

Objective: The following is the results of an investigation carried out into the reported incidences of untreated wastewater and sewage being discharged into the Pagham Harbour. It also examines whether objections from residents and the local Parish Council to the planning applications arising in the Pagham district are valid (or unfounded) on the grounds that infrastructure, and particularly the Pagham Wastewater Treatment Works, is unable to handle the present and future volume of wastewater and sewage effluent.

Both points are therefore validated.

Pagham Harbour is a 625 hectare (1,550 acre) biological and geological Site of Special Scientific Interest on the western outskirts of Bognor Regis, West Sussex. It is designated a geological conservation review site by the UK Joint National Conservation Committee, is a Ramsar wetland UNESCO protected site, a special protection area (SPA) under EU Directive, a recognised marine conservation zone under the Marine & Coastal Access Act (2009), and, supposedly, a local protected nature reserve under the supervision and management of the RSPB.

Sussex MPA Byelaw Schedule 3 Pagham Harbour MCZ

The map shows the Pagham Harbour area, which is shaded in purple with diagonal lines, indicating the Management Boundaries (MCZ). The harbour is located between Pagham and Keymer Estuary. The map includes labels for Pagham Harbour, Pagham, Keymer Estuary, and various points (A, B, C, D, E). A scale bar indicates 0 to 0.5 Miles and 0 to 500 Meters. The map is titled 'Sussex MPA Byelaw Schedule 3 Pagham Harbour MCZ'.

Pagham Wastewater Treatment Works

Pagham Wastewater Treatment Works holds an Environment Agency licence to release 2,309 m³ (2.309 million Litres) per day of daily maximum total dry weather flow ['DWF'] of treated effluent in to Pagham Harbour. It is currently processing it says approximately 1,770 m³ per day DWF and is therefore apparently operating at 76.6%

EA licence permit limit. It has a first stage containment primary chamber tank capacity of 597 m³ together with a storm water overflow mechanism set at 59 litres/sec controlling water flow to the works. Meaning that waterflow fluctuations can be smoothed out by such containment tank but once this tank is full or where a flow rate of incoming water exceeds 59 Litres/sec, or the daily permitted DWF limit is exceeded, then untreated wastewater is automatically diverted directly in to Pagham Rife and onwards to Pagham Harbour. This is permitted to happen under its Environment Agency licence to avoid backflow to homes and gardens and the possibility of pipe network or pumping station failure.

DWF dry weather flow as determined by the Environment Agency licencing process is the maximum permitted release of treated effluent with reference to the drier months of the year which is May through September and is based on a very complicated formula of $DWF = PG + 1_{DWF} + E$ and represents a control parameter so that in those drier months the volume of treated effluent released at its treatment works is adequately diluted by the lowest period of water mass into which it is being released. For October-April period these wastewater treatment works are still constrained and restricted to the DWF permit limit. The reader will soon understand the significance of this last statement. [P = catchment population: G = per capita domestic flow: 1_{DWF} = dry weather infiltration: E = trade effluent flow].

Pagham WTW handles wastewater and sewage arising from North Mundham, Hunston, Runcton, Lagness, Nyetimber, Pagham and maybe some part of West Aldwick and South Bersted.

In relation to the housing developments in the Pagham area to be served by the Pagham WTW located in Summer Lane, Southern Water Services ['SW'] advise that the headroom of 539m³ [2,309m³ minus 1770m³] equates to an additional 1,600 potential new builds able to be connected to the Pagham WTW. Southern Water Services' says that the only issue is its old pipelines and pumping stations which need upgrading for which it needs 24 months to complete its planned works. Meantime, P/134/16/OUT (Land North of Seftor Road), P/58/15/OUT (Summer Lane) and P/18/20/PL have already been directed that these developments cannot connect to the public sewage system until these works are complete. Those developers are therefore now proposing to build adoptable pumping stations and underground storage vessels and transporting untreated wastewater and sewage by HGV tankers to probably Ford WTW for processing until Southern Water allows these developments to join the main public wastewater system. SW have not yet indicated final decisions on the other potential developments in Pagham, but correspondence from SW has come to light dating from 2017 that states, similarly, P/140/16/OUT (Summer Lane & West of Pagham), P/6/17/OUT (North of Hook Lane, but which became P/30/19/OUT), and P/25/17/OUT (Church Barton House) and their letter at the time states *'we cannot accommodate the additional foul flows from the proposed development in the local sewer network, without the development providing additional local infrastructure'*. The reader should note however, that Pagham WTW does not only cover the Pagham area but includes also developments in North Mundham under Chichester District Council where there has been and continue to be ongoing housing developments.

SW's data suggests they are processing on average of 337 litres/per day per average household through the Pagham WTW at 76.6% licence permit capacity. For the proposed addition of 1,200 new dwellings under solely the Pagham developments this would then take Pagham WTW's operating position to 94.15% of EA licensing DWF permit limit. But at 1,600 new dwellings then Pagham WTW would operate at 100% and thereafter have nil EA licence permit reserve capacity. This is what SW thinks.

The present averaged flow rate going to the Pagham WTW is 20.48 litres/second. With 1,200 additional properties the flow rate likely increases to (averaged) 25.16 l/sec. For 1,600 new houses the flow rate becomes (averaged) 26.72 l/sec. Another way of looking at this is relative to the storm water overflow control set at 59 l/sec. Currently it stands at 34.7% of this limit under DWF conditions and at 1,600 homes then the flow rate increases to 45% of the 59 l/sec storm overflow control. These are of course averaged flow rates over a 24-hour period of wastewater and combined rainwater and does not reflect potential true variability during any particular day or week, but does indicate that the flow rate per second provides the necessary capacity to handle more at the WTW.....or so the initial information provided by Southern Water suggests. But read on.

Older properties in the area, as is the same elsewhere, use combined wastewater and rainwater drainage systems where all water goes to the wastewater treatment works irrespective. Newer builds or extensions to old properties are subject to building regulations requiring rainwater to be segregated and piped to storm water systems and waterways and no longer permitted to be mixed with domestic wastewater. Many developments now also add landscaping with ponds or ditches to help handle heavy periods of rain and these are often referred to as SuDs [Sustainable Drainage Systems]. While SuDs installations certainly substantively help this process, it is apparently by no means absolute if rainfall is greater than it is designed for or the SuD has not been adequately maintained and can consequently still lead to cross contamination/infiltration.

Sidlesham Wastewater Treatment Works

The Sidlesham Wastewater Treatment Works holds an Environment Agency licence permit to release 5,800 m³ per day of maximum total dry weather flow ["DWF"] treated effluent in to Pagham Harbour. It is currently processing SW tells us on average 5,321 m³ per day DWF and is therefore operating at 91.74% licence permit capacity. It has a first stage primary containment tank capacity of 1,266 m³ with a storm water overflow mechanism set at 201 litres/second. Again, once its containment tank is full or where the flow rate of incoming wastewater exceeds 201 l/sec, or its daily DWF limit is exceeded, then untreated wastewater is thereafter similarly diverted directly in to Broad Rife and onwards to Pagham Harbour.

Sidlesham WTW's coverage area is 46 pumping stations over a 36km pipe network covering Almodington, Birdham, Bracklesham, Selsey, Sidlesham, East & West Wittering, West Itchenor and all properties in between. In 2015 it was reported to be covering 10,500 domestic dwellings, but that number will have substantively increased over the last 4+ years with new builds, and particularly in Selsey. There are also localised Combined Sewer Overflow mechanisms situated at East Beach Road, Crablands and at Church Road which would release excessive wastewater overflow at those points directly in to the sea, and Environment Agency reporting for Selsey suggests via an outlet some 14k out to sea.

Sidlesham WTW is already well recognized by Southern Water and also by the Environment Agency as high-risk flood Zone 3 category with a >1% annual flooding probability and very susceptible in conditions of high rainfall. In particular Itchenor pumping station is categorized >3.3% flood risk. This is fully documented in a 2015 publication 'Southern Water Drainage Strategy (Manhood Peninsular)'. But no similar publication exists in relation to Pagham WTW which, presumably, is because no historic concerns have been raised, or, perhaps not enough attention has been paid to actual events.

Water quality testing

Southern Water at all its WTWs extensively sample tests the processed effluent being released according to the Government Environmental Agency licencing requirements for Biochemical Oxygen Demand (Homogenised) and Chemical Oxygen Demand (Low Level) (Homogenised) which is checking water oxygenation and is obviously important for marine life but not directly for bacterial contamination. Any WTW close to an estuary, harbour or nature reserve (such as Pagham Harbour) is also required to test for Nitrate, Nitrogen, suspended solids at 105c, Turbidity, sample temperature, Alkalinity, Ammonia, Iron, Ortho-Phosphate, Phosphorus, Zinc, Cadmium, Chloride, Chromium, Conductivity, Copper, Lead and Nickel. All sample testing results are now readily available to us.

Having said that, the following table clearly shows that each is in fact testing according to very differing criterion which may warrant further examination...and explanation. Some chemical elements being tested may possibly relate to particular differing historic business or land uses upstream of each WTW.

	Pagham	Sidlesham		Pagham	Sidlesham
Ammonia	√	√	Cadmium	X	√
Copper	X	√	Lead	X	√
Nickel	X	√	Nitrates	X	√
Nitrogen	X	√	Phosphates	X	√
Phosphorus	X	√	Zinc	X	√
Iron	√	X	Alkalinity	√	X
Chromium	X	√	Chloride	X	√
BOD	√	√	COD	√	√
Solids (Suspended)	√	√	Temperature	√	√
Turbidity	√	√	Ave Sample Temp	√	√
Number of Sub-samples	√	√	Conductivity	X	√

Southern Water do not however appear to observe a strict and uniform sampling cycle as does the Environmental Agency or Chichester District Council, and SW appears somewhat ad hoc according to the data points. The sampling data already available for 2020 YTD (at time of preparing this report) and up to end of August 2020 for Sidlesham in particular shows that sampling was done on 12-13/3/20 (Thur-Fri), 3-4/04/20 (Thur-Fri), 10-11/05/20 (Sun-Mon), 16-17/06/20 (Sun-Mon), 29-30/07/20 (Wed-Thur) and 17-18/08/20 (Mon-Tue). Number of days between these sampling dates were 22, 33, 36, 44, 19 which doesn't seem to really meet the Government guideline of 'Regular and randomised means approximately equal intervals during the year and includes samples from different days of the week'. There is probably very good and genuine reason for the dates chosen by SW, but variability does suggest it is open to anti-selection. Testing on each occasion at both WTWs is over 2 days with sampling being run twice [crude pre-processed, and then, post processed final effluent to be released]. The author has the full sampling data for 2019.

Also, and a point worth mentioning, is that under the Government licencing rules it seems a WTW can have an acceptable proportion of sample results in a 'fail' category without any obvious consequences. It uses a sliding scale from 1 fail out of 4-7 tests, 2 fail out of 8-16 tests, 3 fail out of 17-28 tests and so up to 24 fails out of 335-350 tests. The Effluent Compliance reports for 2017, 2018 and 2019 only report 13 fails and none of these are for Sidlesham or Pagham.

The Environment Agency ['EA'] on the other hand only sample tests bathing water quality at beach level for Escherichia Coli [EC] and Intestinal Enterococci. [IE] at locations all along the Hampshire, Sussex and Kent coast May through to 1st October and their findings are reported on the internet for all to see. During 2016 through to 2019 EA was sampling on a weekly basis. This was suspended of course during COVID-19 lockdown in 2020 but not reinstated until back end of July 2020 and has since only been tested on one day in July (27th), one day in August (18th) and one day in September (10th). Thereafter no EA bathing testing will take place until May 2021...presumably on the basis that few if any go swimming at other times of the year. In the Environment Agency data it is noted that on the 24th April 2015 it did publish some Benthic Bi Intertidal testing results but this testing seems to have been a one-off exercise and never repeated. Benthic Bi Intertidal sampling is usually carried out to monitor microeukaryotes organisms in sediment in intertidal zones and which are essential to the ecosystem and will reflect environment change.



The date 18th August 2020 is interesting. There likely occurred on this date, or shortly before it, a probable massive release of untreated sewage likely in to Pagham Harbour. Both the EA and SW chose to conduct sampling on that precise date, and very unusually, simultaneously, and this was in fact the only date in the month of August that either EA and SW conducted any such sampling. Coincidence?

The SW results on treated effluent released at Sidlesham and Pagham WTWs on 18th Aug 2020 look ordinary to the author based on comparison with prior sample results as I am not an expert in this field so I cannot use the word 'normal'. EA, however, at 12.15pm on 18th August at Pagham Beach recorded EC 45x acceptable limit and IE 74x acceptable limit and also abnormal samples were noted at Bognor Regis, Felpham and Middleton-on-sea and so on all along the coast eastwards. Pagham Beach EA sample results for whole of 2017, 2018 and 2019 are largely 'normal' throughout and while there is recorded a few results in 2019 which are slightly up but not higher than 9x, 6x or 7x permitted values, nothing like this 45x or 74x safe to swim in result has occurred. It is noted that Bognor Regis (Aldwick) result was even higher, but it is not clear whether this was the bloom of effluent moving eastwards or simultaneous spills were occurring along the coast.

Selsey, to the West of Pagham however, recorded absolutely normal levels for both EC and IE. As coastal tidal flow and wind direction is usually west to east along the south coast and given that the Selsey beach sample was perfectly normal, then the only possible conclusion is Pagham Harbour and is attributable to an exceptionally large untreated wastewater sewage spill having occurred on that date or a few days earlier. A question then arises that if it was 45x and 74x acceptable limit after being substantially diluted in the open sea, then what exactly might have been the sample result had it been taken within Pagham Harbour itself. This is the only logical conclusion.

Important points to emphasise at this stage of the report is:

- (i) Southern Water sample test at the precise point treated effluent is released into the environment and not downstream of any overflow release, and,
- (ii) Pagham Harbour is not entirely and thoroughly 'flushed out' upon each tide cycle. The harbour does not fully empty at low tide so some sediment and heavy particles will settle into mud and on marine vegetation and over time obviously there will be a natural and gradual build-up of microscopic bacterial and other particulates which will have potentially increasing long-term affects upon its ecology.

Therefore, you may at times see the spill. You may well smell the spill. But in the absence of any data to the contrary no official entity or organisation seemingly considers Pagham Harbour sufficiently important enough to test what is exactly happening.....or is someone doing so but not telling.

Chichester Harbour we know is used extensively for water recreation and leisure purposes (boating, canoeing, fishing, swimming) and is therefore extensively tested for EC and IE by Chichester District Council at 11 specific locations consistently on the 1st and 3rd week of each month 12 months a year and the sampling reports have remained normal for 2020 YTD August and throughout the whole of 2019. Normal means <10 particles per 100ml

for each of EC and IC. The designated sampling locations are: Thorney Island Sailing Club slipway; Cobnor Dinghy Park Slipway; Bosham Quay; Dell Quay; Chichester Sailing Club slipway; Itchenor Jetty; North of Dell Quay; Chichester Marina Beacon; Deep End Bodham Channel; Emsworth Jetty; East Head. Compliments also go to CDC in working in close partnership with Southern Water to build a new 10 km wastewater pipe connection away from Chichester to Tangmere WTW and this will be completed by end of 2025. The only thing CDC needs to remember is that many of its District Wards are in fact connected to the Pagham WTW (eg. Hunston, North Mundham) and Sidlesham WTW.

The author has so far not been able to find any evidence of testing, reporting or planning similarly by Arun District Council within who's district Pagham Harbour largely falls.

Chemical Filters & UV equipment

Pagham and Sidlesham WTW do not possess any chemical filtration capability, but SW confirm that they are investigating currently the possibility of installing Nitrate filtration maybe in 2025. Pagham and Sidlesham WTW similarly do not have ultraviolet 'disinfecting' equipment and SW has confirmed that they have no plans at this time of installing any such equipment at these works.

The absence of ultraviolet equipment is potentially very important and Chichester Harbour is a clear example of how important this might be. Chichester Harbour has advantage over Pagham Harbour in both water critical mass and the fact that of the 3 WTWs releasing effluent in to the Chichester Harbour 2 works have full UV 'disinfecting' capability which they apply to both treated and storm water overflows. Over the reporting period 2017-2019 there were 35 Chichester reported spills. 9 came from localised combined sewer overflows (CSOs) but of the 26 spills reported at its WTWs 20 (77%) were fully 'disinfected' by UV.

UV is used to kill bacteria and performs in the same way as a garden pond filter with a UV light. It destroys Escherichia Coli and Intestinal Enterococci which causes eye and ear infections and gastro-intestinal illnesses and the higher the level the more hazardous it is to humans and wildlife alike. Exposure to untreated sewage or its products can also result in Weil's Disease, Hepatitis, jaundice, respiratory difficulty and asthma, and in severe cases possibly allergic alveolitis.

SuDs limitations

Southern Water in its own publicly available materials admits that new builds using SuDs will not necessarily eliminate storm water from getting into the wastewater systems if these are overwhelmed and/or have not been maintained adequately and flooding arises to the point where groundwater reaches combined drains, gullies or sewers and thereby infiltrates the flow leading to the wastewater treatment works.

They also express concern of what they describe as 'urban creep' whereupon permeable land is being increasingly consumed and lost through overbuilding with new houses, roads, paths, patios and drives and whereupon a diminishing amount of rainwater is being allowed to naturally dissipate. Southern Water is also concerned for premises using private cesspits for which they have no control or responsibility whatsoever. These too they say could flood out and result in cross contamination/infiltration. All these statements are made in SW publicly available materials. This rather comical photograph showing someone ~~canoeing~~ sailing a dinghy (with a rudder and centre board!) on a usually dry Sefter farmer's field was posted on general circulation 2019 showing flooding on an area of land where outline approval has already been granted to build 300 houses and a care home. The point is well made however that this will need a substantially large SuDs, but once covered in urban creep and the SuDs maybe is full then this water will need to go somewhere. Can we be absolutely certain that this will not just cause the flooding to reappear somewhere else?



Spill reporting

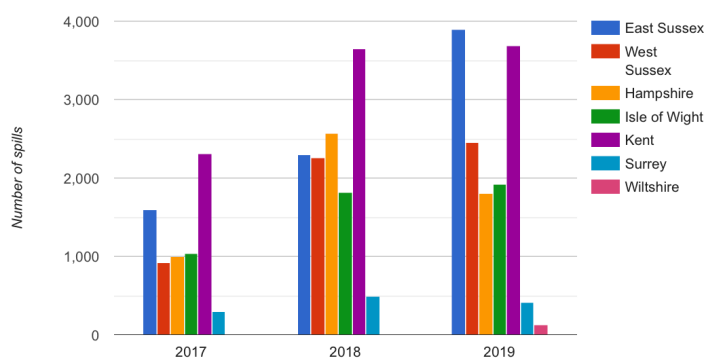
Official reporting by Southern Water to the Environment Agency and which is now also readily available in the public domain (internet) includes Flow & Spill Reports for all its operating wastewater treatment works. The following is an extract for Sidlesham and Pagham WTW reporting spills over the last 3 full years. Spill and flow data is not usually available until some while after end of year, so 2020 cannot at this time be presented to the reader.

	2017		2018		2019	
Pagham WTW (North Mundham WPS)	2	11/10/2017* 21/10/2017*	0		1	22/12/2019
Sidlesham WTW	0		0		14	6/2/2019 4/4/2019 12/9/2019 20/7/2019 24/9/2019 29/9/2019 11/10/2019 2/11/2019 4/11/2019 7/11/2019 9/11/2019 13/11/2019 25/11/2019 12/12/2019

*This was a sewage pipe situated at North Mundham which released sewage into the waterways and could have ultimately flowed to Pagham Rife. But otherwise there has been no reported spills relating to Pagham WTW.

Interestingly, nil spillage is reported for Sidlesham in 2017 and 2018, but jumped to 14 incidents in 2019.

The Bognor Post on 11th October 2019 actually carried a report from a resident of seeing raw sewage in the harbour near Sidlesham, and that she had also seen it 2 weeks earlier. She had also read it was happening every 5 weeks. While not precisely 5 weeks apart, the table above of reported spills clearly corresponds, but what is not clear is whether these are SW self-reported spills or spills reported only by members of the public via the SW hotline 0330 303 0368 (option3) or via the EA national hotline 0800 807060. The Bognor Post article then went on to report that this has happened 53 times in the last 5 years, but nothing is reported by SW in the supposedly 'official' report for the 2 prior years.



This chart is from SW's website and indicates just how many spills are actually occurring each year in West Sussex and neighbouring counties. The figure for West Sussex for 2019 is 2,456 spill incidents. The highest bar relates to East Sussex of 3,893 spills. This chart of course quantifies how many incidents were reported, but not necessarily over how many days it had occurred.

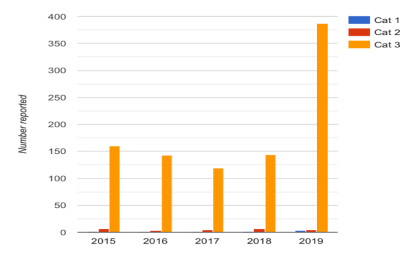
Remember that a spill of untreated sewage and wastewater occurs if a pipe bursts, a pumping station fails, or when

the storage primary containment tank is full or the amount of water going to the wastewater treatment works exceeds the overflow control limit, or, exceeds its EA licence permit. Remember that the WTWs are only permitted to release a specific maximum m³ of treated effluent in to Pagham Harbour. Everything beyond that EA DWF permit limit is forced into Pagham Harbour untreated.

If Sidlesham WTW in particular is handling 5,321 m³ daily at 91.4% licenced capacity and on this basis is handling 61.58 l/sec against a storm water overflow control mechanism set at 201 l/sec, yet had 14 reported spill 'incidents' in 2019, the question then is what is likely to be the situation for Pagham WTW going forward once it reaches 94.15% or even 100% licence capacity and yet continues to operate with a storm overflow control of mechanism of only 59 l/sec in the event of network failure or high rainfall. When SW were asked what their operational capability would be if this DWF permit limitation were to be increased by EA, they replied that they didn't actually know what each WTW was capable of as they cannot release more than their permit. This seems very odd and somewhat alarming that they do not know, but clearly they are rigidly sticking with the DWF permit limit and everything above this limit is thrown into the harbour.

A spill is categorized by the Environment Agency based on information reported to it by Southern Water Services according to the following designations.

- **Category 1** incidents have a **serious**, extensive or persistent impact on the environment, people or property
- **Category 2** incidents have a lesser, yet **significant**, impact
- **Category 3** incidents have a **minor** or minimal impact on the environment, people or property with only a limited or localised effect on water quality
- **Self-reported** - where we (ie. SW) report an incident to the Environment Agency before it's reported by a third party, it's also recorded as a 'self-reported incident'.

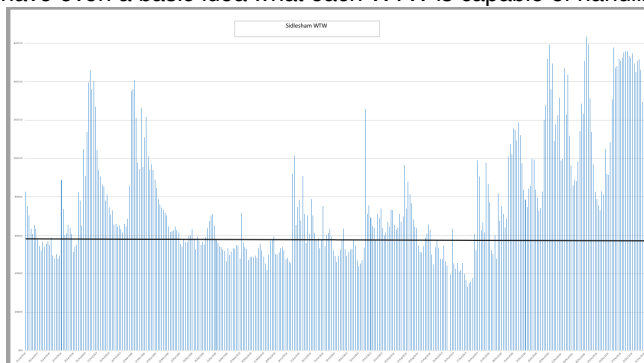


It is noticeable that Cat 3 jumped alarmingly in 2019, either on account such incidence has indeed rocketed, or, simply, it is just now being more readily and accurately reported / admitted. But someone, somewhere, is making a judgement call as to whether it is or is not Cat 3.

Alarming, the actual SW spill report for 11th October 2019 states a 'discharge period in hours' of 182.74hrs and a 'discharge duration' of 84.02hrs suggesting that over 182.74 hours (7.6 days) period untreated effluent was released into Broad Rife for 84.02 of those hours (equivalent to 3.5 days). Even more alarming, is 12th December 2019 where the discharge period was 390.26 hrs with a discharge duration of 266.21 hrs. Was this still only reported as Cat 3?

Flow reporting

Southern Water confirmed it does not actually know the maximum operational capability of each of its WTW's beyond its licence limit and because of the overflow control mechanisms. It said that if it were given a higher EA permit then they would then be able to determine this. But it is somewhat odd that SW can report with some precision the amount of m³ wastewater flowing to the WTW, the m³ amount it treats and releases but yet it doesn't have even a basic idea what each WTW is capable of handling if allowed (licenced) to do so.

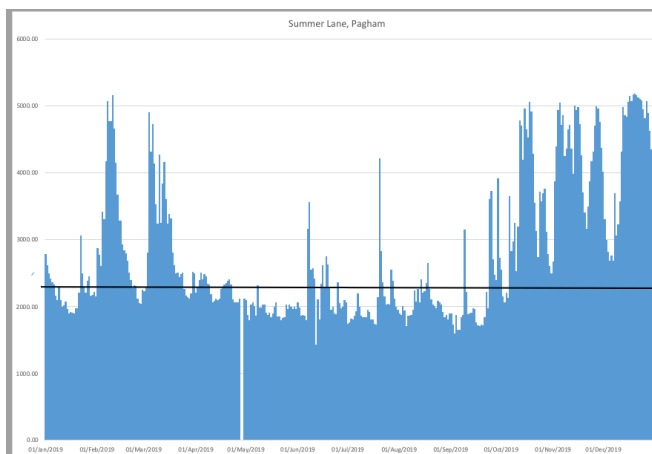


The graph to the left has been put together by the author to graphically illustrate the data provided in the SW flow report.

This is Sidlesham WTW's reported flow m³ volume for each of 364 days' in 2019. One day is missing from the data report for reasons unknown. The horizontal black line is the maximum DFW permitted release of treated effluent (5,800m³ per day) and we can therefore clearly observe everything above the line which goes straight into the Broad Rife and onwards to Pagham Harbour untreated.

This second graph to the right similarly shows graphically the data points from Pagham WTW flow report for each of 363 days in 2019. 2 days' data is missing from the data report for reasons unknown. The horizontal black line again is the DFW EA licence maximum permitted amount (2,309m³ daily) of treated effluent and everything above the line goes via the Pagham Rife untreated in to Pagham Harbour.

The Environment Agency is fully aware that this is happening and this, supposedly, is to avoid backflow of sewage to homes, gardens, roadways etc and maybe causing sewage pipe breach or pumping station failure.



The following Table provides a summary of those flow reports.

	2019 Annual Actual Total M ³ received	2019 Actual Averaged Daily m ³ received	EA DWF Daily permit limit	Variation Actual from DWF baseline	2019 Averaged Actual Flow Rate per L/sec
Sidlesham WTW [364 days reported]	2,786,559	7,655	5,800	131.98%	89.33
Pagham WTW [363 days reported]	1,005,866	2,770	2,309	119.97%	32.00

	2019 May-Sept Total m ³ received	2019 Daily Averaged May-Sept m ³ received	EA DWF Daily permit limit	Variation Actual from DWF baseline	2019 Averaged Flow Rate per L/sec
Sidlesham WTW [152 days report]	897,373	5,903	5,800	101.78%	67.88
Pagham WTW [153 days reported]	319,683	2,089	2,309	90.47%	24.2

Over the whole year 2019 Sidlesham WTW released at least **698,152 m³** (at **1,918 m³** averaged day) of untreated flow. Pagham WTW released for the whole year 2019 at least **167,343 m³** (at **461 m³** per averaged day) of untreated flow....on an 'averaged' basis.

During the DWF period May through September this data indicates that Sidlesham WTW released not less than **15,773 m³** over this period at **103.76 m³** average per day of untreated effluent. However, for Pagham WTW during the DWF period Nil untreated effluent was released on this analysis based on data 'averaging'.

The truth of the matter however for Pagham, and similarly for Sidlesham, is that the amount of effluent being processed on a day to day basis is actually the lesser of the DWF 2,309m³ for Pagham and 5,800m³ for Sidlesham limit and whatever was received at the WTW on the day. The lowest recorded Pagham count during the 'drier' period was on 12th June 2019 at 1,428m³ and the highest was 29th September 2019 at 3,918m³ as the graph illustrates and 'averaging' distorts the analysis results. But when we use the true actual daily flow count for each of the 153 reported days at Pagham WTW means that **13,342m³** was in fact released containing untreated effluent during this 'drier' period. Applying the same principle to Sidlesham WTW we now learn that during this 'drier' period **86,834m³** was actually released containing untreated by that WTW.

Therefore, over the whole of 2019 [1st January to 31st December] and not counting days where data was not actually provided, the amount of total volume of flow containing variable concentrations of untreated effluent released at Sidlesham WTW was **779,230m³**. For Pagham WTW this was **224,487m³** of variable concentrations of crude wastewater for the whole year. The combined total was **1,003,717m³**. (~~40.03 million~~ 1 Billion litres!)

This information, which is derived from the full data reports actually provided by Southern Water Services clearly shows that both Sidlesham and to a lesser extent Pagham are releasing significant amounts of untreated wastewater into Pagham Harbour throughout the year.

During the course of any typical day householders will of course demonstrate different behavioural patterns. When they wash up. When they turn on their washing machines. When they have baths or showers. When and where they clean their cars. Even as to when they decide to go to the toilet. This will lead to fluctuations in the flow rate and nature of wastewater, but the volumes will remain essentially stable and fairly consistent from day to day throughout the year. Adding the proposed additional 1,600 new homes in the Pagham area will generate more wastewater and this, as SW gives us to believe, remains within an available DFW permit limit of 539m³. However, this number is totally incorrect. Analysis of the official flow data tells us that the actual Pagham WTW headroom is only 220 m³ which would equate to only 656 new builds. But the data also tells us that Pagham WTW is already currently operating at 90.4% and not at 76.6% as we were given to believe. Sidlesham also is not currently at 91.74% as stated of its operational permit capability but in fact is already at 100%.

Rainfall however is an entirely different proposition and is unpredictable in relation to the pattern of domestic wastewater. The spikes illustrated graphically in the charts above is the rainfall going down gutters and drains (roads and homes) and leading to the WTW, plus any cross contamination or leakage from SuDs or dikes and ditches and all of this SW accurately measures. If the WTW is ordinarily able to cope with 5,800m³ (Sidlesham) or 2,309m³ (Pagham) but at times what is flowing to the WTW is far greater and fills the primary containment tank, then whereas the WTW would be treating entirely maybe a high concentration of wastewater / sewage during the 'drier' periods it is suddenly confronted by a far greater volume of m³ which has essentially diluted the normal and usual wastewater and sewage volume concentration.

Taking as the example the 20th December 2019 which you can see is the highest spike in the graphs, the daily measured flow on that date at Sidlesham was 15,583m³ and for Pagham 5,181m³. Wastewater and sewage presenting to Sidlesham WTW has now been diluted 2.6867-fold and for Pagham diluted 2.2438-fold but still only 5,800m³ (for Sidlesham) and 2,309m³ (for Pagham) can be processed. The rest goes into the Rifes and onwards to the harbour with no treatment. This therefore means that on the 20th December 2019 with this level of dilution only 33.248% of Sidlesham WTW's usual wastewater / sewage volume and only 44.56% of Pagham WTW's usual wastewater/sewage was actually treated. 66.752% and 55.44% respectively therefore went into the harbour untreated. The higher the rainfall the greater the dilution of course, but conversely the lesser the amount of crude wastewater going through the proper treatment process.

The Surge Affect

I am sure there is a very scientific term for the following, but I will call it the 'Surge Affect' ['SA']. This is where a contrary force changes the behaviour of the data points and any conclusions we might draw from an averaging or actual basis. Returning to the lady's personal observations on 11th October 2019, and her reference to seeing similarly this 2-weeks earlier. It is likely she is observing this 'SA'.

Members of the public do not carry around with them scientific equipment and can only react to what they see, what they smell and what they hear. If they can see it and smell it then some individuals will report it. If they can see it but cannot smell it they may or may not report it. But if they can only smell something but cannot see any obvious reason for it then it is unlikely they would report it. Then there is the 'I can see it and smell it, but I'll leave it to someone else to report' brigade, and at all other times we may have no idea what might be happening in the Rife or harbour.

During the course of a typical day we humans bath, shower, toilet put on the washing machine or dishwasher and pour all sorts of things down the kitchen sink in a fairly consistent and predictable way. At night we sleep. If it rains and rains constantly and unvaryingly during the day then this just dilutes the daily wastewater flow. If it rains only during the night when we are asleep then what goes into the combined mains system will be very little wastewater and therefore mostly rainwater but which will have a flushing and cleansing effect to the pipes and pumping stations. But if the rain comes down in a torrent then it will have a surge effect and push and force at a fast rate everything that was already in the system, maybe way too much for the primary containment tank and is then forced into the overflow and, therefore, maybe a high concentration of untreated effluent goes into the Rife. If though, this torrent occurs perhaps at 7am in the morning, then this surge of cleaner water could get in the way of the normal daily human wastewater that has yet to begin. If the containment tank is already full-up with rainwater then the human wastewater bypasses the treatment process. But as it enters the Rifes this is then additionally complicated by the tidal cycles of the harbour. When the tide is coming it will reach a stage where the Rife will begin to back-up and if this coincides with a spill of high concentrated wastewater this most certainly may be readily visible and smelly and some photographs that have been circulated by members of the public provide possible visible evidence of this. Further, if we were able to actually overlay historical meteorological, tidal, flow and spill data we will likely, maybe, then see exactly which spills had high and which had low concentrations of wastewater arising from this 'Surge Affect'.

Conclusions drawn

Returning now to the original objectives of this research and investigation. Both objectives have been validated.

There has indeed been serious and significant regularly occurring releases of untreated wastewater in to Pagham Harbour from both of the Southern Water Wastewater Treatment Works and Pagham Wastewater Treatment Works over many, many, years. Sidlesham is already at DFW maximum permitted capability and Pagham similarly if proposed developments are connected to the mains sewage system. But as soon as either of the WTWs is presented with a flow of water greater than its EA licence DFW permit allows them to process, even currently and without any more dwellings coming on line, then variable concentrations of untreated wastewater effluent is released directly into Pagham Harbour via the Rifes. At times this maybe is at alarmingly high amounts which must, surely, seriously damage the supposedly protected harbour environment and ecology and its Rifes. Adding more new builds will add considerably to this problem.

It will be interesting to re-examine this situation once the 2020 full data becomes available, but our expectation will undoubtedly be that things are getting worse rather than better.

This research and analysis may also have revealed some shortcomings in data and information gathering processes of entities concerned and this perhaps should be explored in more depth.

The author gives thanks and compliments Southern Water for its help and willingness in providing and responding to my ROI requests for information and data. Lesser thanks go to the Environment Agency who have been rather, well, less responsive and less helpful.

The issues raised in this report are not unique to Pagham Harbour. To a lesser or greater extent it is likely this is just as prevalent at most if not all WTWs and Southern Water data for all its WTWs is readily available to investigate further. If a developer builds dwellings in one location and as a short term, or long-term, solution proposes to use storage vessels and tankers to take away wastewater to another water treatment works, then in addition to considering road congestion and air pollution it would also be necessary to check the capability of any receiving wastewater treatment works.

When such wastewater treatment works were originally constructed so many years ago the designers must have been very visionary and the WTWs at that time will have likely adequately coped with variable rainfalls, with perhaps even no 'spills' at all. But the data tells us that now in 2019 after years of house building that Pagham actually had a 'spill' incidence on 179 days out of 363 reported days and Sidlesham 120 days out of 364 reported days. This is not good and, surely, this is unacceptable if we are truly and genuinely serious about protecting the environment.

Both WTWs would certainly benefit from UV equipment being installed as soon as possible so as to at least 'disinfect' what is released. Far better than releasing, as it does now, large volumes with no treatment at all. The Chichester example shows us the clear benefits through this.

Consideration should be given to increasing the DWF limit as releasing more treated is again better than no treatment at all. Filtration is also needed to remove particulates and chemicals. But really the best solution has to be to build an entirely new WTW (or expand existing) to a level of capability to cope with such variations in seasonal flow and rainfall rates and emerging climatic conditions, and NOT to connect or permit any new builds until and unless this is done, including any development currently outline planning approved but not yet started be suspended.

The tragedy in all this is that the Environment Agency will have known all about this for years, and so too likely did the Government Ministries and its other agencies such as Natural England and Ofwat. The Developers and their independent and supposedly impartial drainage company specialists will have definitely known. But also the District and County Councils will (or should) have known and are therefore equally culpable as, undoubtedly, they will have known all of this and should not have been so dismissive of reports from residents or the objections raised against planning applications and certainly it was very inappropriate for a development control committee and also a senior Officer of Arun District Council on numerous occasions saying that it had no control or responsibility whatsoever as Southern Water are legally obliged and charged with delivering whatever is needed. The point on control is true, they indeed have no management or supervisory influence directly over Southern Water. But these individuals and any other personnel involved in the planning and approval process are responsible and fully accountable for the consequences if they failed to carry out sufficient due diligence, or, ignored and disregarded such evidence when it was presented to them.

Southern Water has in recent times been prosecuted and seriously criticised and ridiculed over releases of untreated wastewater and for manipulating sampling results and reporting, and maybe also for lack of infrastructure spend. This may well have been deserved at the time. But Southern Water Services will undoubtedly have advised and cautioned government agencies and District Council planning officers and presented this evidence. If these government agencies, District or County Councils chose to ignore and disregard this evidence as '*not their problem*', then this surely is a failure in their duty of care to the community, or of incompetence, or raises serious questions as to their motives in doing so.

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Notes: Flow & Spill data is available from Southern Water Services public web site
Effluent sampling data from Wastewater Treatment Works is available through ROI request to Southern Water
Environment Agency water quality sampling is available on the internet
Chichester District Council Harbour sampling results is available from the internet