrast, in December, the works did not spill when both overflows were in action and the flow to treatment was under the minimum rate. This confirms United Utilities suggestion that the EDM devices worked after August 2020.

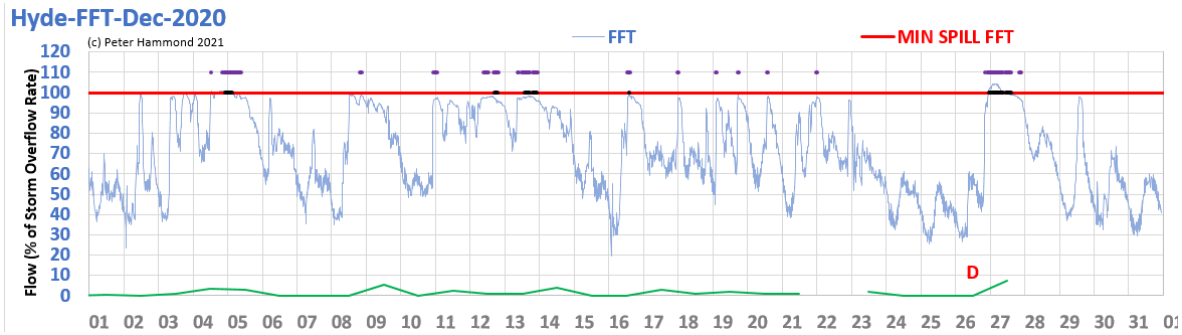


Figure 2: example of full spill compliance at Hyde STW in December 2020

2019

For 2019, United Utilities reported to the EA an identical total of 1,954 spilling hours for both SSO and SO. The EDM spill data provided to WASP agreed with this figure for one overflow but totalled 820 spilling hours for the other. The two overflows were simultaneously active for 783 hours which corresponds to an estimated annual spill via the storm tanks SSO of at least 1,228 M tonnes (1.23 billion litres or 490 Olympic sized pools).

WASP believes that of 178 spilling days, at least **49 involved "early" spills** when both overflows were active and the flow to full treatment did not reach the minimum required. As with 2020, in some months all spills were "early" spills (**Fig**. 3) and some fully compliant (**Fig**. 4).

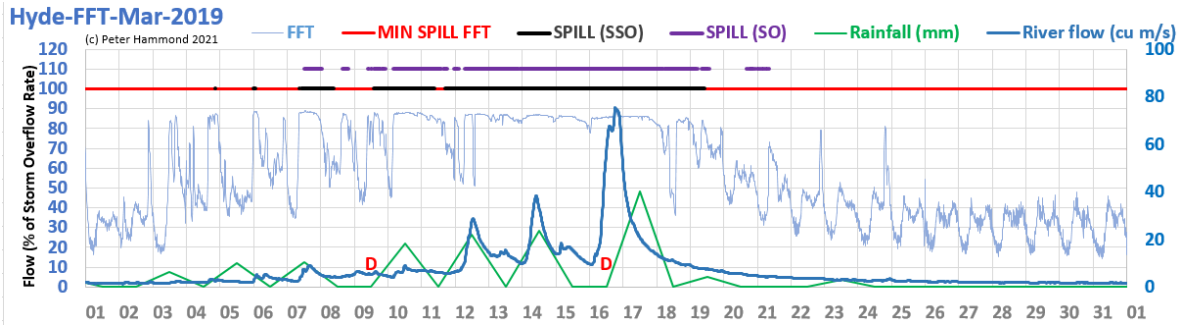


Figure 3: example of non-compliance of all spills at Hyde STW in March 2019

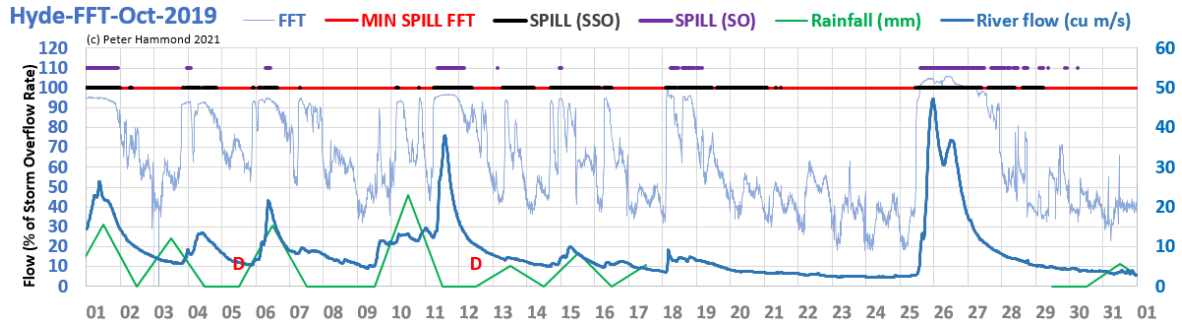


Figure 4: example of full spill compliance at Hyde STW in October 2019 apart from 2 "dry" spills

WASP also believes there were 49 “dry” spilling days in 2019 at Hyde STW. Examples are shown in **Fig**. 5.

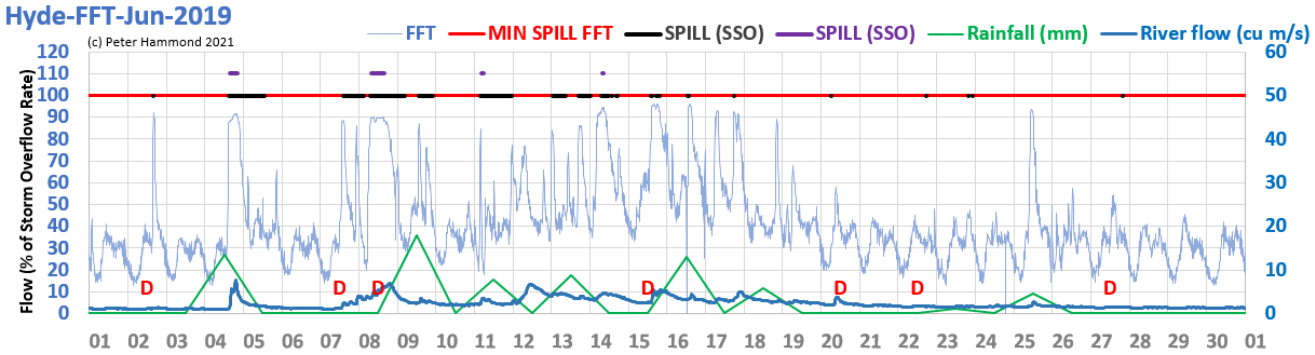


Figure 5: examples of “dry” spills at Hyde STW in June 2019 some of which involved relatively low river flows

2018

United Utilities did not make an EDM return to the EA for Hyde STW in 2018. However, in response to an EIR request WASP was provided with EDM data suggesting the spilling hours for the SSO and SO were 959 and 272 respectively. The SO and SSO were in simultaneous use for 264 hours so WASP estimates the volume of spill during their simultaneous operation to be **415,079 tonnes** (415 M litres or **166 Olympic swimming pools**). Gaps in FFT flow suggest million of litres of untreated sewage are unaccounted for e.g. Jan 15,17,24 in **Fig**. 6.

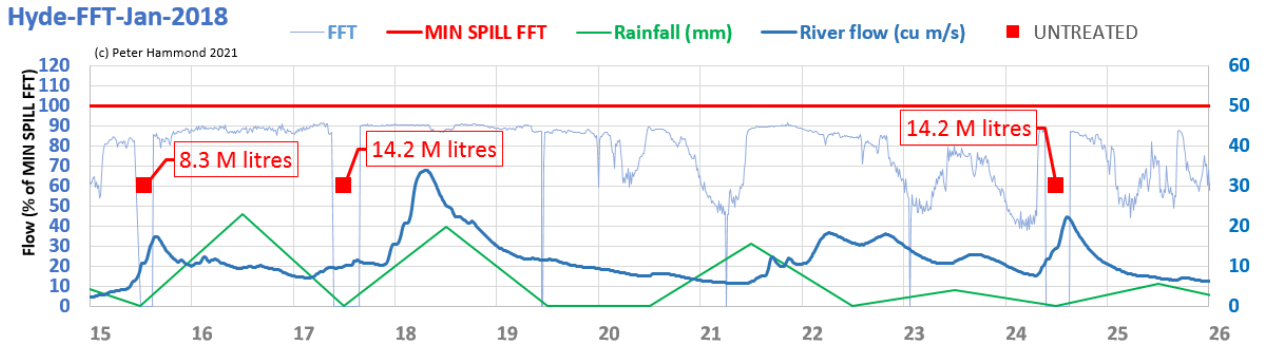


Figure 6: examples of megalitres of untreated sewage unaccounted for in January 2018 at Hyde STW

Of the 107 spilling days, WASP believes at least **9 involved “dry” spills** and at least **20 involved “early” spills** when both SSO and SO EDMs were high (examples in **Fig.** 7).

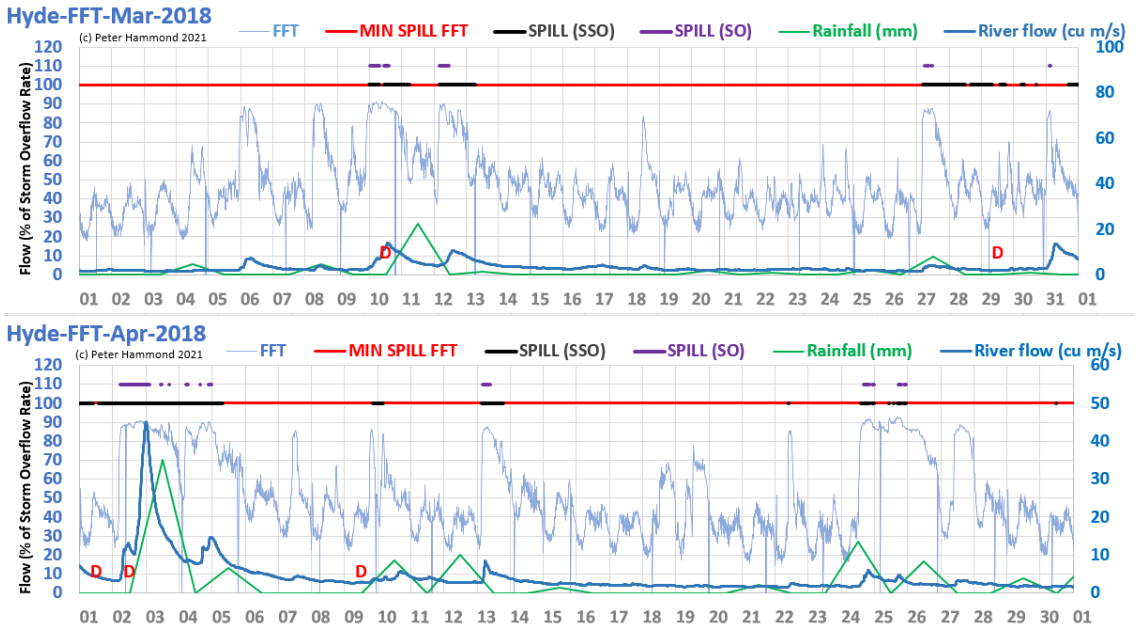


Figure 7: “dry” spills as indicated and “early” spills on Jan 12, 27; Feb 3, 4, 13, 25

Whalley

PE	5,321
TOTAL SPILLS	
dry	early
3	36

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO		SSO		SSO		SSO	
	NDA		*585*		2,485		2,827			
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	NDA	NDA	NDA	8		11	3	17		

Whalley STW's loading has been close to, or at, 100% for more than 10 years (**Table** 1). It discharges to the River Calder, north east of Blackburn, which then joins the River Ribble.

Entering load vs Physical Capacity			
Year	Entering (p.e.)	Capacity (p.e.)	Load rate
2012	4,414	4,408	**99.9 %**
2014	5,076	5,076	**100.0 %**
2016	5,076	4,986	**98.2 %**
2018	5,321	5,321	**100.0 %**

(p.e. = population equivalent)

Table 1: loading of Whalley STW (2012-2018)

Source: https://uwwtd.eu/United-Kingdom/treatment-plant/ukennwuutp000130/history

2020

For 2020, United Utilities returned 160 spilling days of which, WASP believes, **17 involved "early" spills and 3 involved "dry" spills**. **Figure** 1 shows how in February spill were compliant but then heavy rain made the works unstable, resulted in a loss of flow on 3 days (Feb 21st-23rd) and then led to 12 consecutive days with "early" spills (Feb 23rd-Mar 5th). The works recovered by mid-March and became compliant once more.

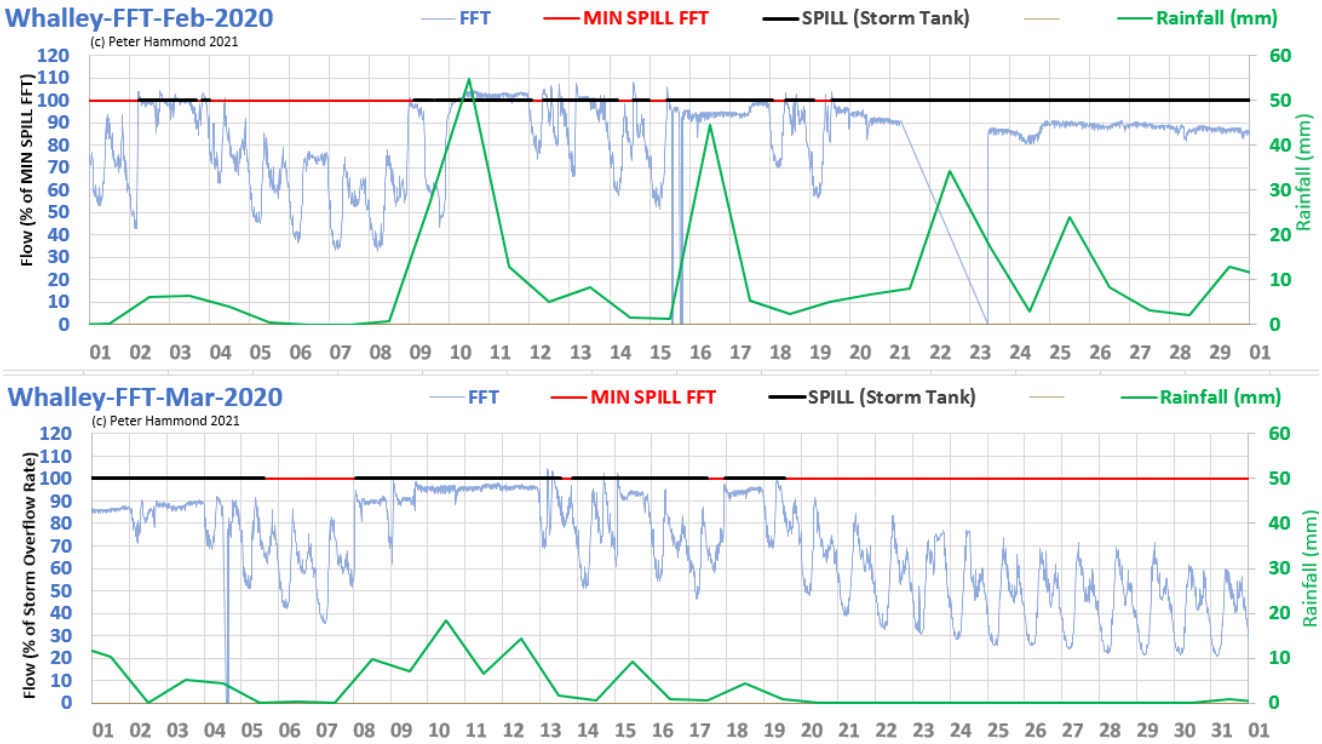


Figure 1: Whalley STW spills compliant in early Feb and non-compliant from mid-Feb until early March

2019

The EDM return of 2,485 spilling hours in 2019 for Whalley STW does not correspond to the EDM spill data provided to WASP. This amounts to 1,826 spilling hours over 131 spilling days of which WASP believes **11 involved "early" spills**. **Fig**. 2 shows at least 6 "early" spilling days between March 8th and March 21st.

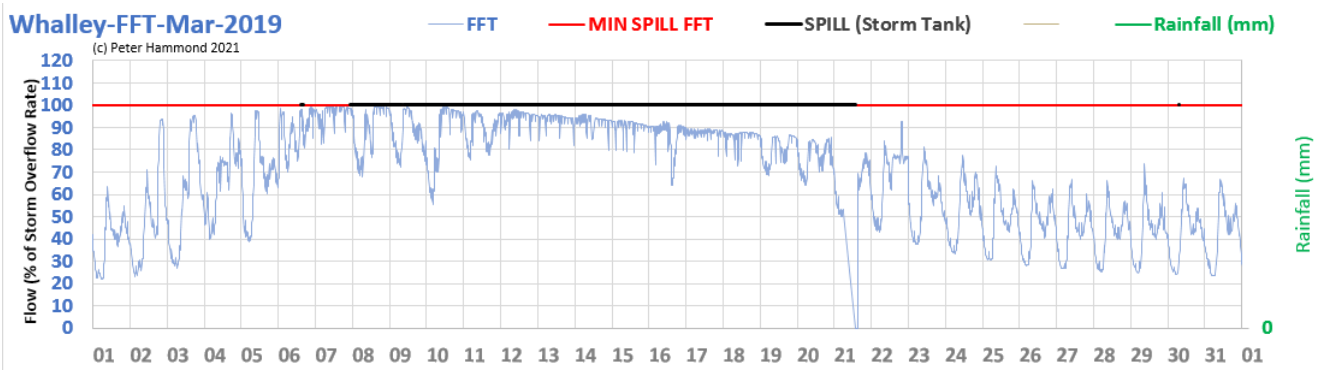


Figure 2: Whalley STW makes at least 8 "early" spill between March 8th and March 21st 2020

2018

No EDM return was made for Whalley in 2018 but the EDM data provided to WASP suggests there were at least 44 spilling days of which, WASP believes, **8 involved "early" spills** in September (**Fig**. 3).

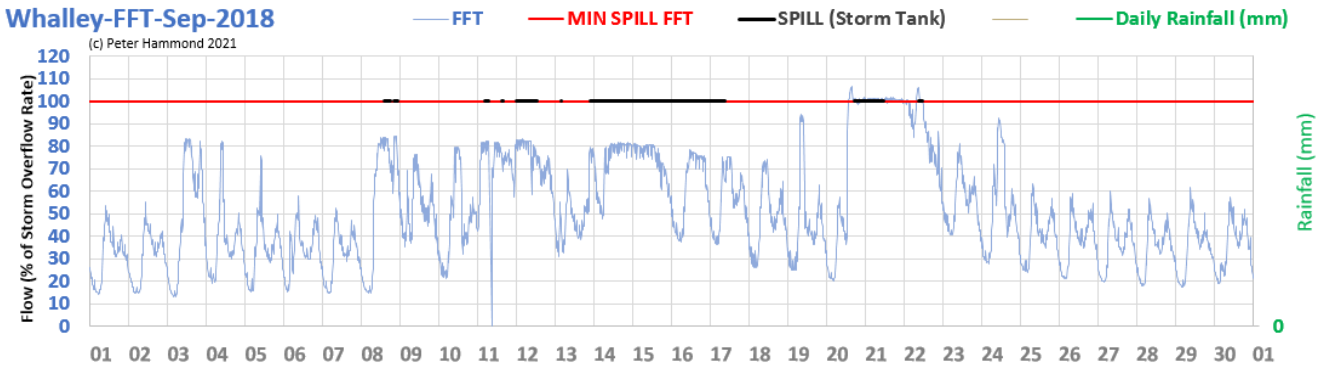


Figure 3: Eight days involving "early" spills (Sept 8th, Sept 10th-17th) at Whalley STW

WESSEX WATER

Concern about the state of rivers in the Hampshire Avon catchment and publicity concerning WASP's analysis of untreated sewage spills from Sewage Treatment Works (STWs) led Patrick Heaton-Armstrong to contact WASP and initiate a small study of STWs operated by Wessex Water. Under WASP's guidance, he submitted an EIR request to Wessex Water for sewage treatment and storm discharge data at several STWs.

Barford St Martin

PE	386
TOTAL SPILLS	
dry	early
23	0

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO		SSO		SSO		SSO	
	NDA		NDA		323		2,332		*1,416*	
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	NDA	NDA	NDA	NDA	4		13		6	

SSO=Settled Storm Overflow PE=Population Equivalent

Bradford St Martin is a small STW that discharges to the River Nadder, a tributary of the River Avon.

2021

No EDM data were available for 2021 but, judging by the flow data, the works was clearly spilling in January and February and, by the end of July, Bardford St Martin STW had spilled for over 59 days of which, WASP believes, **6 involved "dry" spills** and 21 involved up to 2 mm of rainfall on the day and day before.

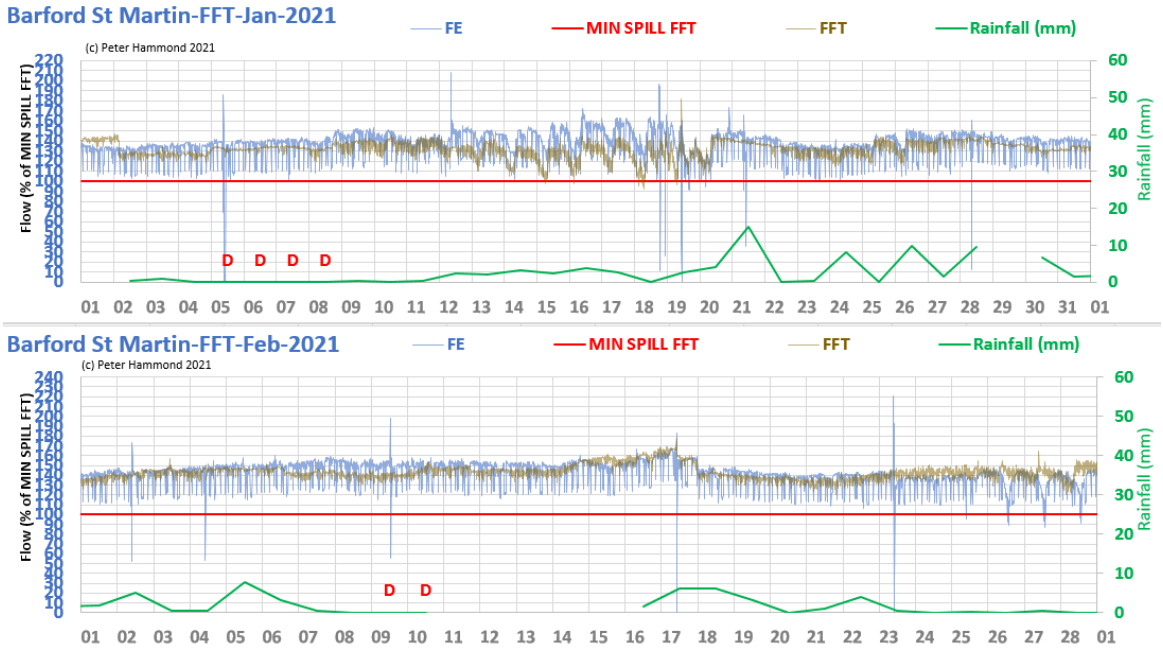


Figure 1: WASP believes there were at least 6 "dry" spilling days at Barford St Martin STW in Jan-Feb 2021

2020

In 2020, Barford St Martin STW was reported as spilling for 110 days, with 91 of them between Jan 1st and Apr 4th. WASP believes, **13 involved "dry"** spills and 42 involved up to 2 mm of rainfall on the day and day before.

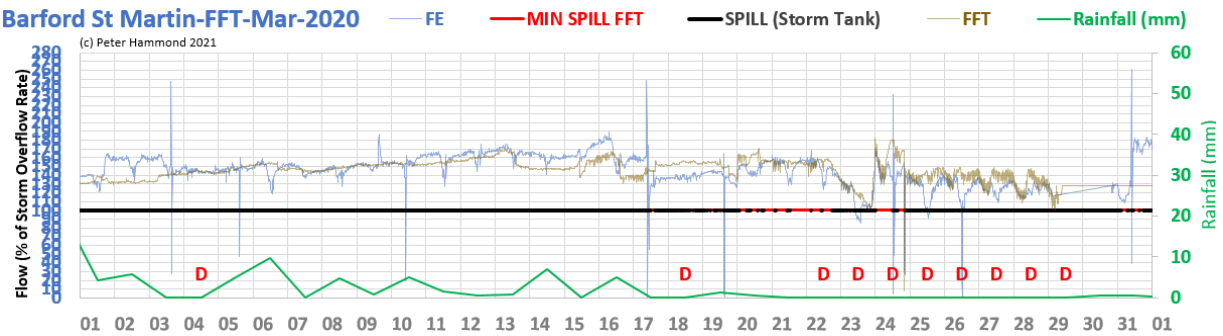


Figure 2: WASP believes there were at least 10 "dry" spilling days at Barford St Martin STW in Mar 2020

2019

There were 51 spilling days declared for 2019 and WASP believes **4 involved "dry" spills**.

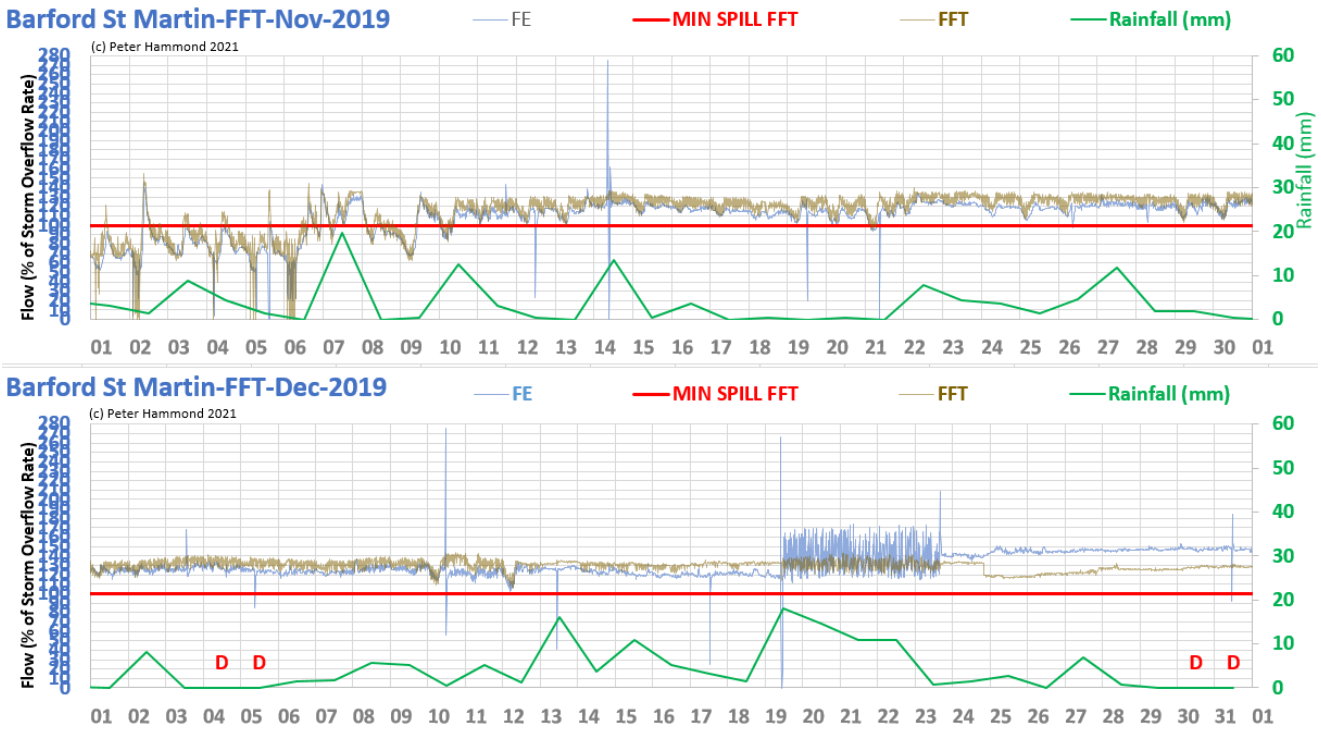


Figure 3: WASP believes there were at least 4 "dry" spilling days at Barford St Martin STW in Dec 2019

2018 & 2017

The flow data for 2017 and 2018 are too anomalous to analyse reliably. An overview of 2018 is shown below by way of illustration.

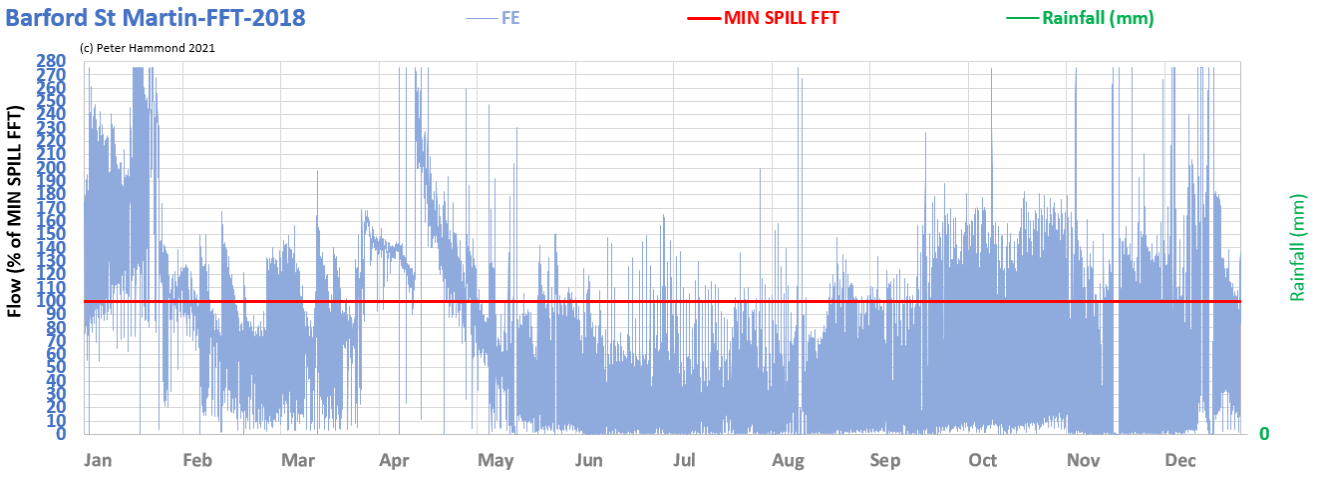


Figure 4: WASP believes the effluent flow data for 2018 for Barford St Martin is too anomalous to analyse

Fordingbridge

PE	9,579
TOTAL SPILLS	
dry	early
3	3

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO		SSO		SSO		SSO	
	NDA		NDA		17.73		6.43		NDA	
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	NDA	NDA	NDA	NDA		2	3	1	NDA	NDA

SSO=Settled Storm Overflow PE=Population Equivalent

Fordingbridge STW discharges to the River Avon in Hampshire. Flow data were provided for final effluent and also for what is described as flow at the inlet. It is not clear if the latter corresponds to flow to full treatment but if it is simply a measure of flow into the works, flow to full treatment will be sandwiched somewhere between the two.

2020

The EDM spill data provided by Wessex Water declared only a single spill of 6 or so hours on January 15th. But, the finale effluent and flow to treatment data for January and February (**Fig**. 1) suggest that there was diversion to the storm tank and possibly discharge to the River Avon. If the former, then the permit was breached as this would count as "early". In any case, WASP believes there were such diversions on at least 4 days without rainfall.

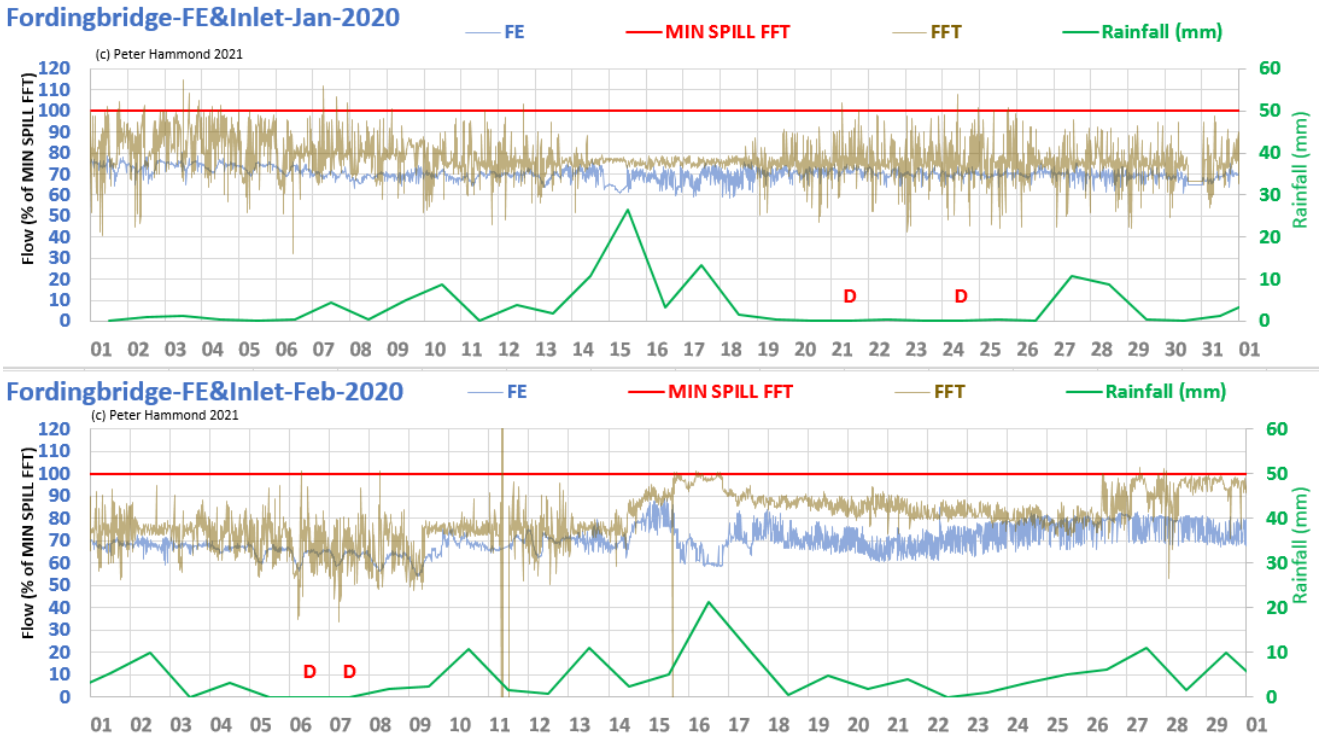


Figure 1: potential "early" and "dry" spilling days possibly not detected and/or declared in 2020

In November, there appear to be 3 undetected and undeclared spilling days that would be considered compliant.

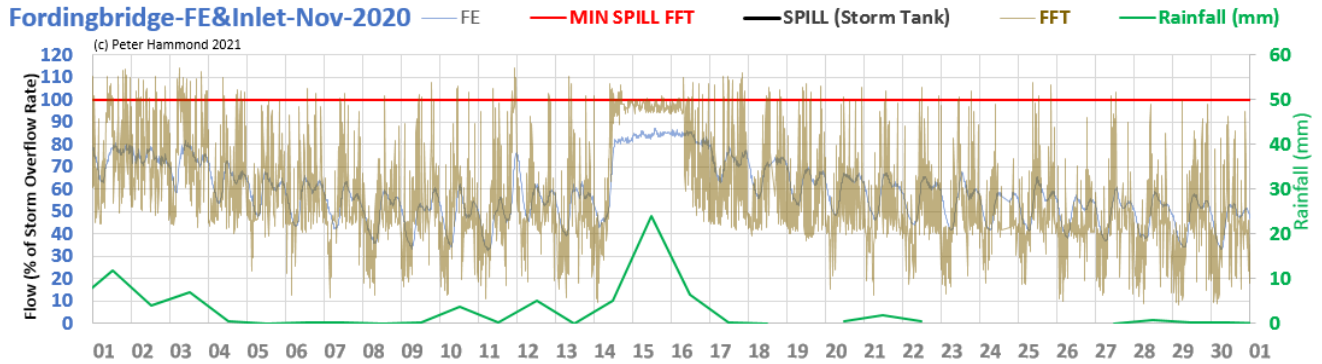


Figure 2: 3 potentially undetected and undeclared spilling days in November 2020 at Fordingbridge STW

These potentially undetected and undeclared spilling days would need further investigation and corroboration using telemetry alarm data.

2019

Wessex Water declared a single spill across two days October 18th-19th (**Fig**. 3) and both spilling days look to have been "early".

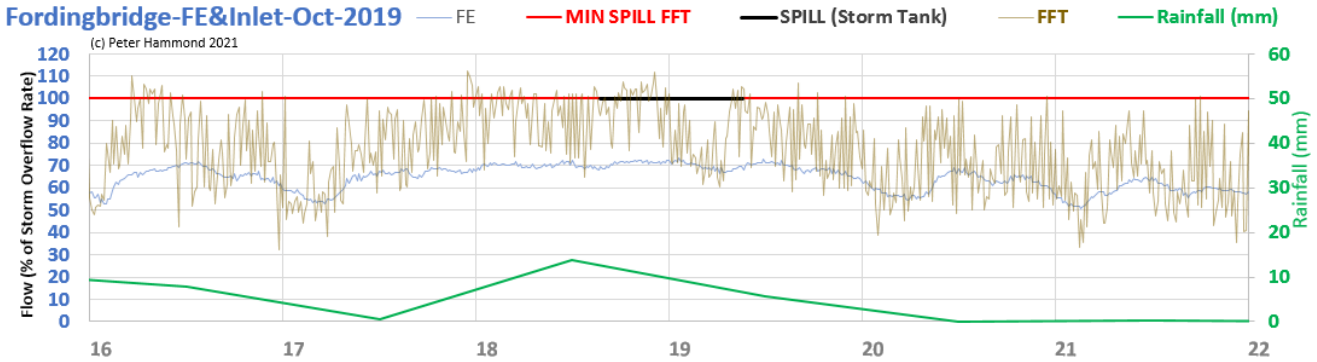


Figure 3: short declared spill of 17 hours or so for October 18th-19th 2019 at Fordingbridge STW

In the last two months of 2019, there are periods of flow that suggest there may have been other diversions of flow to the storm tanks and possibly undetected discharges to the River Avon (**Fig**. 4).

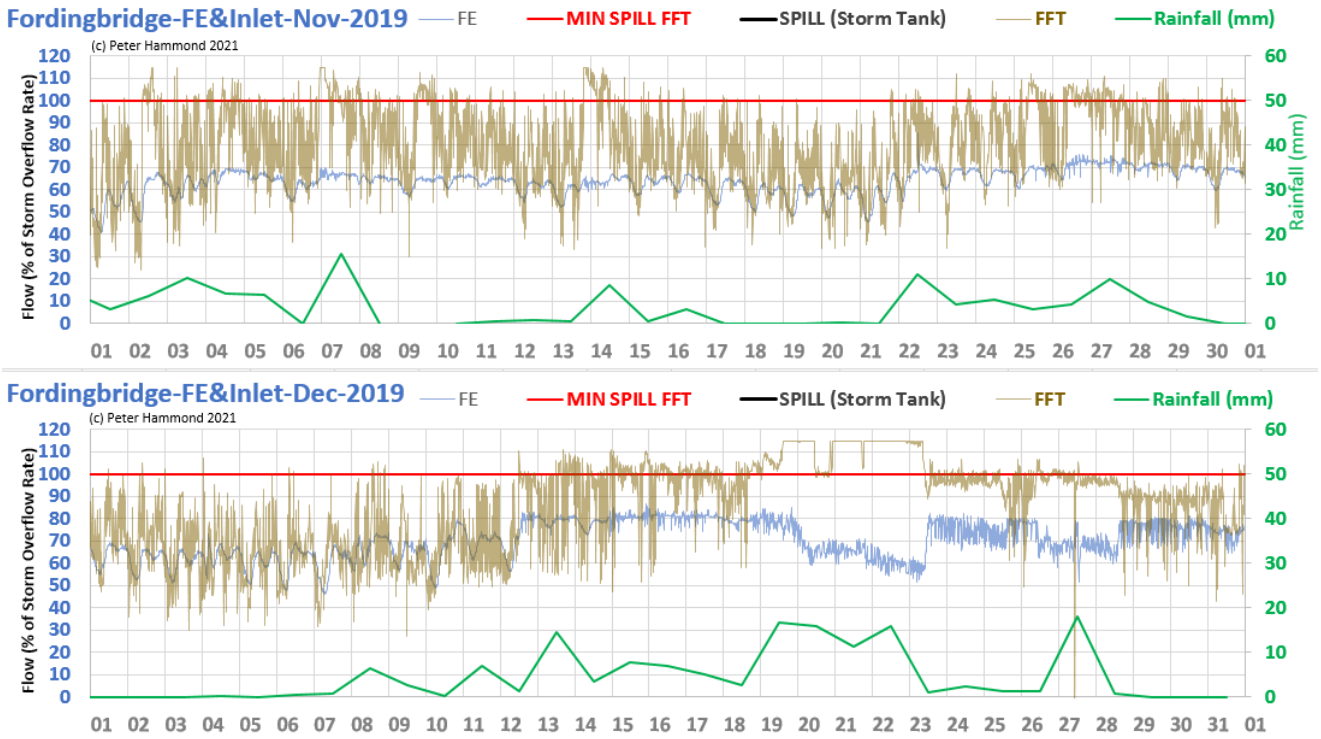


Figure 4: flows in Nov and Dec 2019 suggesting possible diversion to and maybe discharge from storm tanks

Fovant

PE	1,276
TOTAL SPILLS	
dry	early
5	1

Spilling hours	2017		2018		2019		2020		2021	
	SSO		SSO		SSO		SSO		SSO	
	NDA				1,339		1,787		*800*	
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	NDA	NDA	NDA	NDA	2		3	1		

SSO=Settled Storm Overflow PE=Population Equivalent

Fovant STW

Fovant STW discharges to the Fovant Brook which soon joins the River Nadder, a chalk stream approaching Salisbury from the west. As with other STWs in the area it suffers from groundwater infiltration and has received close attention from Wessex Water in terms of CCTV inspection and lining repairs in recent years.

2021

By the end of July 2021, spills had taken place for an estimated 800 hours over about 33 days of which 12 occurred with at most 1 mm of rainfall on the day and day before. Eight such days are shown in **Fig**. 1. The brown curve represents the rate of flow at the inlet of the works and the blue curve the final effluent (FE) leaving the works. The flattening of the inlet flow (FFT) suggests it has been measured after the diversion to the storm tanks during a spill and so reflects the flow to full treatment. This can be confirmed when the permit has been consulted.

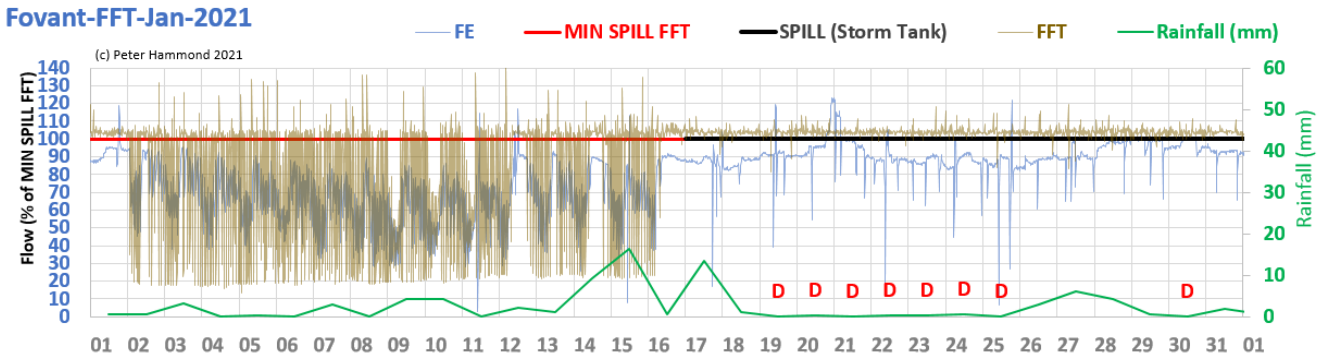


Figure 1: examples of likely spills in January 2021 occurring with at most 1 mm of rainfall on the day and day before

2020

Wessex Water declared spilling over 112 days of which, WASP believes, **1 was "early", 3 were "dry"** occurring with no rainfall on the day or day before and 25 involved at most 2 mm of rainfall on the day and day before. For example, in January 2020 there were spills on 6 days with at most 1 mm of rainfall on the day and day before (**Fig**. 2). Some flow and EDM data were not provided by Wessex Water for the early part of the year.

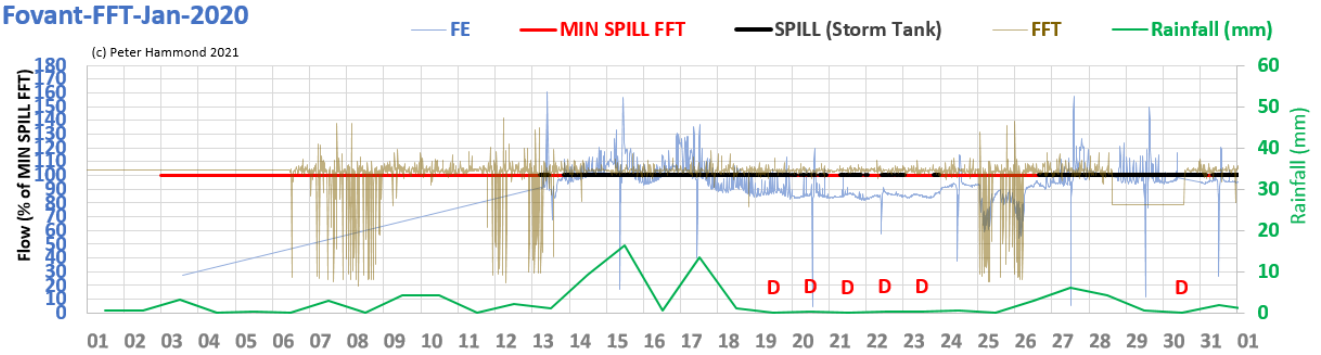


Figure 2: spills occurring at Fovant STW on 6 days when the rainfall was at most 1 mm on the day and day before

WASP believes there was a "dry" spillling day on April 9th (**Fig**, 3)

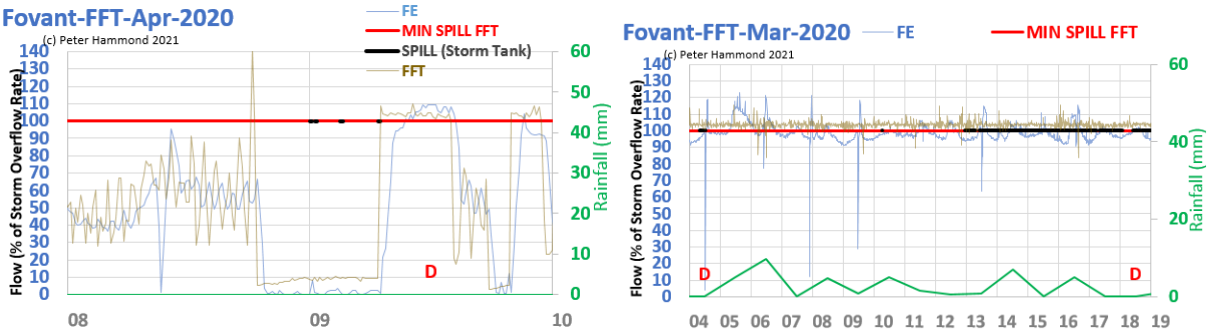


Figure 3: WASP believes there were 3 "dry" spilling days (Mar 4,18; Apr 9) and 1 "early" (Apr 8)

2019

Wessex Water declared 1,339 spilling hours to the EA for 2018 but the spill data provided in response to the EIR request suggests there were 2,017 spilling hours over 103 days of which **2 were "dry"** and involved no rainfall on the day or day before. Some 14 spilling days involved at most 2 mm of rainfall on the day and day before.

Shrewton

PE	1,916
TOTAL SPILLS	
dry	early
191	

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO		SSO		SSO		SSO	
	NDA								4,488	
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	NDA	NDA	37		31		61		62	

SSO=Settled Storm Overflow PE=Population Equivalent

Shrewton STW discharges into the River Till, a chalk stream that joins the River Wylye at Stapleford.

The storm overflow rate at Shrewton STW is 28 litres/sec, the minimum rate at which sewage must continue to be treated even when spills from its storm tanks are occurring. Its storm tank size is 170 cu m which is smaller than the EA's usual requirement to receive the storm overflow rate for 2 hours without overflowing - in this case 201.6 cu m.

2020

The chart below (**Fig**. 1) shows flow to treatment as a percentage of the storm overflow rate (blue curve), spill intervals (black horizontal segments) and rainfall (green curve) for 2020. The red horizontal line, at 100%, is a convenient check on compliance with the minimum treatment level during spills. Wherever there is a black segment, the blue curve should always be above the red line. There is an unspecified allowance by the EA of up to an 8% meter error and so the blue curve need only be above 92% strictly speaking.

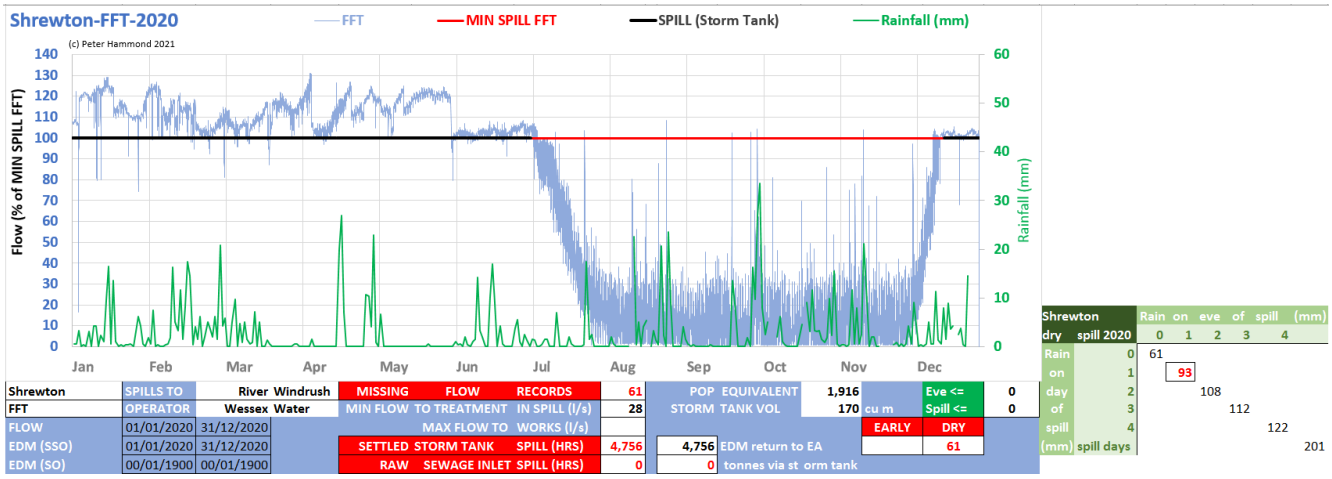


Figure 1: 2020 flow to treatment, spills from storm tanks and daily rainfall for Shrewton STW

Shrewton STW clearly spilled for pretty well the first six months of 2020 (and actually for December 2019 as well) with no or little respite. But none of this spilling was "early" in that the works continued to treat above the storm overflow rate (blue curve above the red line during the black segments). However, there were plenty of illegal "dry" spills. Wessex Water declared to the EA that Shrewton STW's storm tanks overflowed for 4,756 hours. This involved about 200 spilling days, of which **61 involved no rainfall on the day or day before** – clear breaches of permit requirements and hence illegal. Indeed, on more than 50% of the spilling days there was at most 2 mm of rainfall on the day or day before. These spills were due to accepted groundwater ingress or infiltration of the sewerage network in the Shrewton area. To give Wessex Water credit, they are the only water company to declare such data on their website in the form of a detailed list of storm overflows linked to groundwater. Indeed, Wessex Water more generally leads the water industry in its transparency on storm discharges as well as co-operation in providing flow and spill data, much of it online.

The long periods of spilling are reflected in historic data (**Fig**. 2) for Shrewton STW but also for other STWs in the area where data were provided. Fovant STW clearly suffers similarly and to a lesser extent Barford St Martin and Wishford Wilton Road STWs.

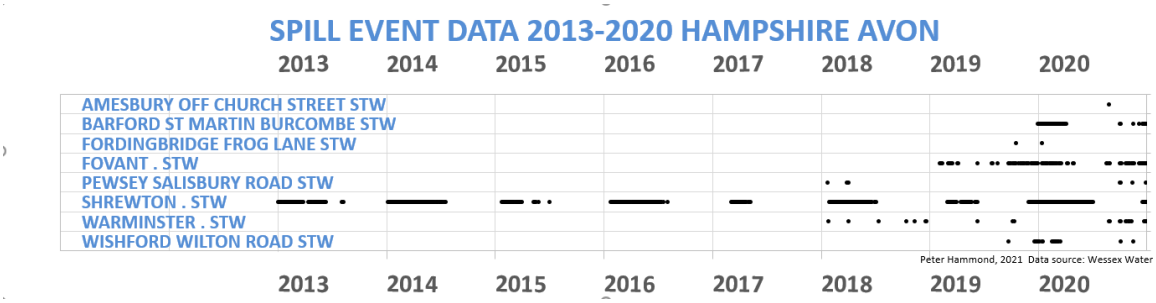


Figure 2: storm discharge interval at Shrewton and several other nearby STWs

Following an article in the Times Newspaper on 8th Nov 2021 presenting the total storm discharge hours for Shrewton that were derived from Wessex Water's data, the company's Head of Communications said

> "what is released from Shrewton is 99% groundwater - to suggest we are dumping sewage in the river for 5,110 hours is totally wrong"

The figure of 5,110 hours is based on Wessex Water's own data. To know that the storm discharges are 99% groundwater requires knowledge of how much sewage arrives at the STW, the discharge from the storm tanks and an idea of groundwater infiltration. But as far as the author is aware, neither of the first two are measured at Shrewton STW. So, it is unclear how such a statement can be made, never mind be so precise.

A more rational, scientific exchange between WASP, local fishing experts and Wessex's environment department has established Wessex Water's serious attempts to address groundwater issues both local to Shrewton STW and at other works it operates. Indeed, Wessex Water is the only water company to voluntarily apportion its CSO discharges to causes like groundwater infiltration and publish the results on its website. Other water companies should follow Wessex Water's lead.

It is possible to estimate underlying groundwater ingress during "dry" periods. For example, based on the data provided by Wessex Water, the average flow during a "dry" 10 day period 01/09/2018 to 10/09/2018 is shown as the blue curve in **Fig**. 3.

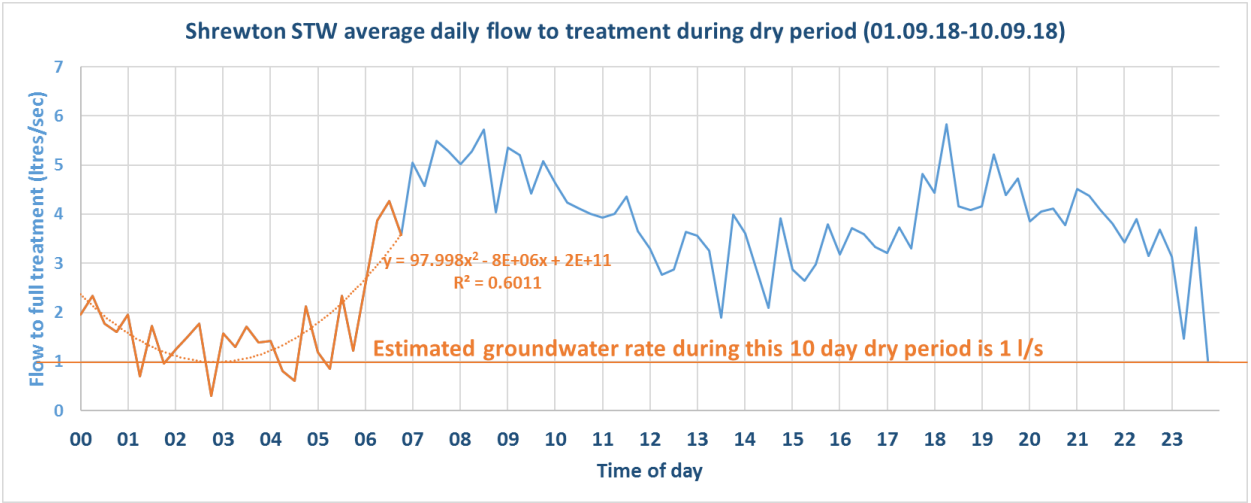


Fig 3: average 15-min flow to full treatment during the "dry" period 01.09.2018 and 10.09.2018

One way to estimate groundwater infiltration is to calculate the overnight low sewage flow point when, in theory, very little, if any, sewage is being generated domestically. It seems reasonable, also, to assume that Shrewton has little or no overnight industrial sewage production. For this "dry" 10 day period, by fitting a quadratic polynomial to the flow, an estimate was made of the low point as just before 3 a.m. when the sewage flow is about 1 litre/second.

On this average "dry" day, a total of 283 tonnes of (screened) sewage is passed to the treatment process. The estimated daily groundwater ingress is 86.4 tonnes (1 * 24 * 60 * 60 /1000) which is about 30% of the daily

sewage volume passed to full treatment. According to data on Wessex Water's website, in 2020, the total amount of sludge produced by Shrewton STW was 46 tonnes compared to a total of 628,799 tonnes of sewage subject to full treatment. This suggests the amount of sewage subject to treatment and the amount of effluent leaving the STW are almost identical as the difference, primarily sewage sludge, is extremely small by comparison.

The River Till is a winterbourne and "dry" for 5 months each year. A Google Earth Pro aerial view of the works and the River Till (**Fig**. 4) from July 18th 2020 shows a "dry" river bed upstream of Shrewton STW and flow downstream. It is possible, then, that during a dormant period of the River Till, immediately downstream of Shrewton STW the river is 100% effluent made up, on average, of 30% groundwater and 70% treated effluent. From **Fig**. 3, it is possible to say minimum exposure to treated sewage is at 3 a.m. (0% treated sewage; 100% groundwater) and maximum exposure (82% treated sewage; 18% groundwater) is at 8:30 am. These timings might be useful to guide river users to periods of least exposure to treated sewage during the summer.

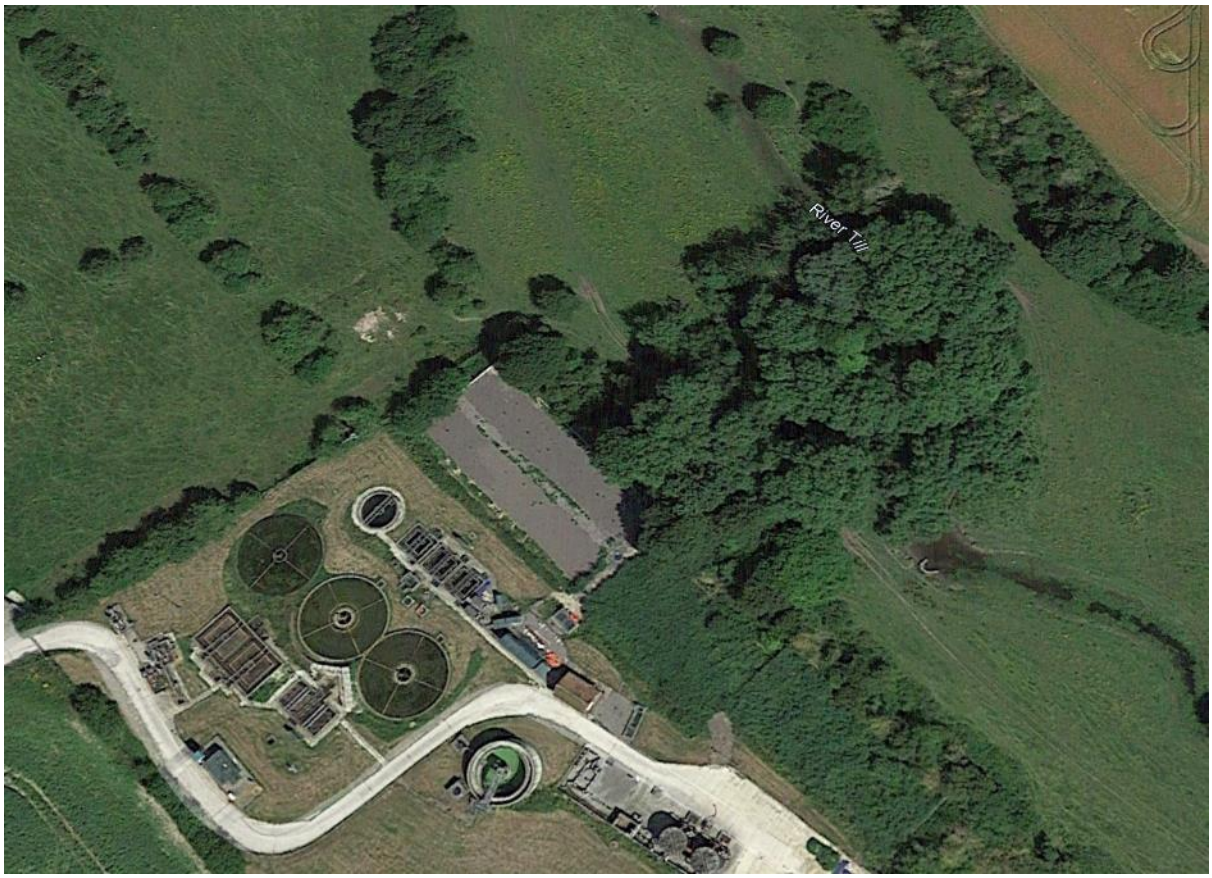


Figure 4: Google Earth Pro satellite image of Shrewton STW on July 18th 2021

2021

By late July 2021, Shrewton STW had already spilled for 187 spilling days of which, WASP believes, **62 involved illegal "dry" spills** and 112 involved at most 2 mm of rainfall on the day or day before.

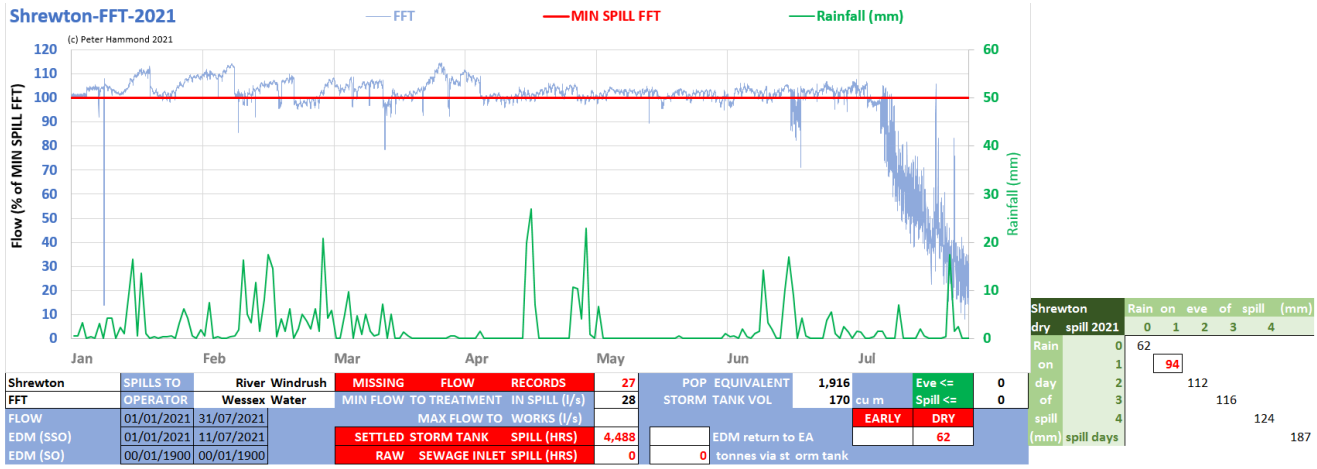


Figure 5: 2021 flow to treatment, spills from storm tanks and daily rainfall for Shrewton STW

Wessex did not provide official spill start/stop times for 2021 but WASP believes the works made an almost continuous spill for the first six months of the year of the order of 4,000+ hours (**Fig**. 5).

2019

For 2019, Wessex Water returned 2,522 spilling hours over 113 spilling days including **31 illegal "dry" spills** as well as 56 spilling days with at most 2 mm on the day or day before.

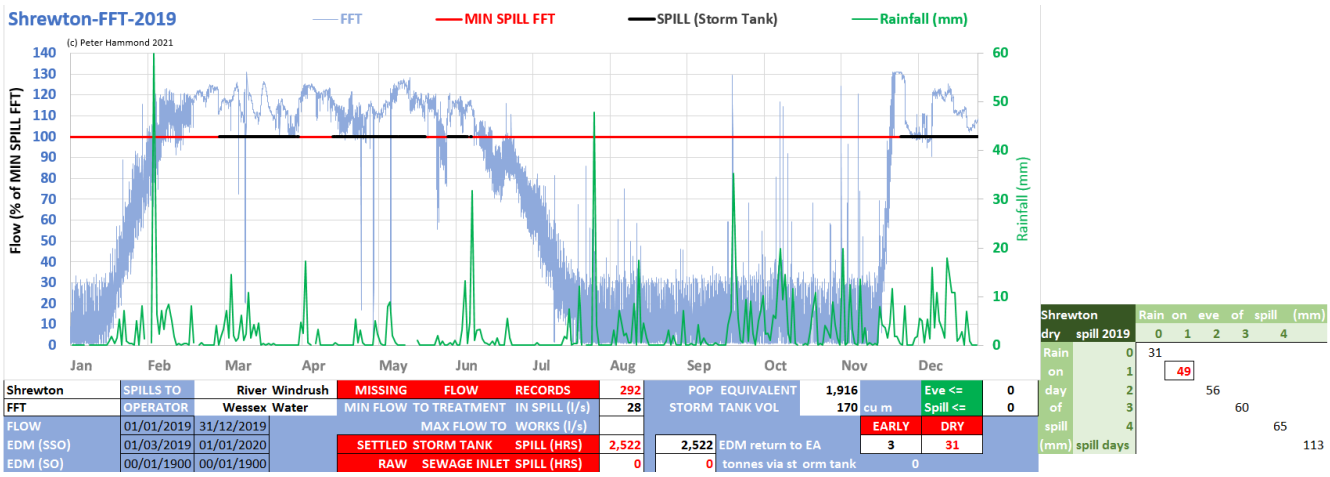


Figure 6: 2019 flow to treatment, spills from storm tanks and daily rainfall for Shrewton STW

In addition, there were a small number of early spills when the works failed to maintain its minimum treatment level while spilling. Two of these occurred in May 2019 (**Fig**. 7).

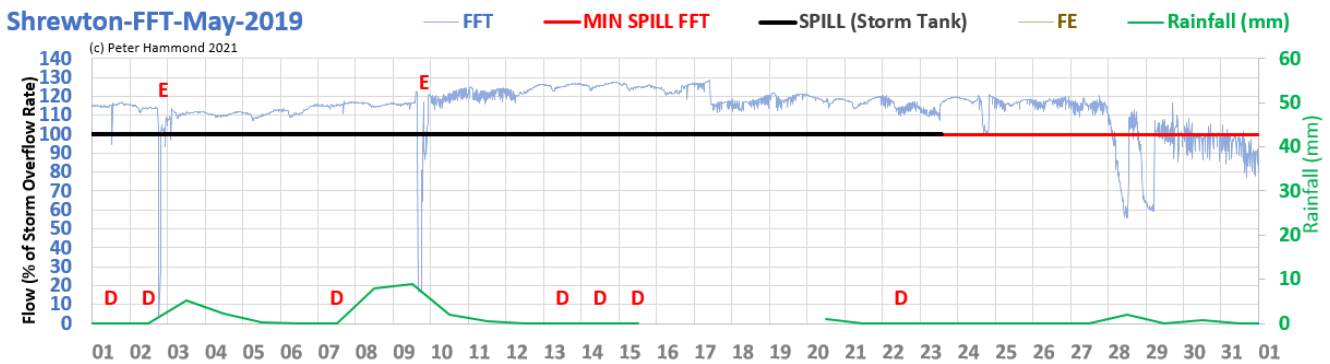


Figure 7: May 2019 flow to treatment, spills from storm tanks and daily rainfall for Shrewton STW

E and D annotations label spilling days that involve illegal early and "dry" spills

2018

For 2018, Wessex Water did not include Shrewton STW in its return of recorded spilling hours to the EA. However, the spill start/stop times provided in response to the EIR request correspond to 3,482 hours and are presented in the chart below (**Fig.** 6). WASP believes the 149 spilling days involved **37 illegal "dry" spills with no rainfall** on the day or day before and 75 involving at most 2mm of rainfall on the day or day before.

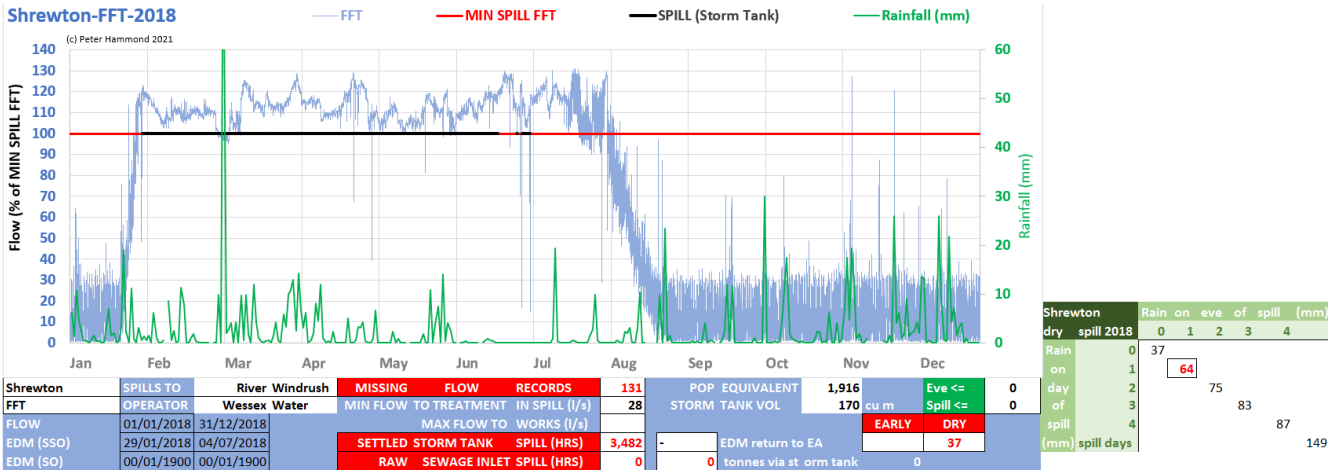


Figure 7: 2018 flow to treatment, spills from storm tanks and daily rainfall for Shrewton STW

WELSH WATER

Aberbaiden

PE	5,359
TOTAL SPILLS	
dry	early
0	22

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO		SSO		SSO		SSO	
	NDA		*>240*				380		NDA	
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	NDA	NDA		12				10	NDA	NDA

SSO=Settled Storm Overflow PE=Population Equivalent

Aberbaiden STW discharges into the River Usk which has been a focus of attention because it has the highest phosphate levels of all rivers in Wales. The River Usk plays an important role in attracting tourism as well as sustaining biological diversity. A recent report[42] by Natural resources Wales said that

> "The Usk is a high quality river for fisheries, supporting salmon, an internationally important population of twaite shad, lamprey, bullhead and brown trout." **Natural Resources Wales**

EDM spill data is available on Welsh Water's website for some STWs, but WASP was unable to find data for Aberdaiden STW.

2020

The EDM spill data provided by Welsh Water starts in late October and totals 23 spilling days of which, WASP believes, **10 involve "early" spills** (**Fig**. 1).

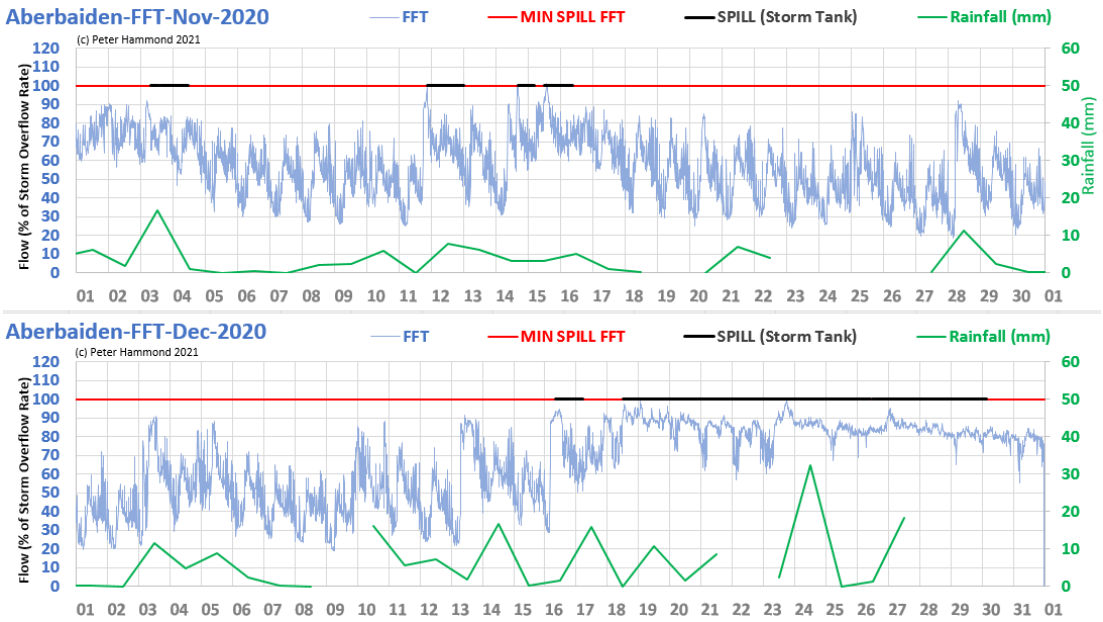


Figure 1: ten "early" spills at Aberbaiden STW (Nov 4th, 12th, 16th; Dec 17th, 22nd, 24th,25th,26th,28th,29th)

2018

There is no EDM data for 2018 but flow data for April 2018 suggests spilling between April 7th and April 24th.

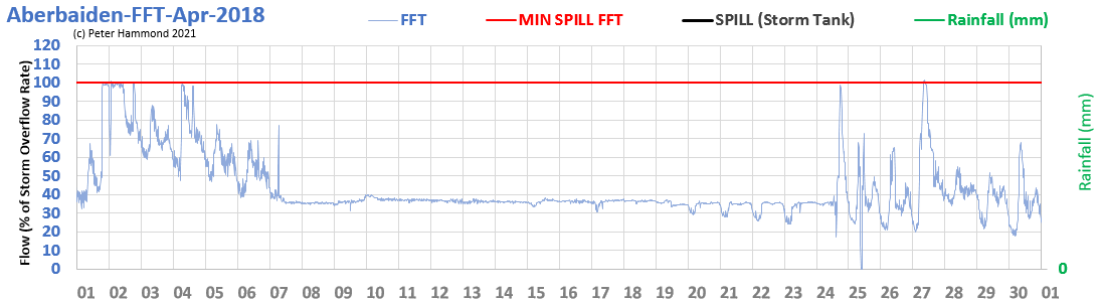


Figure 2: WASP believes there were at least 12 "early" spilling days in April 2018

[42] https://naturalresources.wales/media/679394/2016_updated_usk_catchment_summary_nrw.pdf

Brecon

PE	9,977
TOTAL SPILLS	
dry	early
10	41

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO		SSO		SSO		SSO	
	629				3,012		2,099			
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
		11			7	16	3	14		

SSO=Settled Storm Overflow PE=Population Equivalent

Brecon STW discharges to the River Usk and has recently functioned at between 95% and 100% of its capacity. The BBC Panorama programme *The River Pollution Scandal* attracted the attention of local politicians in April 2021 to the issue of sewage spills in Welsh rivers[43].

2020

In 2020, Brecon STW spilled for over 2,000 hours on 115 days of which, WASP believes, 3 involved "dry" spills and 14 involved "early" spills. The flow data provided was for final effluent so a threshold of 67% was used for the potential detection of an "early" spill. In fact, Brecon STW appears to make compliant spills almost always when the final effluent rate is about 80% of the storm overflow level as **Fig**. 1 demonstrates.

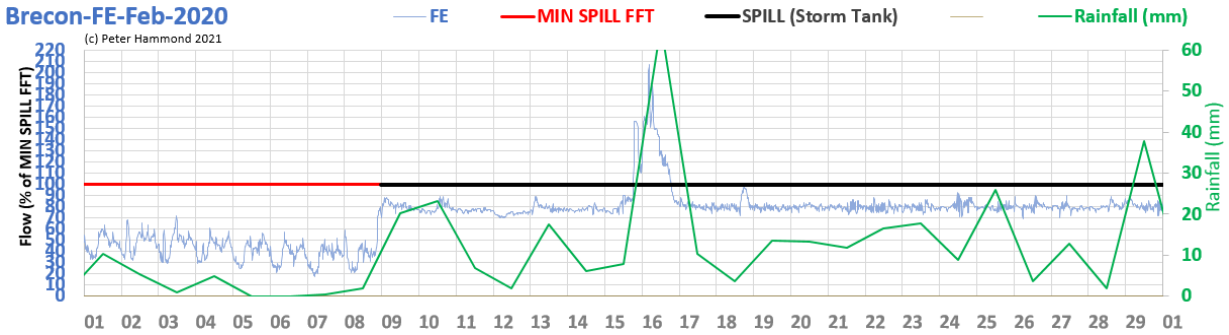


Figure 1: a long, compliant spill in February 2020 demonstrating an 80% effluent rate threshold

Early spilling days appear to occur at the end of compliant spills as the rainfall disappears or returns at low levels. This suggests groundwater infiltration is an issue (examples in charts in **Fig. 2**)

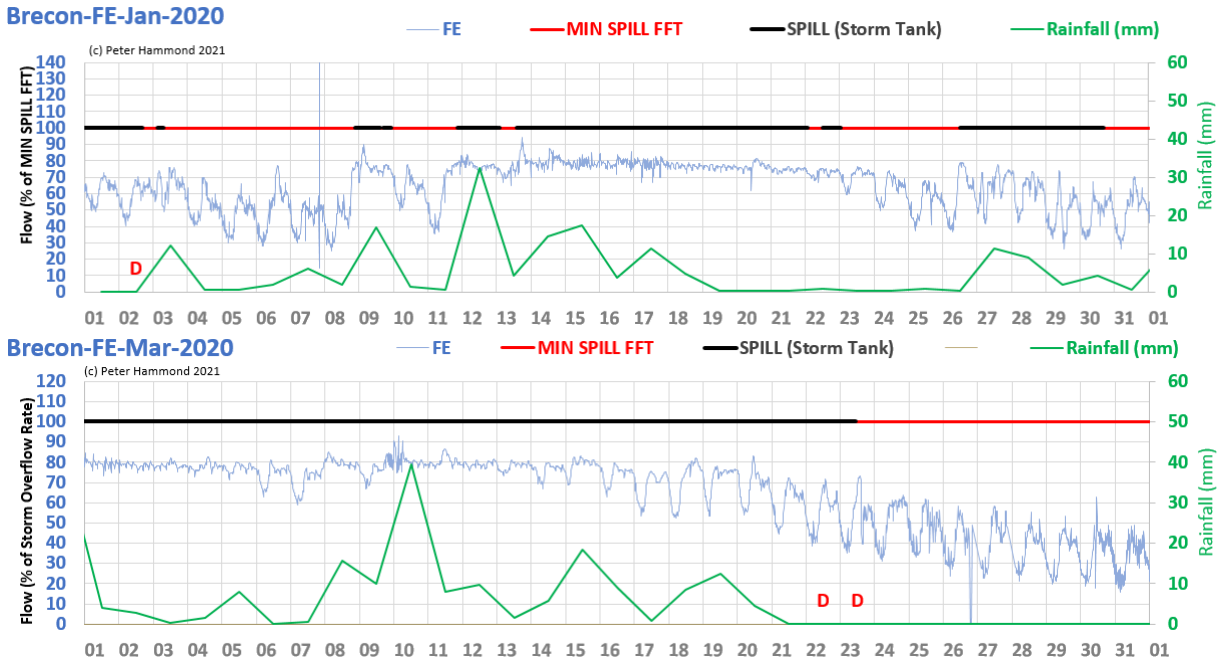


Figure 2: WASP believes there were "early" spills (Jan 27th, 30th; Mar 20th, 21st) and 2 "dry" spills in March

[43] https://www.fayjones.org.uk/news/fay-jones-mp-calls-nvz-be-halted-light-water-companies-pollution-rivers

2019

In 2019, the EDM data provided by Welsh Water corresponded to 3,012 spilling hours over 156 spilling days of which, WASP believes, 7 involved "dry" spills and 16 involved "early" spills.

As with 2020, compliant spilling appeared to occur consistently at a final effluent threshold of about 80% of the storm overflow rate. There was a long period of "early" spilling in late October to mid-November 2019 as the charts in **Fig**. 3 demonstrate, involving at least 16 consecutive "early" spilling days. There were also "dry" spills during this period. WASP also believes there were other "early" spills in 2019 but those described are the strongest candidates.

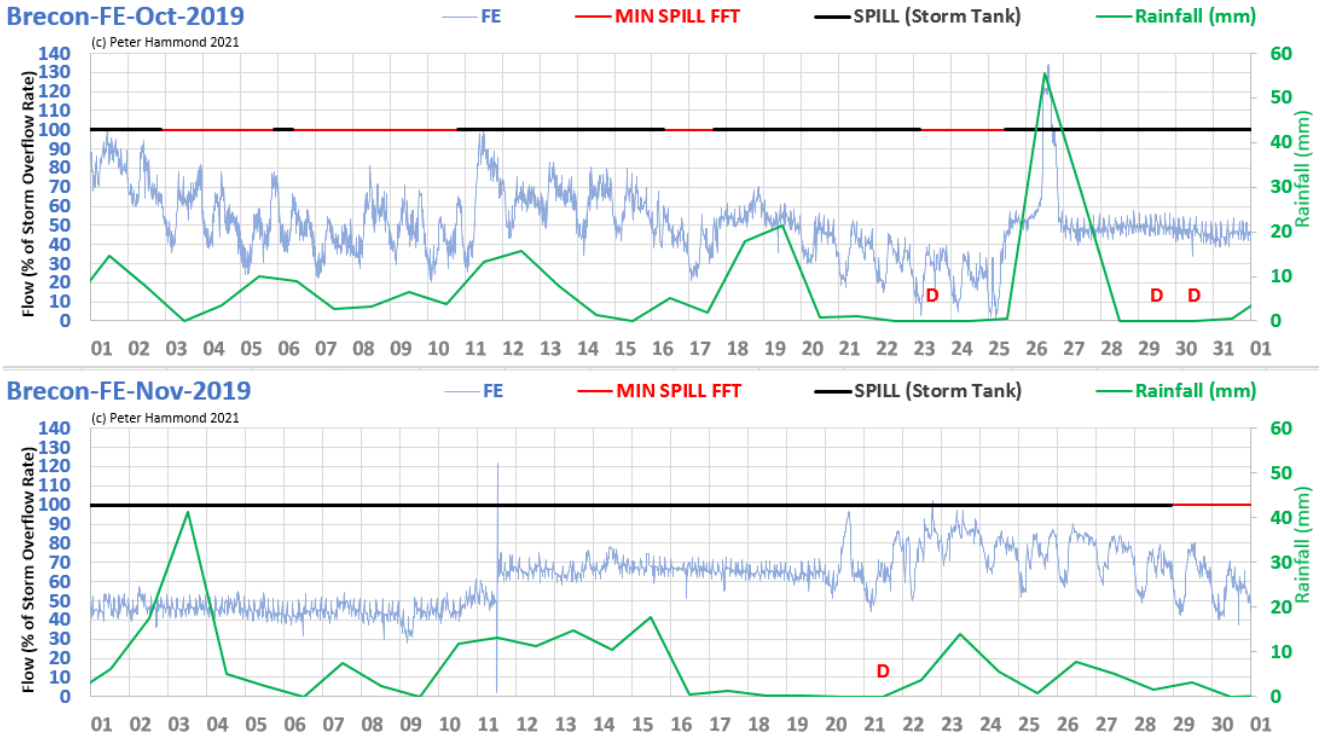


Figure 3: WASP believes there were at least 15 "early" spills and 4 "dry" spills in Oct-Nov 2019

2018

In 2018, the spilling appears to be compliant and occur at a threshold when the final effluent rate is about 80% of the storm overflow rate as the 2018 overview chart confirms (**Fig**. 4).

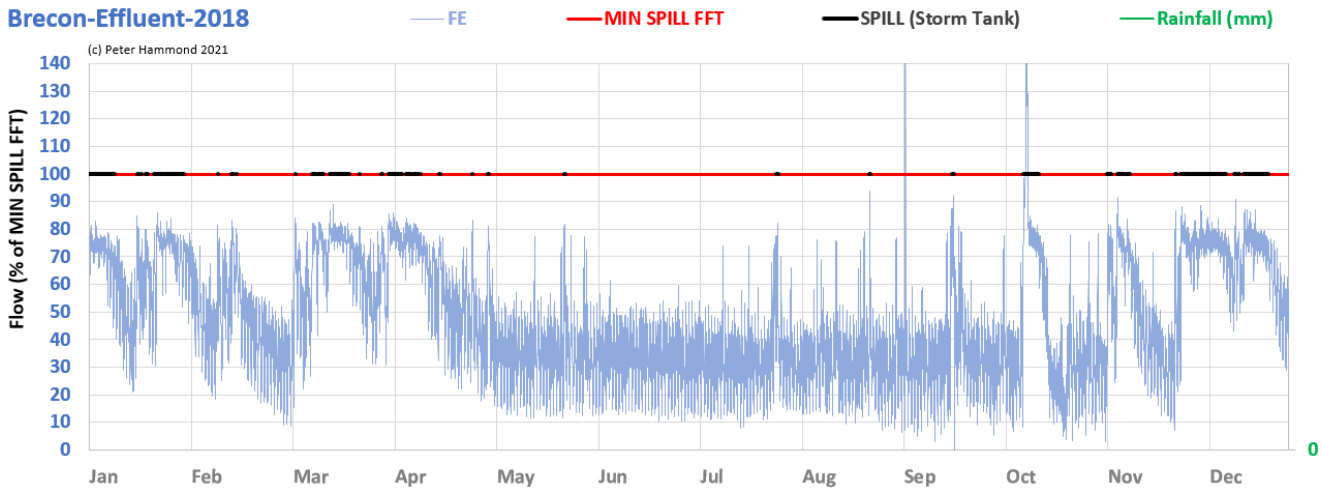


Figure 4: compliant spilling throughout 2018 at Brecon STW

2017

In 2017, there were fewer spilling hours and the majority of the spills were compliant. Exceptions, WASP believes, were in February and March when there appear to be "early" spills with the final effluent rate as low as 25% to 60% of the storm overflow rate.

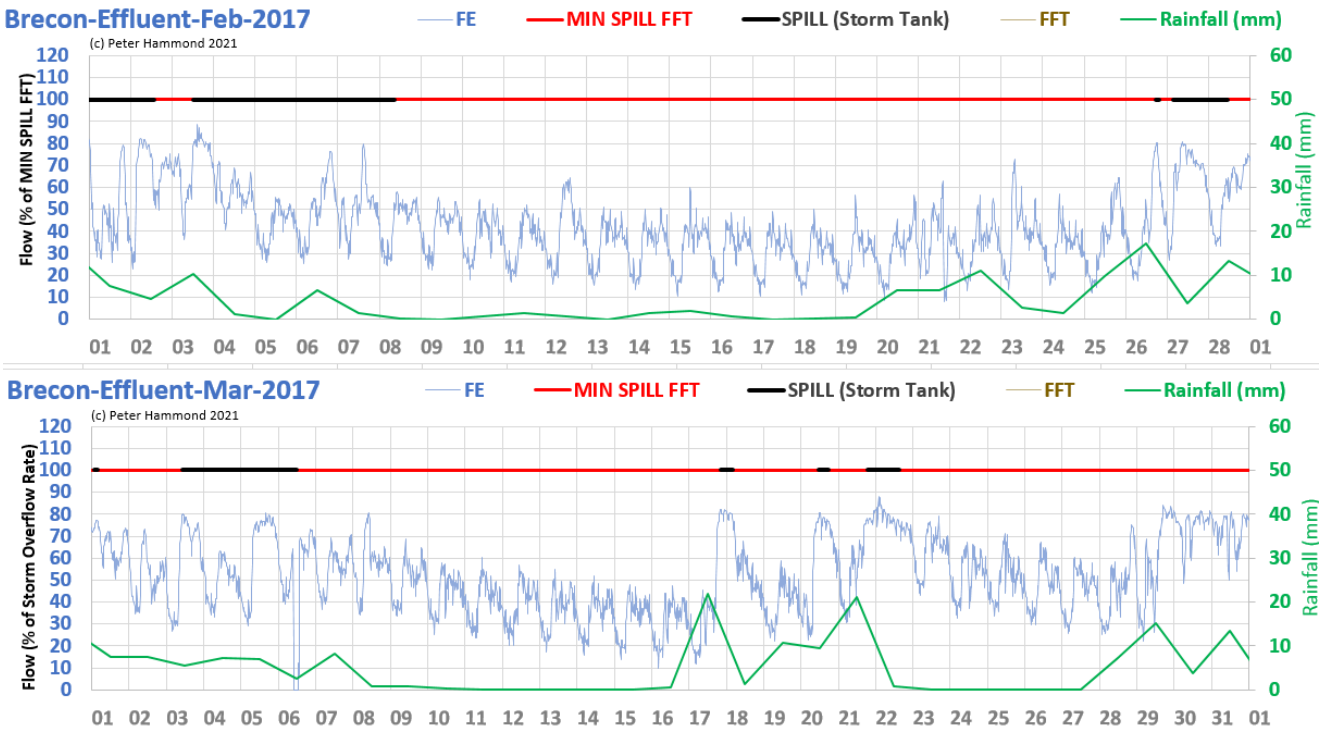


Figure 5: WASP believes there were "early" spills in February (1,2,4,7; 28th) and March (4-6)

Llanfoist

PE	16,784

TOTAL SPILLS	
dry	early
	14

Spilling hours	2017		2018		2019		2020		2021	
	SSO		SSO		SSO		SSO		SSO	
	PDQ		PDQ		*1,540*		*535*			
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
								14		

SSO=Settled Storm Overflow PE=Population Equivalent PDQ=Poor data quality

For the past 10 years, Llanfoist STW has had a loading of 88.3% to 100% of capacity. It discharges to the River Usk and according to a recent report by Guy Mawle of Afonydd Cymru "despite being a Special Area of Conservation, the future of the river Usk and its ecology looks bleak"[44]. High levels of phosphate from sewage treatment and from agriculture are considered a major problem requiring immediate intervention.

WASP was unable to find any EDM spill data on Welsh Water's website. The spilling hours reported above are derived from the spill start/stop times provided. The spill data looks unreliable as was suggested by Welsh Water.

2020

In 2020, Llanfoist STW had 58 spilling days of which, WASP believes, **14 involved "early" spills**. Llanfoist was one of the STWs studied by BBC Panorama and in response to EIR requests Welsh Water said that

> *… whilst the complete EDM data were provided for Llanfoist SWK for 2020 to date, it has been identified that the data for the period 08/02/2020 to 19/06/2020 is unreliable. Dwr Cymru's technical team have identified moisture damage to the EDM monitor which has resulted in false readings indicating a level in the spill channel while it was empty.* **Welsh Water**

WASP believes there were "early" spills in January as shown in **Fig**. 1.

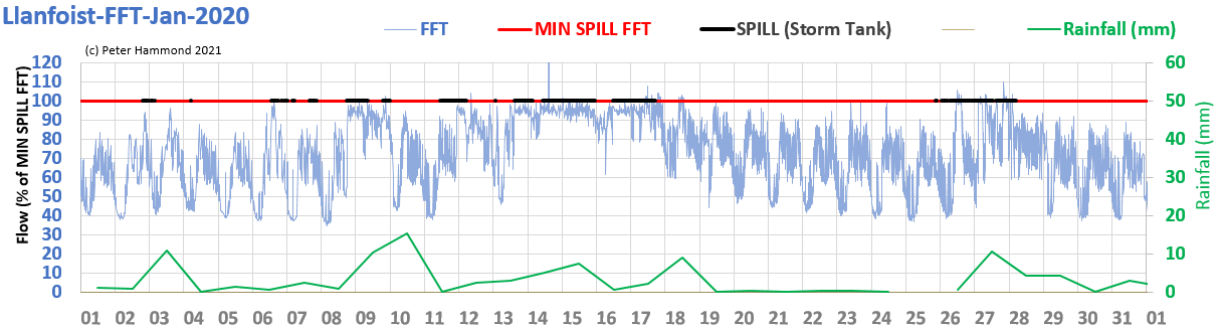


Figure 1: 4 WASP believes there were "early" spills at Llanfoist STW in January 2020 (3rd; 4th; 6th, 7th, 11th, 26th)

Accepting that the EDM spill data is considered by Welsh Water to be unreliable, there still appears to be a spill starting on Feb 15th /16th caused by 20+ mm of rainfall that is immediately followed by total loss of flow to full treatment data for 9 days (**Fig**. 2). Such a hiatus in flow to treatment needs further investigation.

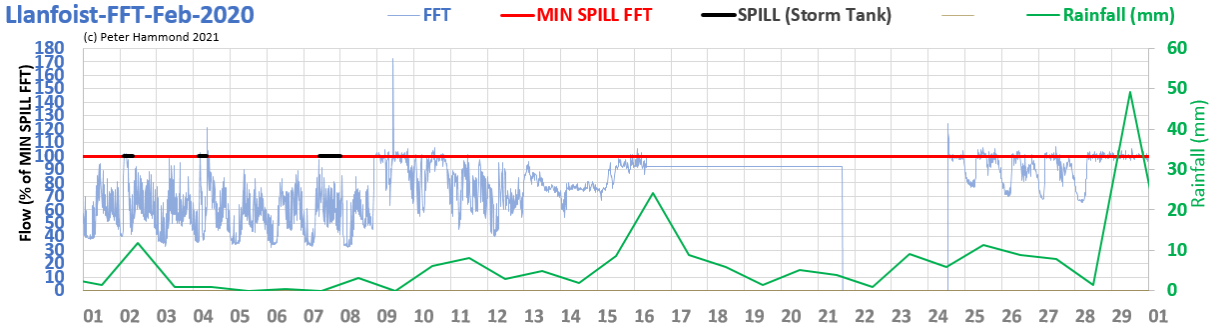


Figure 2: complete flow to full treatment data loss at Llanfoist STW in February 2020

[44] https://afonyddcymru.org/wp-content/uploads/2021/11/The-State-of-the-River-UskFinal.pdf

2019

EDM start/stop times look very unreliable and so little analysis has been undertaken.

2018

The EDM data provided by Welsh Water for 2018 looks unreliable as is illustrated for January (**Fig.** 3) where the flow to full treatment pattern is only consistent with the "detected" spill for parts of each spill interval.

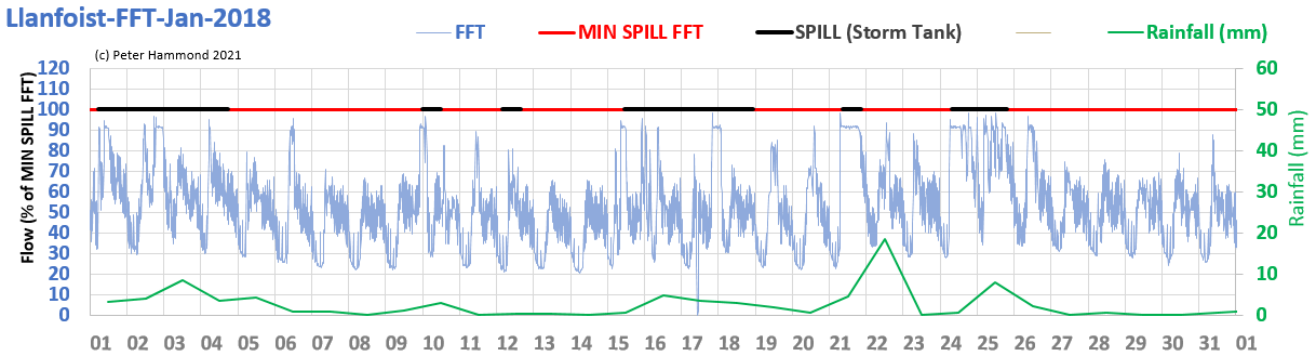


Figure 3: examples of unreliable EDM monitoring data at Llanfoist STW in January 2018

Machynlleth

PE	3,450
TOTAL SPILLS	
dry	early
1	11

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO		SSO		SSO		SSO	
					826		784		*325*	
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
				2			1	1		8

SSO=Settled Storm Overflow PE=Population Equivalent

Borth STW and Machynlleth STW are the most significant continuous discharges to mussel beds at Aberdovey with Machynlleth discharging approximately 4km upstream of the tidal limit and Borth discharging to the tidal reaches of the Afon Leri[45].

Machynlleth STW's loading has been 100% for over 10 years. It has two outlets, one to the River Dyfi (Outlet 1, Fig. 1) and another to the Garswin Ditch (Outlet 2, **Fig.** 1A). Five different forms of discharge are permitted.

Figure 1: A: Machynlleth STW's outlets;

Outlet 1 (River Dyfi)

FE final treated effluent (permit: CG0083001 1)

SSO settled storm overflow via storm tanks (permit: CG0083002 01)

Outlet 2 (Garswin Ditch)

SO raw sewage (permit: CG0083101/PAN-010564)

EO emergency overflow (permit: CG00830-04)

BEO biologically treated effluent in emergency (permit: CG0083003 01)

B: 5 forms of discharge from Machynlleth STW

It was not clear in the NRW storm discharge permit if the inlet meter solely measures wastewater arriving at the works or whether when the storm tanks' contents are pumped back for treatment they pass again through the inlet meter and thus are double counted. In response to a follow-up query, Welsh Water said

> *the inlet flow meter will not double count any return flows which have entered the storm tank as they are only counted on passing forward past the storm weir. However, any sludge decant flows or humus flows are returned to the inlet well and pumped back through the process therefore these flows will be double counted. These return flows are controlled so they do not return to the inlet well in storm conditions.* Welsh Water

This needs to be kept in mind when interpreting the ratio of the weekly inflow to the weekly effluent flow (**Fig**. 1) which is a rough estimate of the proportion of arriving wastewater that receives treatment. It may explain the relatively low proportions of treatment at 50%.

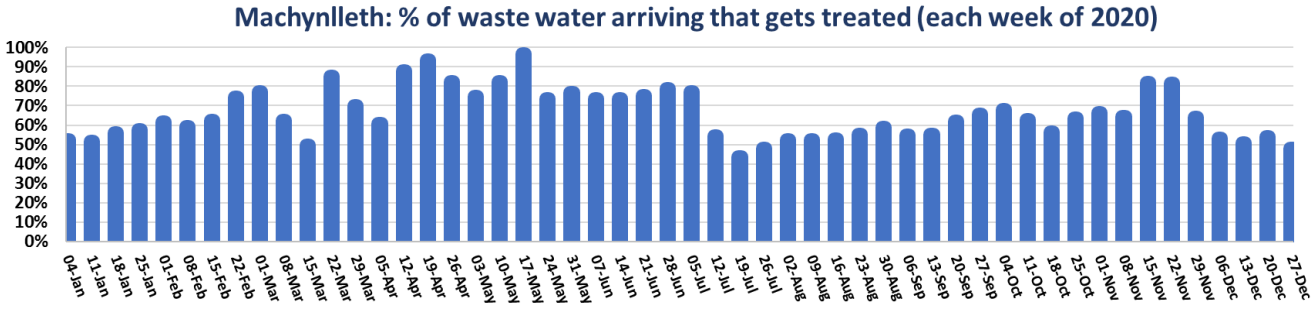


Figure 2: proportion of wastewater treated for each week of 2020

Generally speaking, Machynlleth STW does not appear to spill "early" or "dry" regularly but it has frequent intervals when either or both of the inlet flow and effluent flow are zero for significant periods.

[45] https://www.cefas.co.uk/media/ioxlhuyf/final-dovey-estuary-sanitary-survey-report-2010.pdf

2021

The EDM data provided by Welsh Water suggest that **8 "early" spills** occurred. In contrast, the inlet and outlet flow patterns suggest they are false positives (**Fig**. 3) and undermine the reliability of the EDM device.

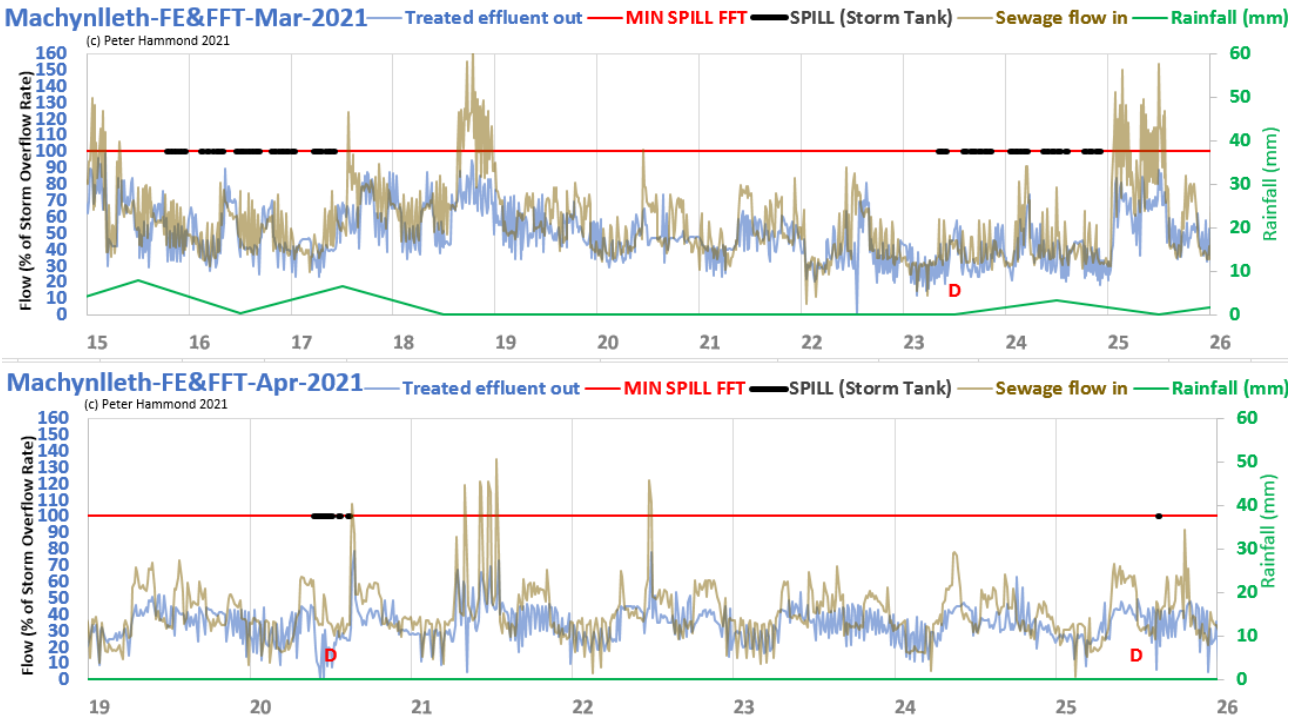


Figure 3: possible false positive spills flagged by spill monitoring in March and April 2021

However, there are anomalies in the flow data that need further investigation. On January 13th, in the middle of spilling, the inlet and the effluent flow are negligible for 3-4 hours. On February 26th, in the middle of spilling, both flows are negligible for up to 7 hours. From previous observation of similar events, these data suggest there was equipment failure and there may have been associated spills of untreated sewage.

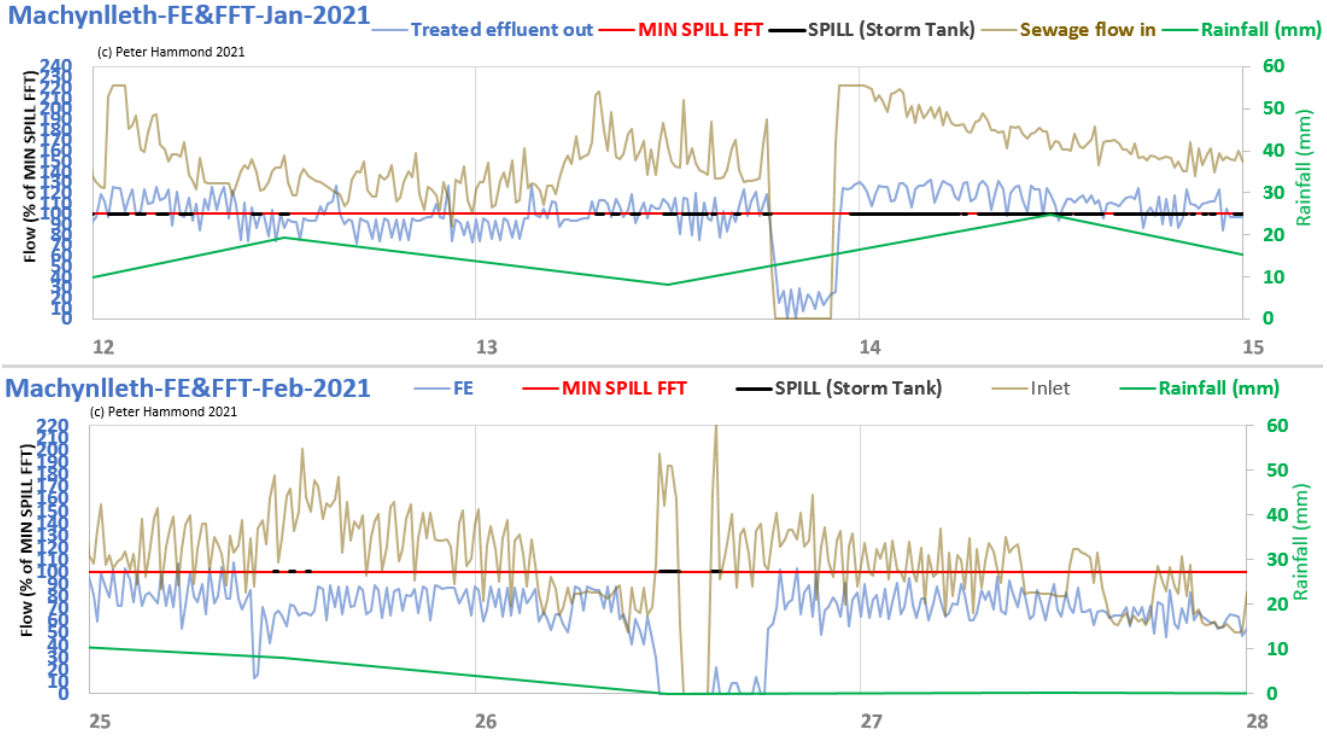


Figure 4: losses of inlet and effluent flow on Jan 13th and Feb 26th at Machynlleth STW in 2021

2020

Machynlleth STW spilled for over 81 days in 2020. Assuming the EDM data provided are more accurate than that for 2021, WASP believes there was **1 "dry" and 1 "early"** spill. Once again, there are unusual, sudden losses of flow such as the 22-hour hiatus on October 25th-26th (**Fig**. 5). It cannot be that both meters failed for the precisely the same interval. Was there an undetected spill?

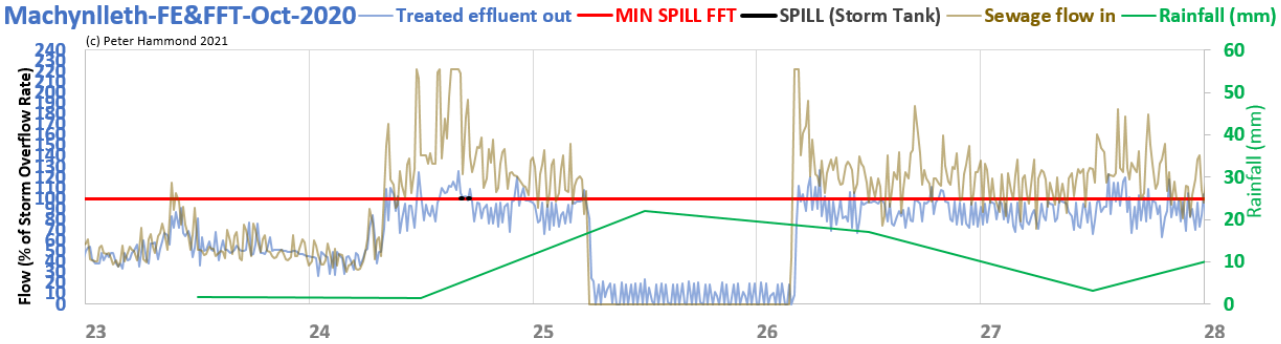


Figure 5: loss of inlet and effluent flow for 22 hours on Oct 25th-26th at Machynlleth STW in 2020

2019

In 2019, there were many suspicious gaps in flow data – in April (**Fig**. 5), August (**Fig**. 6), September (**Fig**. 6), and October (**Fig**. 7). Another pattern that emerges is a frequent cut off of FFT at 220% of the storm overflow rate. From previous experience, this suggests the flow has hit the maximum the flow meter can register.

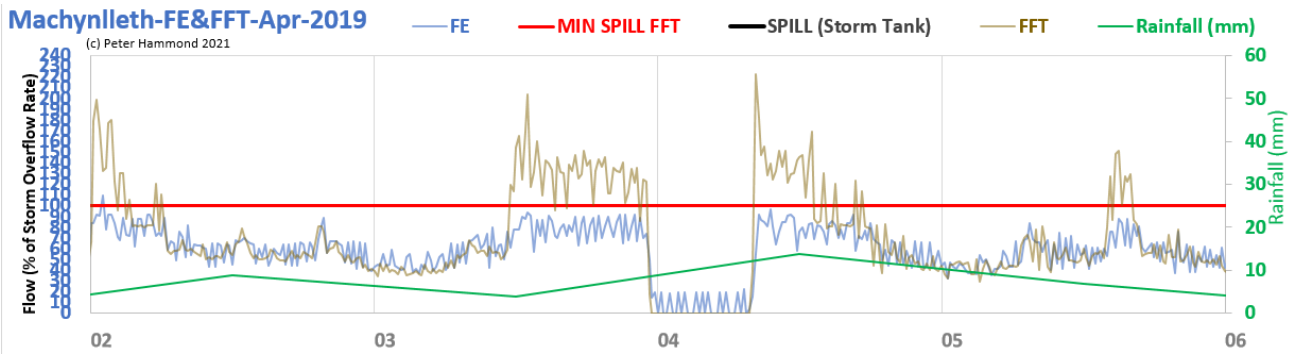


Figure 6: total loss of inlet and effluent flow data over 8 hours on April 4th 2019

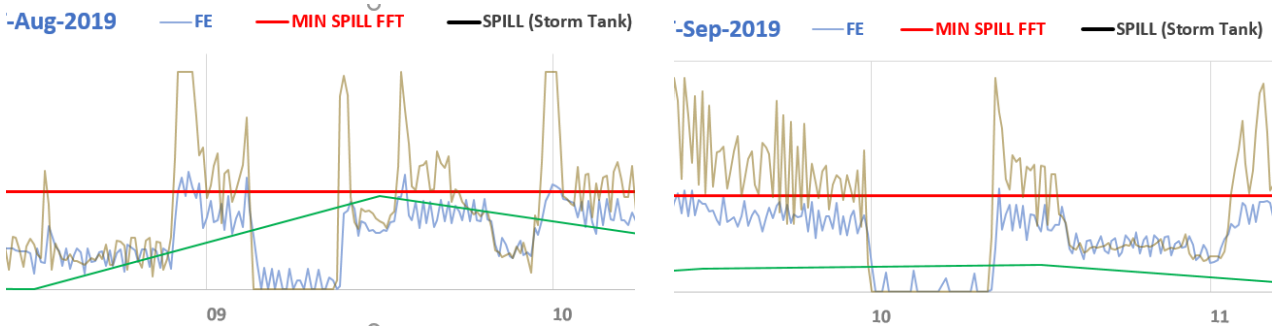


Figure 7: loss of inlet and effluent data on August 9th and also on September 10th

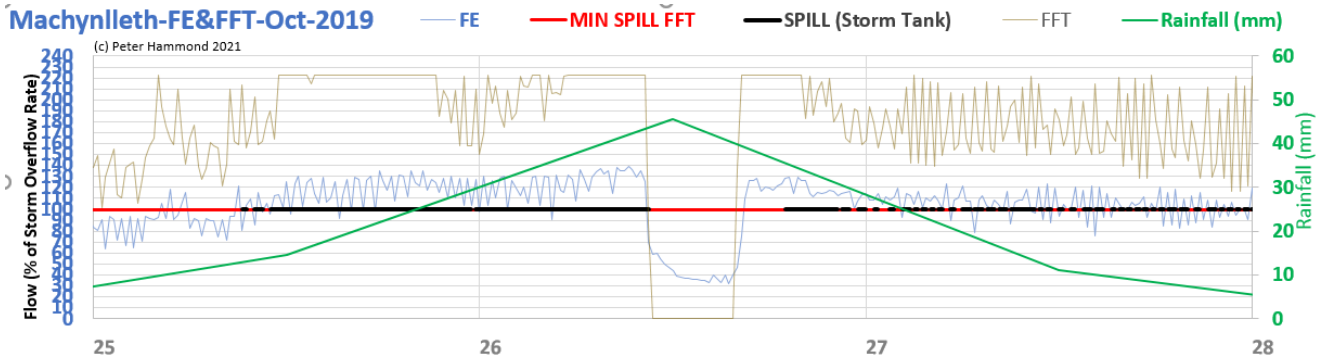


Figure 8: loss of inlet and partial loss of effluent data on August 9th 2019 in the middle of a spilling series

2018

In 2018, there are further data gaps. For example, on March 14th 2018 there was a dramatic loss of flow data immediately after an apparent period of spilling with the effluent rate at about 60% of the storm overflow rate. WASP believes, therefore, that there were at least **2 "early" spilling days** in March 2018.

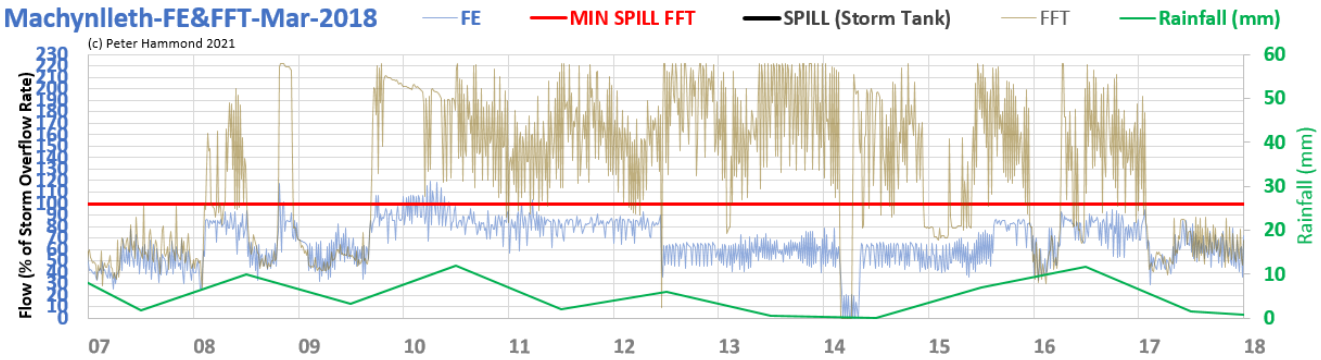


Figure 9: WASP believes there were at least 2 "early" spills in March 2018

What caused the step change and reduction in effluent flow on 12th March 2018, followed by the almost total loss of effluent on 14th March 2018? Were there equipment failures?

YORKSHIRE WATER

WASP has investigated 7 Yorkshire Water STWs: Ben Rhydding, Burley, Danesmoor, Ilkley, Otley, Pickering, Pool. Five of these works discharge into the River Wharfe, the first UK river to have a section designated as requiring protected Bathing Quality Status.

Ben Rhydding

PE	4,433
TOTAL SPILLS	
dry	early
9	7

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO		SSO		SSO		SSO	
	NDA				2,597		2,398			
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	NDA	NDA	NDA	NDA	5	1	4	6		

SSO=Settled Storm Overflow PE=Population Equivalent

Ben Rhydding's storm tank, at 451 cu m, is considerably larger than the permit requirement (309 cu m) to hold 2 hours' worth of flow at the storm overflow rate of 42.9 l/s.

2020

In 2020, Ben Rhydding spilled over 149 days which include, WASP believes, at least **6 early spills**.

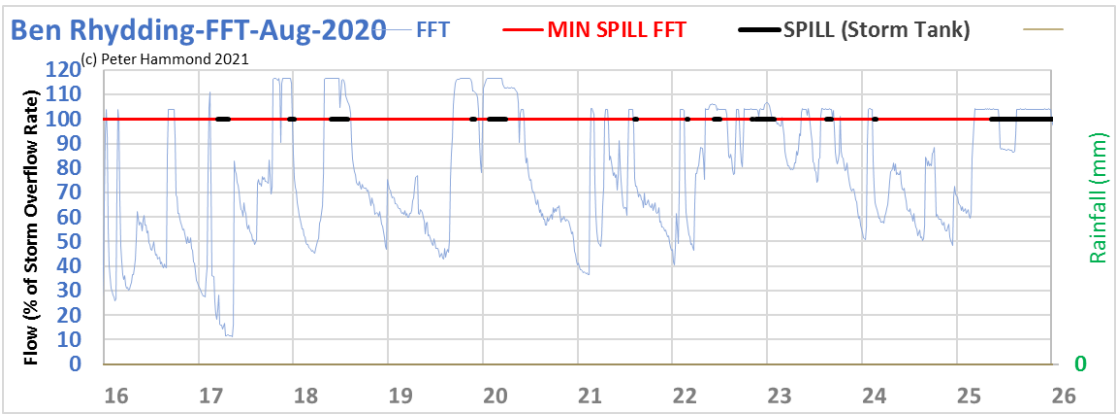


Figure 1: Examples of early spills in February 2020 (17th, 21st, 22nd, 24th, 25th)

2019

No EDM return was made for Ben Rhydding by Yorkshire Water despite the provision of EDM data to WASP totalling 2,597 hours over 131 spilling days. **One spill was early** and **5 were "dry"** (examples in **Fig**. 2).

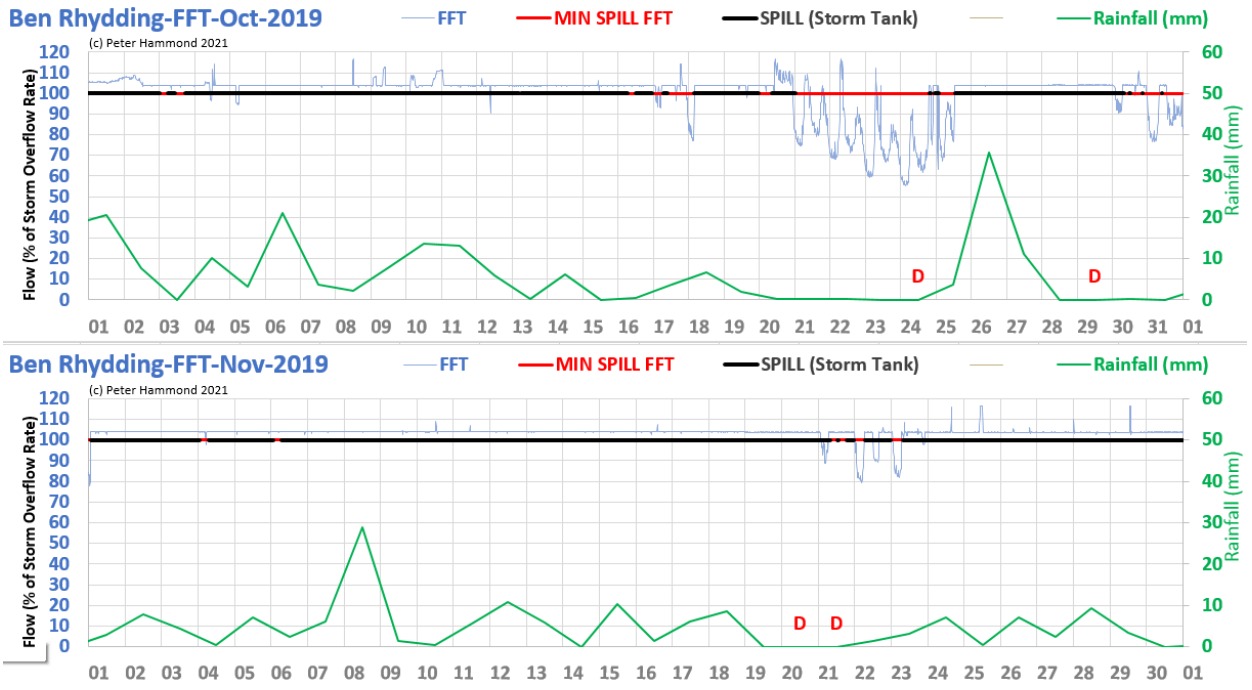


Figure 2: WASP believes there were 4 "dry" spills in Oct-Nov 2019 at Ben Rhydding STW

16 spilling days involved at most 1 mm of rainfall on the day and day before as illustrated by **Fig**. 3 for 7 days in December during an 18-day spill.

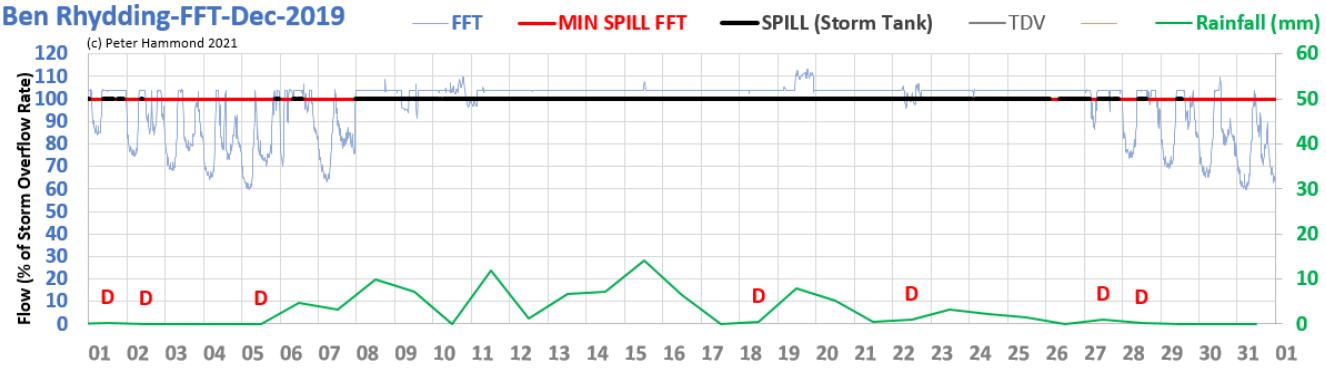


Figure 3: examples of spills occurring when the was up to 1mm of rainfall on the day or day before

Burley

PE 13,232

TOTAL SPILLS	
dry	early
14	2

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO		SSO		SSO		SSO	
	NDA						3,081		*2,361*	
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	NDA	NDA	NDA	NDA			7		7	2

SSO=Settled Storm Overflow PE=Population Equivalent

2021

The EDM spill data provided by Yorkshire suggests that already by May 21st 2021, Burley STW had over 107 spilling days which, WASP believes, **involved 2 early** and **7 "dry"** spills. Examples are shown in **Fig**. 1.

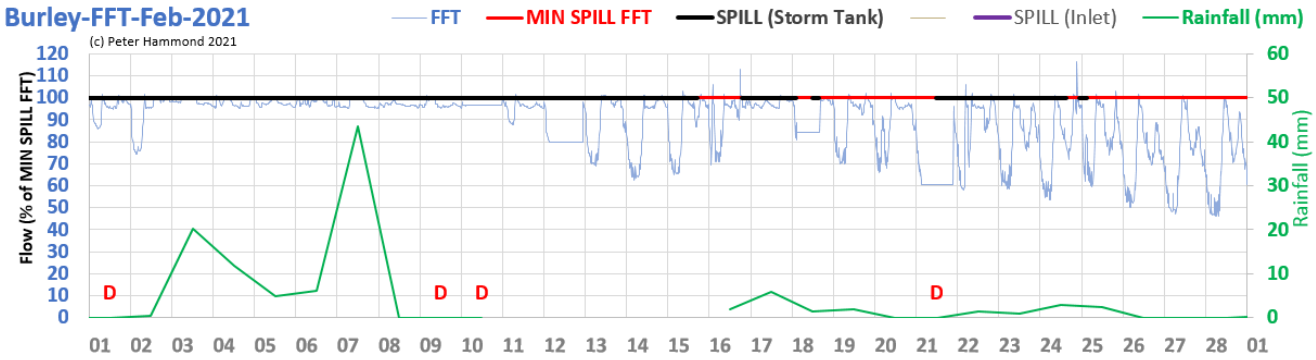


Figure 1: WASP believes there were 4 "dry" and 2 "early" (18,24/25) spills at Cold Hiendley STW in Feb 2021

2020

Yorkshire Water's EDM return for 2020 was for 3,163 spilling days of which, WASP believes, **7 were "dry"** involving no rainfall on the day or day before and 29 involved at most 2 mm of rainfall on the day and day before (examples in **Fig**. 2).

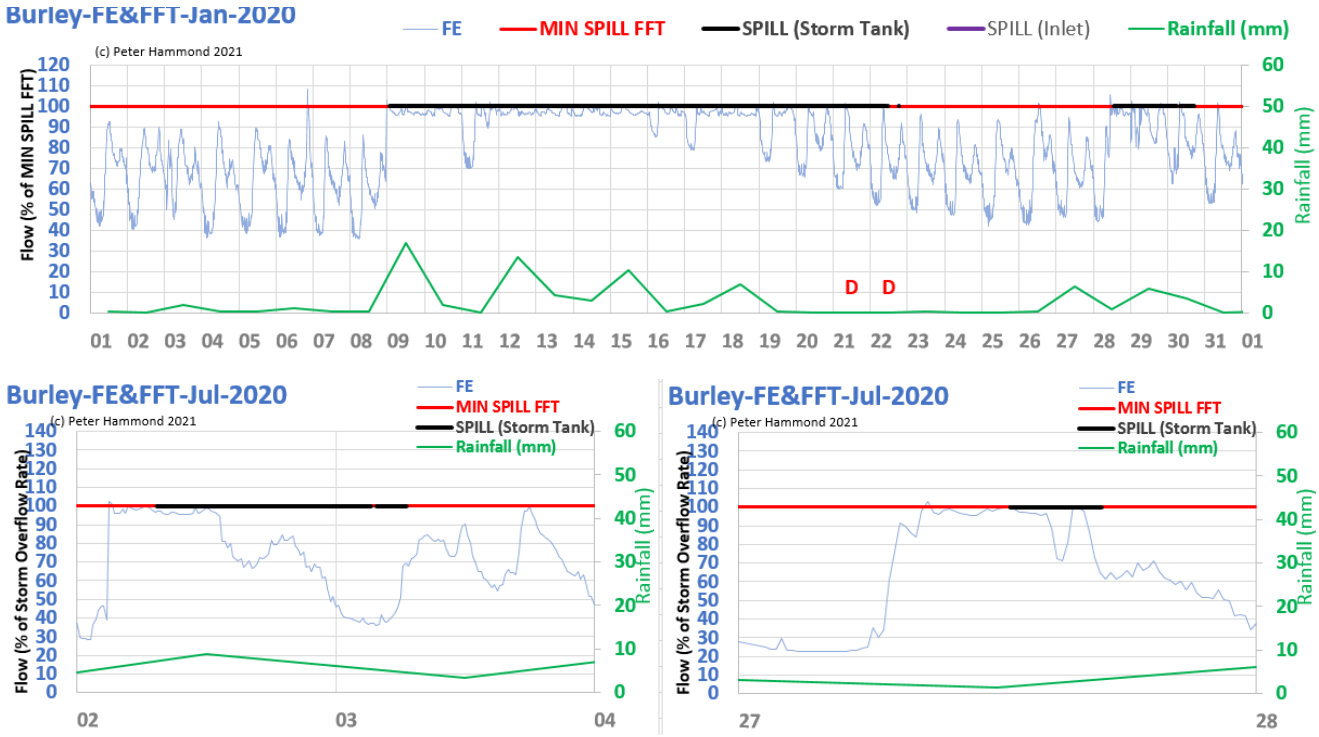


Figure 2: WASP believes there were at least 2 "dry" (Jan) and 2 "early" (Jul 3,27) spills at Burley STW

Cold Hiendley			2017		2018		2019		2020		2021	
PE	5,276	Spilling hours	SSO		SSO		SSO		SSO	*WASP*	SSO	
TOTAL SPILLS			NDA	NDA			*66*		48.51	*160*		
dry	early	Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
3	23			5				10		3	3	5

SSO=Settled Storm Overflow PE=Population Equivalent

Cold Hiendley STW is very unusual in that it is one of only two STWs in England, and on the EU WWTD database, that discharges to a reservoir. Cold Hiendley Reservoir is not part of clean water production, its primary function is to maintain levels in the Barnsley Canal. It is used for fishing but swimming is forbidden.

Figure 1: Google Earth satellite image of Cold Hiendley STW adjacent to the reservoir

Another Google Earth satellite image (May,2009) may have captured the build up sewage pollution to the west of the works as a result of a spill (**Fig**. 2).

Figure 2: Google Earth satellite image from May 2009 that may have captured bankside detritus from a spill at the STW

In response to an EIR for flow data from 2009 and EDM spill data from installation, Yorkshire Water provided flow to treatment and final effluent data from Jan 2012 and Dec 2014 respectively. The EDM data provided was from 2018 but on inspection looks completely unreliable and incompatible with the flow data. This may explain why Yorkshire Water did not submit EDM reports for 2018 and 2019. The submission of 48.51 spilling hours over 352 days to the EA is not consistent with the data supplied to WASP amounting to 163 spilling hours over 352 days. In any case, the EDM data looks to WASP to be worthless. The flow data provided is almost as bad as the EDM data in that the flow to treatment (FFT) and the treated final effluent data (FE) have frequent losses, are only occasionally in agreement (without scaling). WASP would ordinarily not pursue

analysis of this STW but given it is discharging into static water that support a fish and bird population WASP would have expected the flow and EDM record keeping to be of a much higher standard than normal.

In 2015, the twin flow records begin in close harmony (**Fig**. 3).

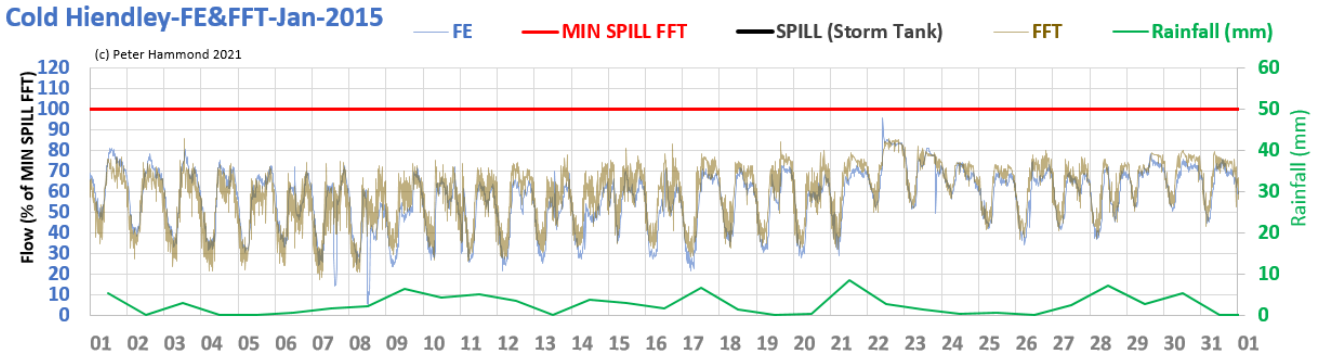


Figure 3: FFT and FE flow data in Jan 2015 at Cold Hiendley STW are in close harmony

This continues until August 2015 when the FFT flow drops to zero for the rest of the year while the FE behaves in an expected fashion. When FFT returns in January 2016, the two flows have a similar shape but there is obviously a scaling issue with FFT (**Fig**. 4). (WASP believes the STW did spill in the first part of Jan 2016)

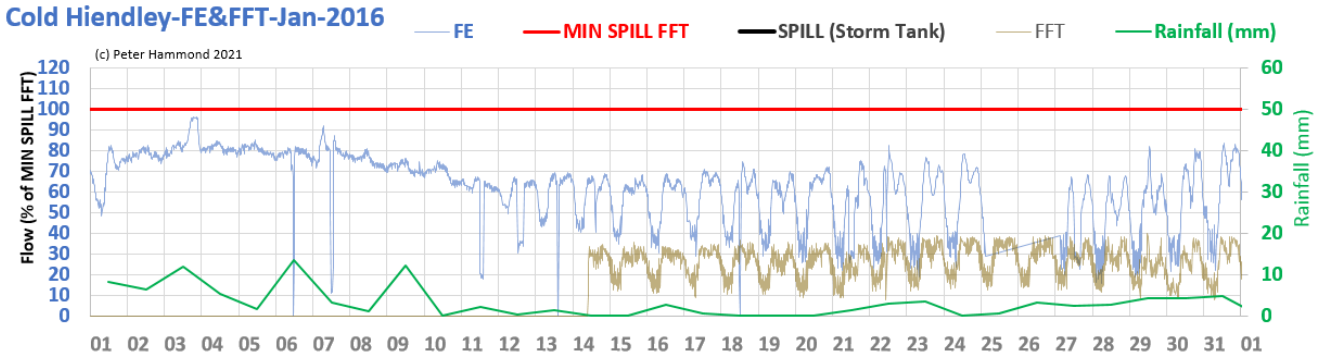


Figure 4: continued discrepancy in scale of FFT and FE flows at Cold Hiendley STW in 2016

The scale differences between FT and FE continue to be present/absent intermittently for the rest of 2016 as is the loss of one or both flows for lengthy periods.

2017

The scaling inconsistency for FFT and FE continued throughout 2017. In March 2017, WASP believes the works spilled "early" on at least 4 days between Mar 3rd and Mar 8th (**Fig**. 5).

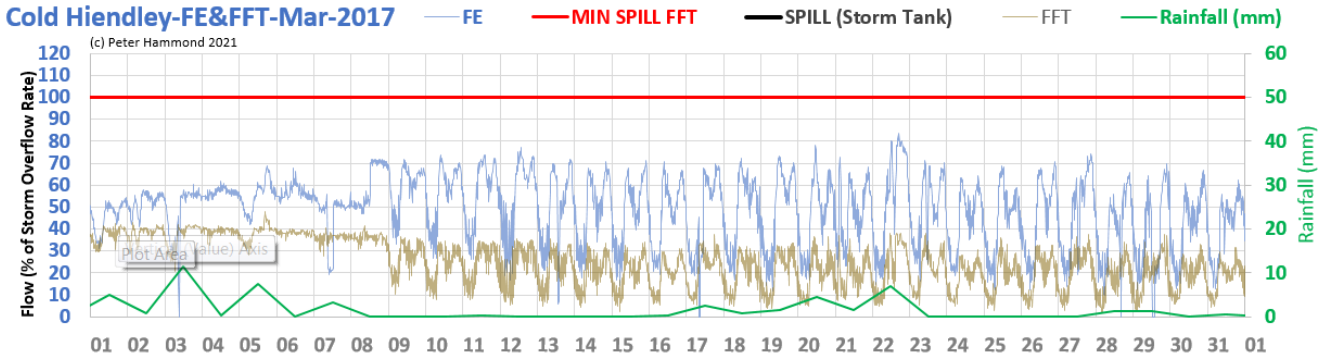


Figure 5: WASP believes there were at least 4 "early" spilling days at Cold Hiendley STW in March 2017

2018

The scaling issue continued in 2018 but it is difficult to confirm unpermitted spills because of poor EDM data.

2019

The scaling discrepancy between the two flows inverted in 2019. WASP believes that in November there is evidence of spilling "early" between Nov 5th and Nov 20th.

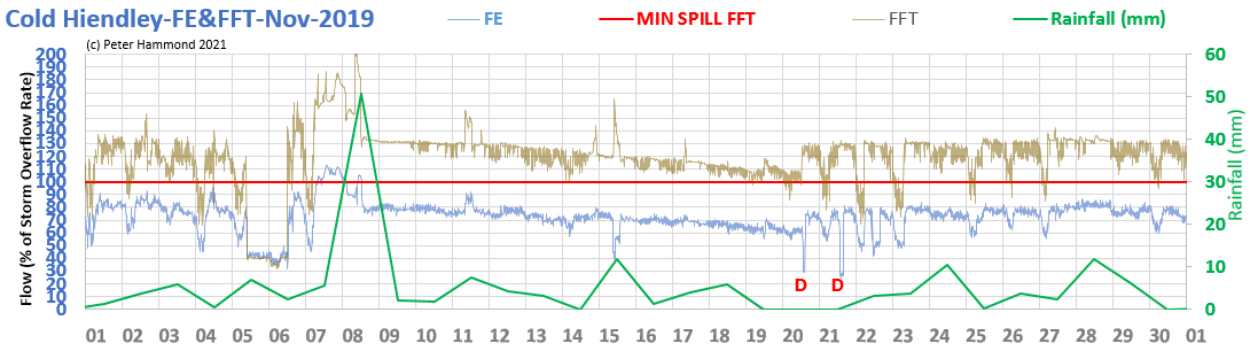


Figure 6: WASP believes there were "early" and "dry" spilling days at Cold Hiendley STW in Nov 2019

2020

WASP believes there were "early" spills on at least 3 days between Feb 21st and Feb 29th.

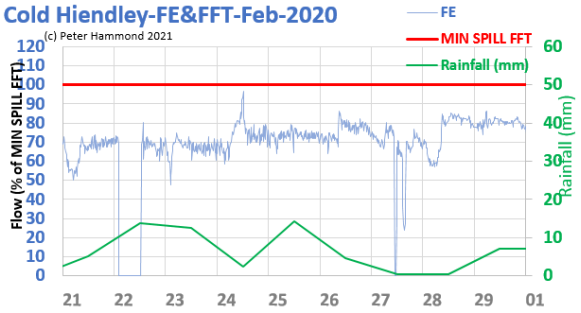


Figure 7: WASP believes there were at least 3 "early" spilling days at Cold Hiendley STW in Feb 2020

2021

WASP believes there were at least unpermitted spilling days between in 2021 (examples in **Fig**. 8).

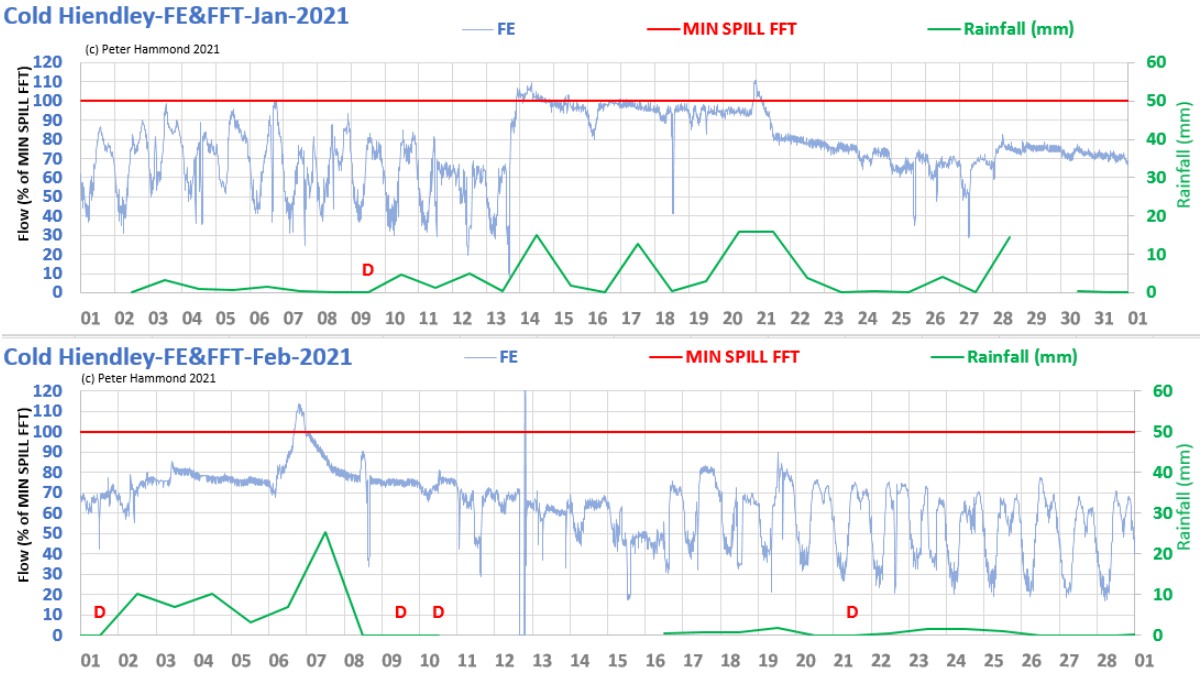


Figure 8: WASP believes there were at least 3 "dry" and 5 "early" spilling days at Cold Hiendley STW in Jan-Feb 2021

Danesmoor		FFT	2017		2018		2019		2020		2021	
PE	6,615	Spilling hours	SSO	SO	SSO	SO	SSO	SO	SSO	SO	SSO	SO
			NDA	NDA	NDA	NDA	NDA	NDA	2360	151	NDA	NDA
TOTAL SPILLS		Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
dry	early						0	15	0	4		
0	19											

SSO=Settled Storm Overflow PE=Population Equivalent

Danesmoor STW has been functioning at full capacity for the past 6 years or so. In response to an EIR request, Yorkshire Water provided EDM spill data for four overflows entitled STORM_TANK_1_OVERFLOW, STORM_TANK_2_OVERFLOW, INLET_OVERFLOW, UNSCREENED_OVERFLOW and SPILL_TO_WATERCOURSE. The SPILL_TO_WATERCOURSE was installed on 15/08/2019 and the other four on 12/02/2019. No explanation for the outlets was given other than

> *Danesmoor has multiple tanks that are hydraulically linked to produce the combined result for Danesmoor and all individual components have been provided.* **Yorkshire Water**

As there appear to be discrepancies between the EDM data provided to WASP and that provided to the EA, it makes sense to start with an analysis of 2020 – the only year for which a return was made to the EA.

2020

For 2020, the EDM spilling hours returned to the EA (see table above) are for what WASP believes to be the SSO and SO discharges. A figure of 97.65 hours was returned as *DANESMOOR_NO3*_CSO which corresponds to the data given to WASP for the UNCREENED_OVERFLOW and must be assumed to be for a network discharge of raw sewage not even screened for "rags". The 151 SO spilling hours do correspond to the data provided to WASP for INLET_OVERFLOW. But WASP is unable to make a correspondence between the 2360 hours returned to the EA and any of the three remaining overflows named in the data provided to WASP by Yorkshire Water.

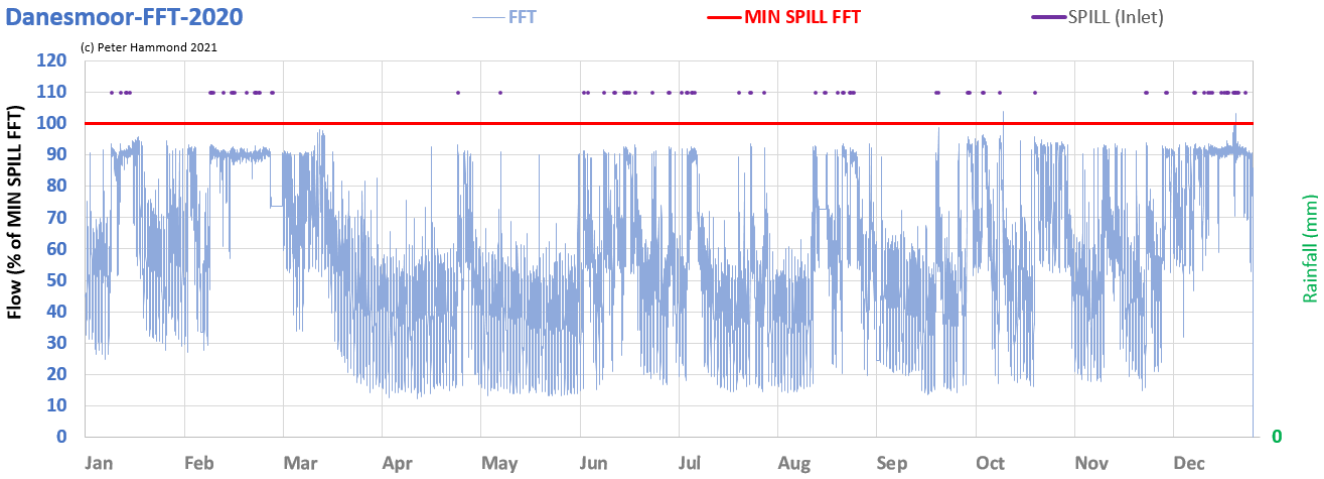


Figure 1: 2020 overview for inlet EDM and FFT data at Danesmoor STW

The flow to treatment and inlet overflow data for 2020 are shown in **Fig**. 1. It is reasonably clear that the spilling indicated by the usual flatlining of the FFT flow occurs around 92% for the ratio of FFT to the storm overflow rate. This suggests compliance when taking into consideration the 8% meter error allowed by the EA. There are just 4 exceptions where WASP believes there were "early" spills on June 14-15, Aug 20 and Sept 23.

2019

There was no EDM return to the EA for 2019 but the data provided to WASP suggests there were 157 inlet spilling hours via the SO. The spilling to storm tank and/or to the watercourse for 2019 as indicated by flattening of the FFT looks much more ill disciplined in terms of "early" compliance. The inlet EDM and FFT flow data for 2019 are shown in **Fig**. 2.

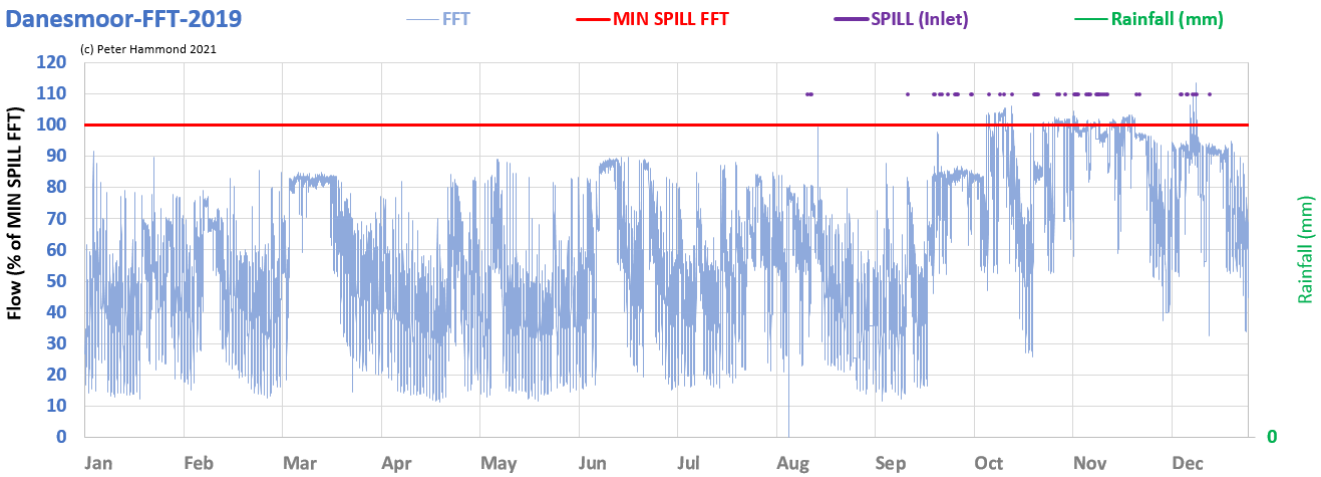


Figure 2: overview of inlet EDM and FFT for 2019 at Danesmoore STW

All instances of FFT flatlining between January and November occur well below a 90% ratio of FFT and the storm overflow rate. So any spills during that period WASP believes to be “early”. WASP has taken a very cautious and reasonable approach to applying the provided EDM data by focusing on the spills detected by SPILL_TO_WATERCOURSE. WASP believes, therefore, that there were at least 15 “early” spilling days in 2019 at Danesmoor STW. Examples are shown in **Fig**. 3.

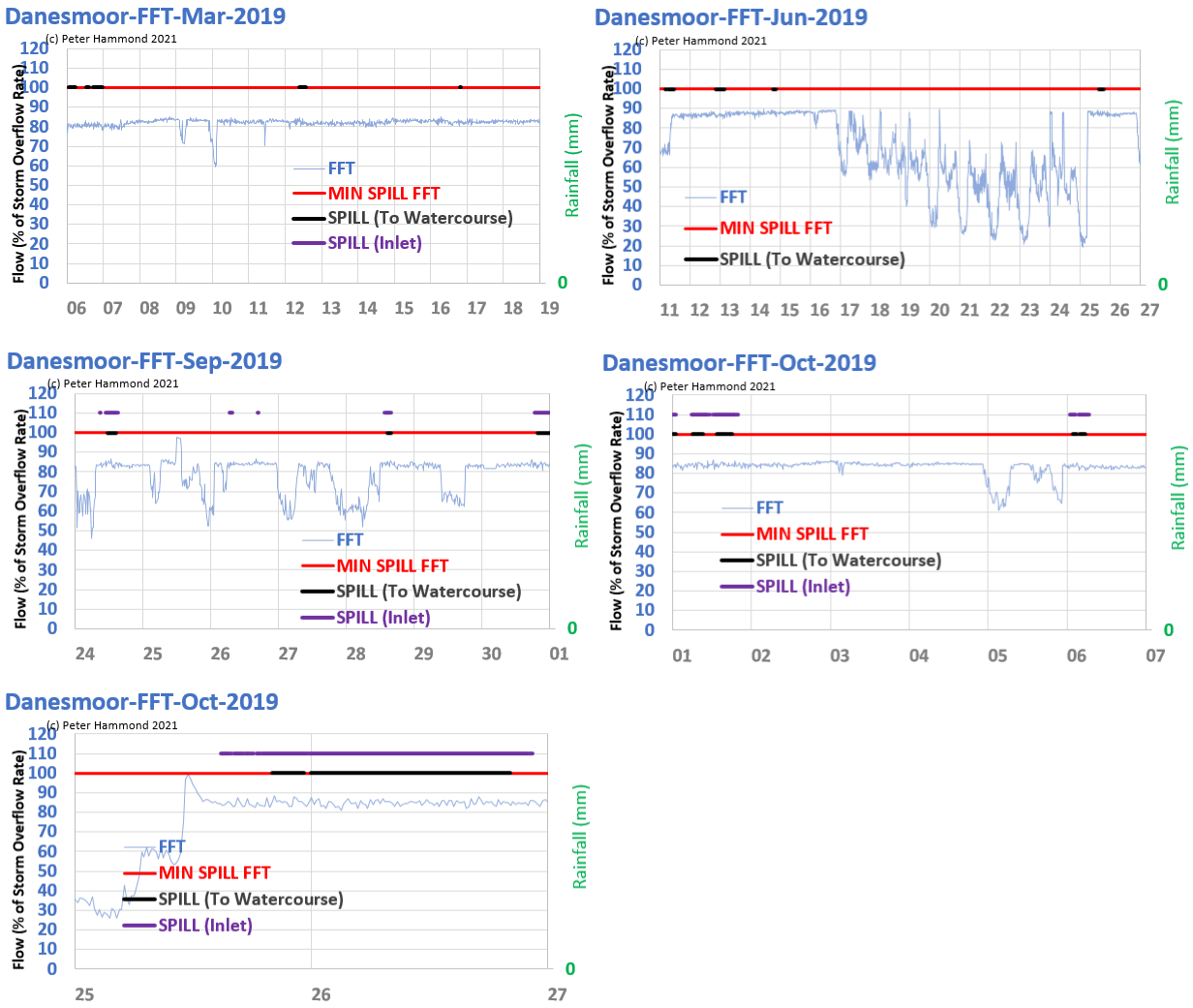


Figure 3: examples of “early” spills at Danesmoor STW in 2019

2018

In 2018, the FFT pattern is considerably different from that of 2019 and 2020. The works appears to continue to treat well above the storm overflow rate. Only from September onwards is there evidence of untreated sewage spills, some of which WASP believes to be “early”. These have not been included in the findings as there is no available EDM data.

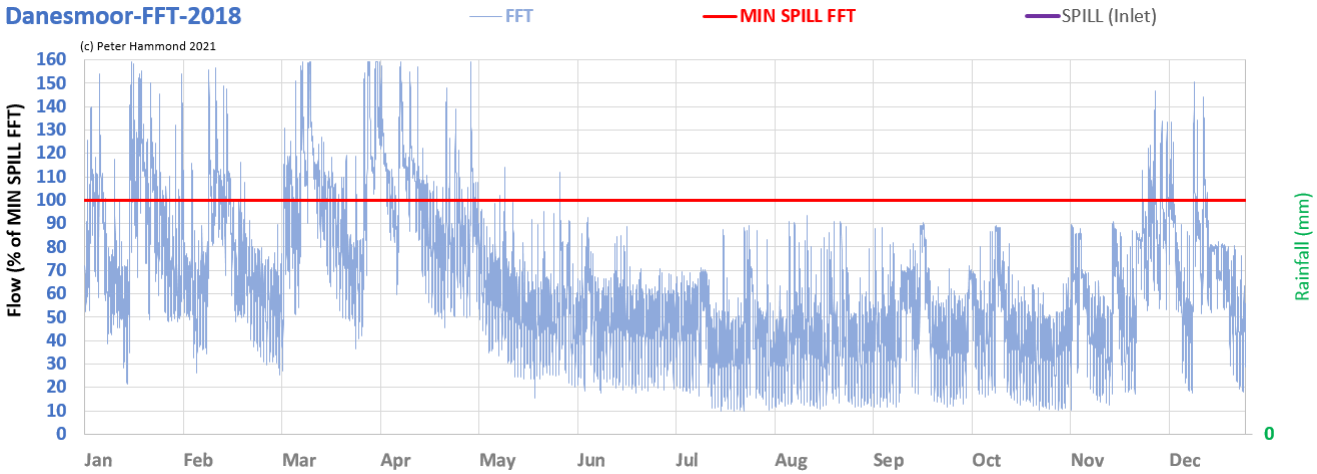


Figure 4: overview of FFT data for 2018 for Danesmoor STW

2021

In 2021, the data provided up to May suggests a number of spills of untreated sewage occurred, some of which WASP believes were marginally “early”. None of these have been included in the findings.

2014

2014 was an unusually wet year so WASP thought it would be interesting to see how this works held up given its recent history of illegal spilling. The overview for 2014 is shown in **Fig**. 5.

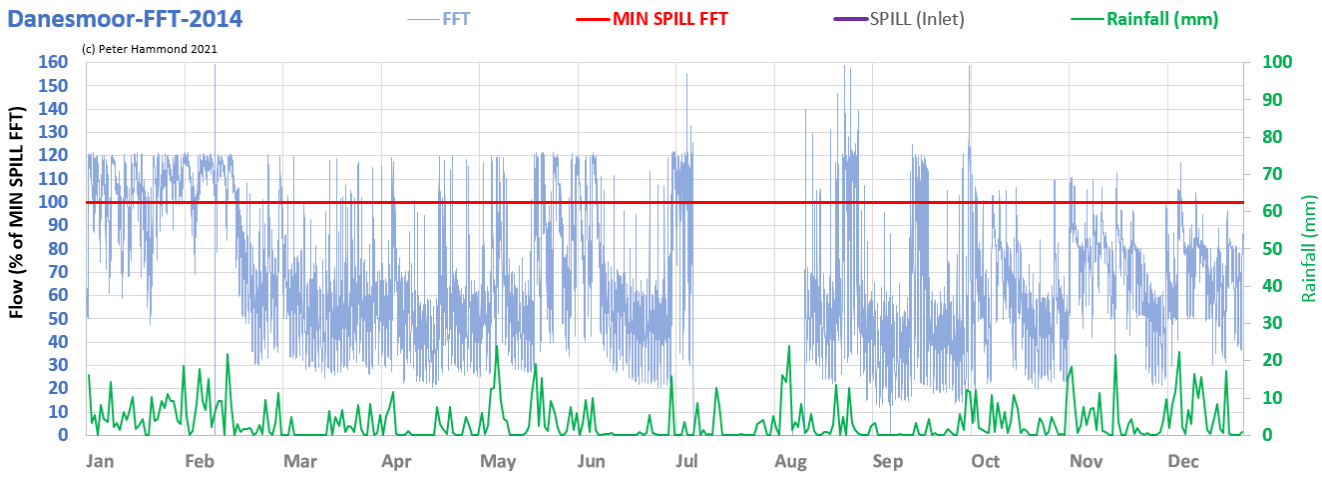


Figure 5: overview of FFT data for 2014 for Danesmoor STW

As expected, there is considerable evidence of spilling untreated sewage but clearly the works treated well above the storm overflow rate and coped. So, something has changed in the management of this STW so that it no longer is able to manage flows during periods of sustained rainfall.

Ilkley

PE	15,829

TOTAL SPILLS	
dry	early
8	1

Spilling hours	2017		2018		2019		2020		2021	
	SSO		SSO		SSO		SSO	SO	SSO	
	NDA		*1,440*				2060	549		
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	NDA	NDA	5	0	0	1	3	0		

SSO=Settled Storm Overflow PE=Population Equivalent

Ilkley STW's spills into the River Wharfe and its loading has been between 95% and 100% for the past 10 years. It has been under particular scrutiny given its proximity to locations of network CSOs where untreated sewage spills are regularly discharged in low or no rainfall. The works appears to WASP to spill "early" on very few occasions, typically spilling above the storm overflow rate. It could be that Ilkley STW, as with other STWs on the Wharfe, is somewhat protected by the network CSOs. However, there are many instances of spills when the rainfall on the day and day before is under 2 mm.

2020

Yorkshire Water's 2020 EDM data suggests there were **3 "dry" breaches** with no rainfall on the day or day before. A total of 16 spilling days resulted from 2 mms or less of rainfall on the day and day before. **Fig**. 3 provides two examples of the latter during an intermittent spill over 18 days in March.

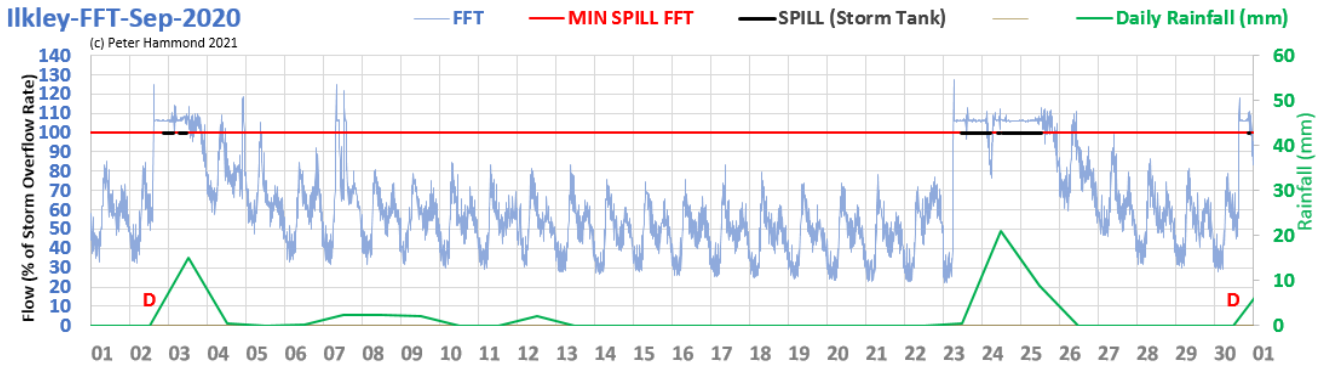


Figure 3: examples of 2 "dry" spilling days in Sept 2020 at Ilkley STW

2019

There appear to be no "dry" and just 1 very brief "early" spill (July 23rd) at Ilkley STW in 2019. The overview chart (**Fig**. 4) clearly demonstrates that when Ilkley STW spilled it continued to treat sewage at well above the storm overflow rate. There were 5 spills when there was at most 1 mms of rainfall on the day and day before. It appears that there are spills in the period early Jan to Mar that were not detected by the EDM device.

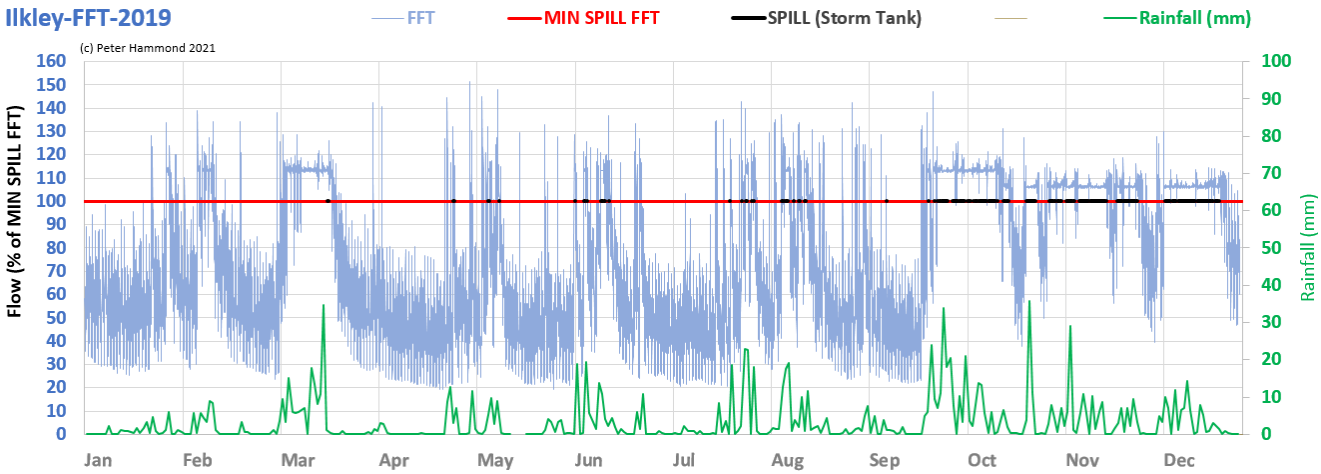


Figure 4: WASP believes that Ilkley had 1 brief "early" spill in 2019 and otherwise made compliant spills

2018

WASP estimates the spilling to be 1,440 hours over 60 days of which WASP believes at least **5 were "dry"**.

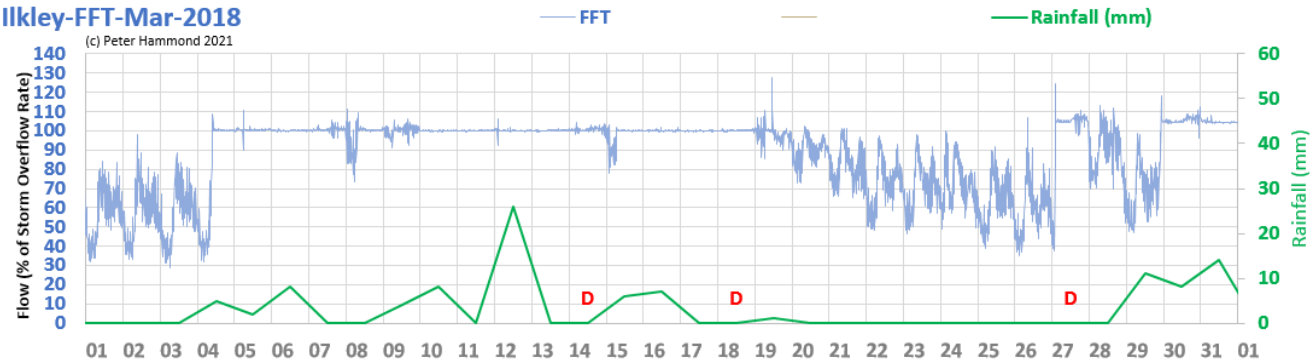


Figure 5: 3 WASP believes there were examples of "dry" spilling days in March 2018 at Ilkley STW

Pickering

PE	7,879
TOTAL SPILLS	
dry	early
	15

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO	SO	SSO	SO	SSO	SO	SSO	SO
	NDA	NDA	-	-	-	-	262	1	NDA	NDA
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	NDA	NDA		15	NDA	NDA	NDA	NDA	NDA	NDA

SSO=Settled Storm Overflow PE=Population Equivalent

Pickering STW discharges into the Costa Beck, a small spring-fed river in the Ryedale district of North Yorkshire. It has been a focus for Fish Legal who advise the Pickering Fishery Association in connection with long-term pollution from Yorkshire Water's assets, watercress and fish farming operations which has caused the loss of grayling and brown trout at the fishery[46].

Pickering has both an inlet storm overflow (SO) and a settled storm overflow (SSO) from its storm tanks. The EA permit for Pickering STW includes the following condition on the use of storm tanks and storm discharges:

2.6 **Occurrence**

2.6.1 The Discharge shall occur when and only for as long as, the storm tanks are full. The discharge of storm sewage to the storm tank shall only occur when the rate of flow at the storm sewage separating weir is in excess of 57.5 litres per second due to rainfall and/or snowmelt.

Note that even spillage to the storm tank requires the flow to full treatment (FFT) to be in excess of the storm overflow rate of 57.7 litres/sec. WASP believes this condition was breached on at least 15 days in 2018 (see **Figs.** 1 and 2).

2018

Yorkshire Water did not submit a 2018 EDM spill return to the EA for Pickering STW. EDM spill data provided to WASP through an EIR request indicates that the SSO discharged for 129 hours and the SO for 9 hours.

Between April 10th and 16th, the storm tanks were being filled and emptied while the flow to treatment rate (FFT) was below the required threshold. When the storm tanks were full and the flow to treatment was held level for several days there must have been continued diversion to the storm tanks and an overflow from the storm tanks to the river (**Fig**. 1, April 10th-16th).

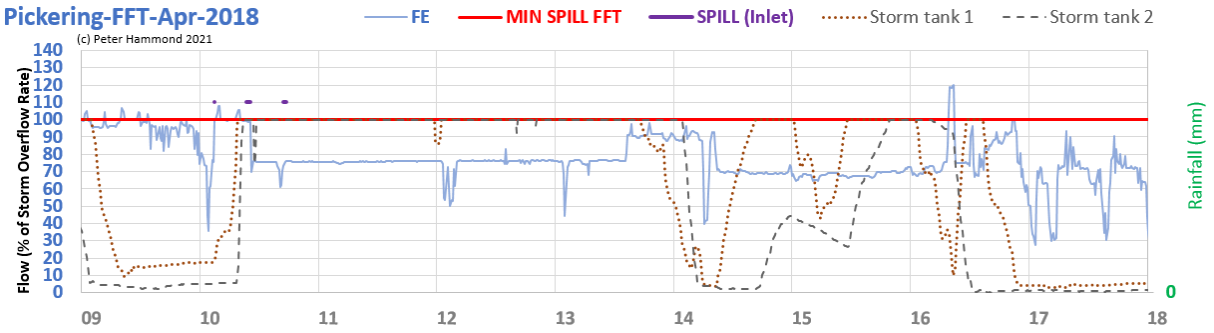


Figure 1: WASP believes storm tanks were full or filling when FFT was below storm overflow rate in April 10-16 2018

The dashed and dotted curves in **Fig**. 1 show the storm tanks to be filling or full when the FFT is well below the storming threshold. A similar pattern is observable on July 29th. (**Fig.** 2).

[46] https://fishlegal.net/case-studies/costa-beck/

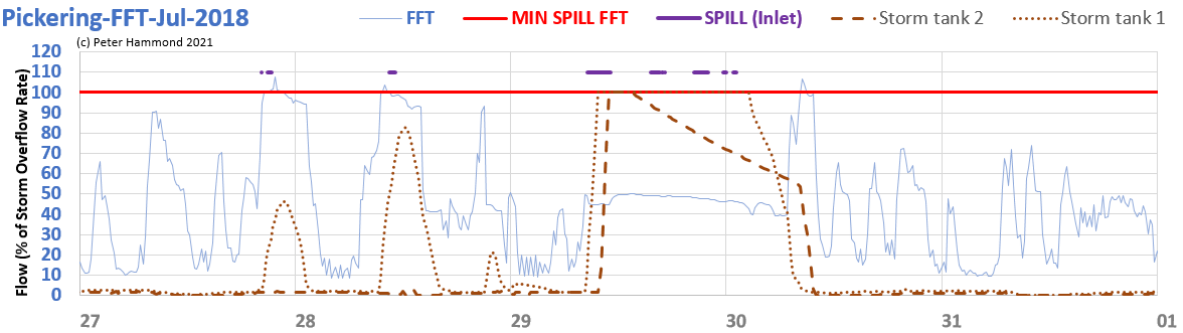


Figure 2: WASP believes there were "early" spills to the storm tanks and river in July 20218

WASP believes that additional "early" spills to the storm tanks and likely to the river were made on October 27th and November 10th,11th, 20th and 21st (**Fig**. 2)

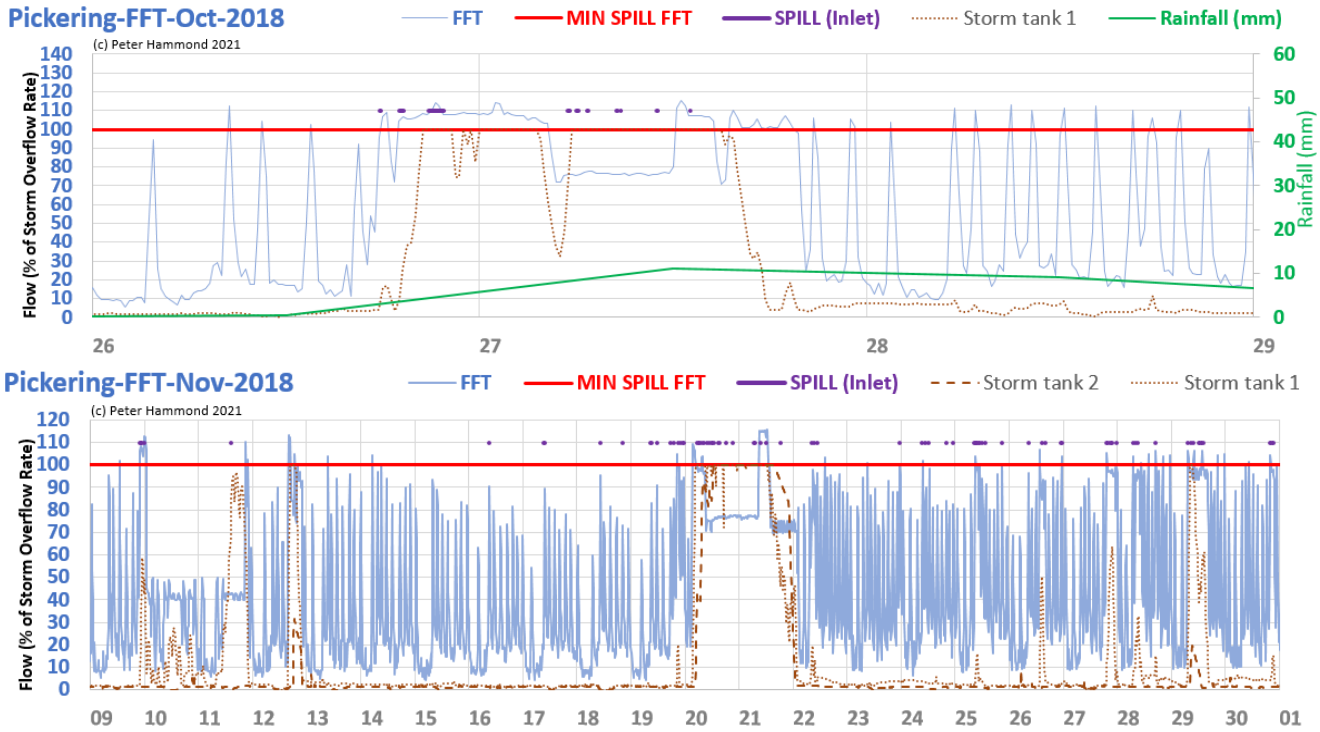


Figure 3: WASP believes there were "early" spills to the storm tanks and river in October and November 2018

Pool

PE	4,349
TOTAL SPILLS	
dry	early
6	46

	2017		2018		2019		2020		2021	
Spilling hours	SSO		SSO	SO	SSO	SO	SSO	SO	SSO	SO
	NDA	NDA	NDA	NDA	-	-	1,071	269	NDA	NDA
Unpermitted spills	dry	early	dry	early	dry	early	dry	early	dry	early
	NDA	NDA	NDA	NDA	4	13	2	33	NDA	NDA

SSO=Settled Storm Overflow PE=Population Equivalent

Pool STW serves a population equivalent of 4,349 and discharges to the River Wharfe. It has been working between 97% and 100% of full cpacity for over 10 years and has both a settled storm overflow (SSO) connected to the storm tanks and a storm overflow (SO) at its inlet.

2020

In 2020 the spill return for Pool STW was 126 spilling days of which, WASP believes, **33 involved "early" spills and 2 involved "dry" spills**. For 176 hours, both overflows were in operation which WASP believes resulted in an estimated 36,653 tonnes (36 million litres or 14.6 Olympic sized pools' worth) of untreated wastewater spilling via the storm tank overflow (SSO). Examples of "early" spills are shown in **Fig**. 1.

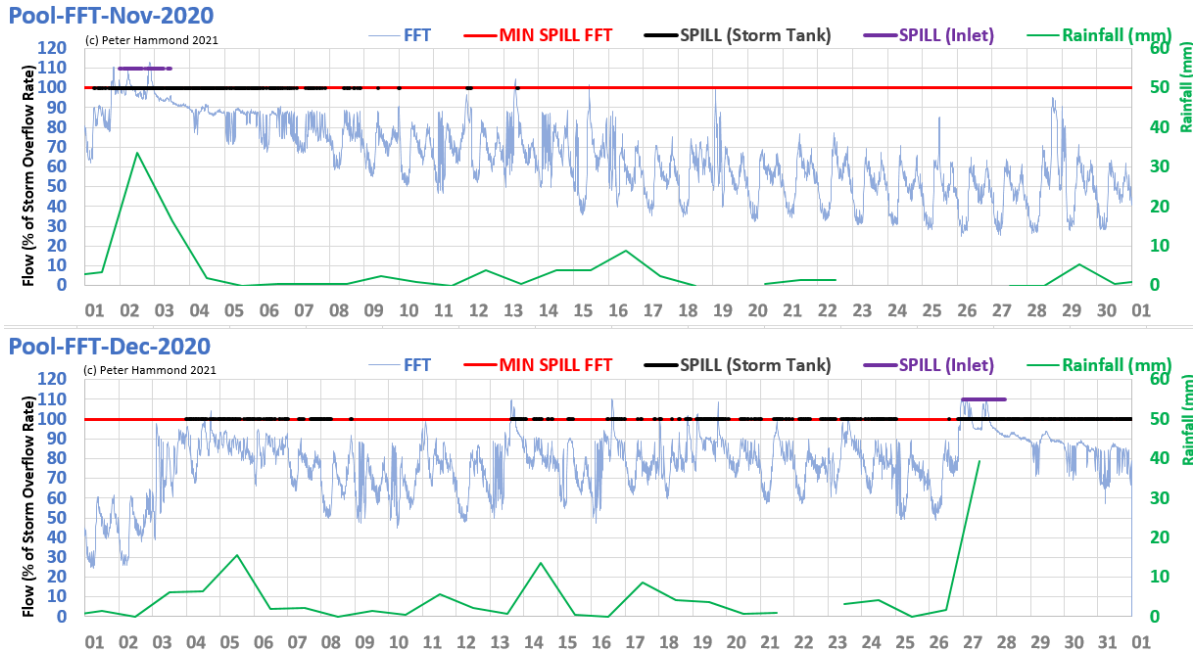


Figure 1: WASP believes there were at least 20 "early" spills in Nov-Dec 2020 (Nov 4th-9th; Dec 5th-8th,14th-22nd,29th-31st)

2019

For 2019, Yorkshire Water did not submit an EDM spill entry to the EA. The spill data provided to WASP corresponds to a total of 640 spilling hours at the storm tank overflow over 81 spilling days of which, WASP believes, **13 involved "early" spills and 4 "dry" spills**. **Fig**. 2 shows examples of spilling "early" (Sept 5th, 6th, 9th, 10th, 13th, 18th, 29th). Without inlet overflow (SO) data it is not possible to estimate any volume of spillage for 2019.

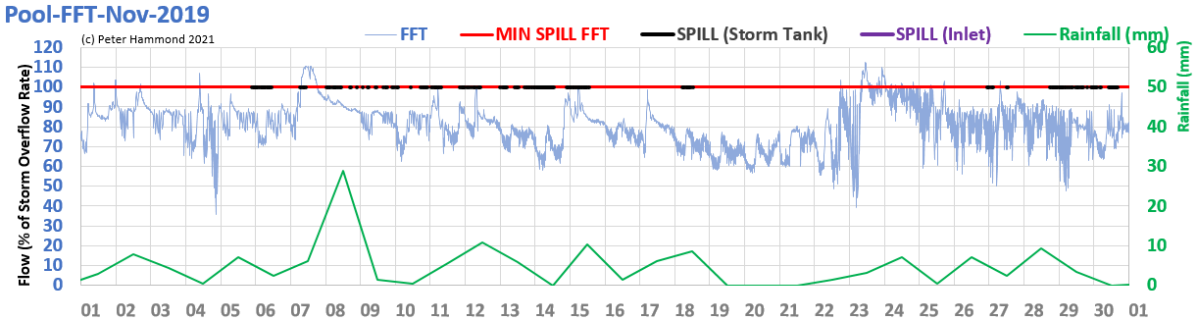


Figure 2: WASP believes there were 13 days involving early spills in Nov 2019

APPENDIX A Generic format of the EIR request and email addresses of EIR teams at each water company

Anglian Water	EIR@anglianwater.co.uk
Northumbrian Water	EIR@nwl.co.uk
Severn Trent Water	CustomerEIR@severntrent.co.uk
Southern Water	sm_eir@southernwater.co.uk
South West Water	finreg@southwestwater.co.uk
Thames Water	EIR.Requests@thameswater.co.uk
United Utilites	EIRRequests@uuplc.co.uk
Wessex Water	env.info@wessexwater.co.uk
Welsh Water	EnvironmentalInformationRequests@dwrcymru.com
Yorkshire Water	EIR@yorkshirewater.co.uk

Dear EIR Team

I would be grateful if you could provide flow and spill data for <STW> from 1/1/2009 to the present:

a) all 15-minute flow to treatment and final effluent flow data (MCERTS preferred);
b) all total daily volume (TDV) data as submitted to the Environment Agency;
c) all individual (preferable to block) spill start/stop times as recorded by all EDM devices since installation;

Thank you for your cooperation.

Kind regards

Appendix B: WASP's list of regulation errors made by The Environment Agency

This report inevitably focuses on the unacceptable behaviour of the water industry but the Environment Agency's regulatory role should also come under scrutiny. Sir James Bevan, the current Environment Agency CEO, in an interview by the House of Commons Environmental Audit Committee in early 2021, stated that his organisation's funding had been reduced by 60% over the past 10 years. But underfunding cannot excuse the following errors it has made in its regulation of the water industry, many of which have been exploited

a) translating the EU Wastewater Treatment directive that restricted sewage spills to "exceptional circumstances" to an imprecise permitting of spills "due to rainfall" with no quantification, or even qualification, and so providing a gaping loophole; government and the media still mistakenly refer to spills as being allowed during "heavy rainfall";
b) requiring STWs to keep treating sewage at a minimum rate without insisting on it being measured and recorded and so undermining compliance checking; akin to the police regulating speeding without speedometers in vehicles and roadside cameras;
c) only receiving and routinely checking daily volumes of sewage treatment when 100 times more data is available that can reveal illegal spilling; WASP always asks for treatment rates recorded at 15-min intervals; akin to monitoring speeding by asking drivers to report their average speed for a journey;
d) introducing an unnecessary scheme to count sewage spills in blocks and thereby providing water companies with an opportunity to hide start/stop times of individual spills and once again undermine compliance checking;
e) collating and publicising spill data on a calendar basis when there clearly is a spilling season (October to March with locational variation); total hours of spilling for a calendar year hide the degree of continuous long spills over the autumn-spring period across the calendar boundary;
f) operating an out of date and poorly maintained public register of permits to discharge to watercourses that hinders investigation; in contrast, Natural Resources Wales has a modern portal that enables instant access to much of its permit and regulatory documents.

Appendix C: Open data and EIR response

SOUTHERN WATER

Total daily volume of sewage treated; start/stop times of blocks of spills https://www.southernwater.co.uk/our-performance/flow-and-spill-reporting; refused to give names of STWs with FFT meter on grounds that "*it would adversely affect national security and public safety*".

SOUTH WEST WATER

2020 annual spill data: https://www.southwestwater.co.uk/siteassets/document-repository/business-plan-2020-2025/edm-return-south-west-water-annual-2020.xlsx

THAMES WATER

2019 & 2020 spill hours https://www.thameswater.co.uk/about-us/performance/river-health

Mogden STW volume spill hours https://www.thameswater.co.uk/about-us/performance/mogden

Undertaking recovery project for River Windrush with Cotswold Rivers Trust; recently instituted spill alerts for 6 CSOs in Oxfordshire.

UNITED UTILITIES

Limited 2020 spill data: https://www.unitedutilities.com/corporate/responsibility/environment/Reducing-pollution/combined-sewer-overflows/cso-performance-data/ ; used EA/OFWAT investigation as excuse to refuse an EIR request.

WELSH WATER

Awkward interface to 2019 & 2020 annual spill hours:
https://www.dwrcymru.com/en/our-services/wastewater/combined-storm-overflows

WESSEX WATER

Wide range of flow, spill and alarm data on well-organised website: https://marketplace.wessexwater.co.uk/dataset http://www.wessexwater.co.uk/coastwatch; EIR requests are dealt with in timely fashion; EIR team went out of its way to construct datasets to match an enquiry. Environment team provided well argued responses to queries.

YORKSHIRE WATER

2019 and 2021 spill data: https://www.yorkshirewater.com/environment/storm-overflows-and-event-duration-monitoring/

Map-based interface at: https://yorkshirewater.maps.arcgis.com/apps/dashboards/eb8c48388d6b4b9c8e7430fc0c39ae42

often provided data of poor quality, requiring extensive pre-processing before analysis – random mixing of European/US date formats; numbers embedded as text; gaps in datasets.

SEVERN TRENT WATER

Ignored at least two EIR requests; used EA/OFWAT investigation as excuse to refuse an EIR request; CEO Liv Garfield responded to the Chair of the House of Commons Environmental Audit Committee as follows https://committees.parliament.uk/oralevidence/2936/pdf/:

Chair: So the days when you require a freedom of information request to get an analysis out of you are over as far as Severn Trent is concerned?

Liv Garfield: That is exactly what I believe. I don't want to be receiving freedom of information requests either and then have my teams poring all over, providing data to somebody. I want them to be getting on and getting river quality to be amazing, so **we decided to make all that information available, then it is for anybody who would like to look at it to be able to access that data.**

WASP found only 2020 annual spilling hours: https://www.stwater.co.uk/regulatory-library/regulatory-library-documents/

NORTHUMBRIAN WATER

Declined to provide a list of STWs with a meter recording sewage passed into treatment claiming EA permits didn't require flow to full treatment to be recorded: *"a public authority may refuse to disclose information to the extent that… it does not hold that information when an applicant's request is received."*

2020 annual spilling hours: https://www.nwg.co.uk/responsibility/environment/event-duration-monitoring/

ANGLIAN WATER

2020 & 2021 annual spilling hours: https://www.anglianwater.co.uk/services/sewers-and-drains/combined-sewer-overflows/