Pollution Incident Reduction Plan

April 2021

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Letter of executive support

We know we have a duty to protect and improve the environment in which we operate, and we recognise that causing it no harm through pollution incidents is the minimum our customers should expect from us. That is why we have set an ambitious target to reduce pollution incidents from 430 in 2019 to less than 80 by 2025.

Our ultimate aim is zero pollution by 2040. To work towards this, we have developed a detailed programme of activities, documented in this Pollution Incident Reduction Plan (PIRP). As our programme embarks on its second year, we remain committed to protect and improve the environment through better pollution performance.

Southern Water is one of the only organisations in the sector to have developed a pollution reduction programme based on extensive data analysis. This in-depth analysis is helping our dedicated Pollutions team to understand where and how our sites are most likely to impact the environment. By understanding what can go wrong, and why, the team can focus investment on areas which will deliver the biggest reduction in pollution incidents. It is also learning from past incidents and industry best practice to drive effective interventions to improve our performance in future.

Despite a challenging start, the interventions delivered in the first year demonstrated notable progress. The programme has already delivered a reduction in pollution incidents of around 10% in 2020. Over the entire year, the number of incidents at wastewater treatment works fell by approximately 40%. Serious pollutions almost halved, while reporting zero category 1 pollutions was a major achievement for us.

However, our pollution performance is still not where we would like it to be. We know there is more to do, and my team, the Board and I share a zero-tolerance attitude to environmental pollution and are fully committed to continuing to improve our business and deliver the services our customers deserve, while fulfilling our commitment to protect and improve the environment upon which we all rely.

Following an agreement reached between our shareholders and a major new investor, around £1 billion of new investment is being injected into our business. This will speed up the transformation we have already started by allowing us to spend more than £2 billion in the next four years improving the resilience of our existing assets and investing in new technologies to reduce pollution. High level plans for this investment have already been prepared and reflect our commitments for this five-year investment period.

We have developed our PIRP 2021 based on our ongoing analysis and lessons learned during 2020. I am confident that our plan, and the continued transformation of the business, will deliver tangible improvements in our performance and the environment as we move into the second year of this ambitious programme.

Best regards

Ian McAulay
Chief Executive

Introduction and document purpose

This document is being published to provide an overview and analysis of our 2020 pollution performance and the key learnings alongside an update on our PIRP delivery in year one and our plans for year two.

1. 2020 pollution performance

1.1. Summary performance

2020 has been a challenging year, despite which we have seen improvements. Notably the number of serious pollutions and the overall number of pollutions has reduced vs. 2019 (Table 1), with no category 1 pollutions in 2020.

Table 1 – Performance summary by category

Pollution category	2019	2020
Category 1	3	0
Category 2	4	4
Category 3	423	396

The first quarter of 2020 in particular saw some very wet weather which followed a very wet 2019 winter. February was our worst month for pollutions and correlated with the wettest February on record. This is obviously not acceptable and our assets should be more resilient to these types of events and this is something we need to improve on.

Despite the challenging start to the year, there are improvements. The number of wastewater treatment works (WTW) incidents has reduced by approximately 40% Our performance in the last three months of 2020 is 46% improved over the same period in 2019 (see section 1.4). The number of serious pollutions has reduced from seven to four and we have had zero category 1 pollutions in 2020 vs. three in 2019.

1.2. Serious pollutions

Figure 1 shows the improvement seen in serious pollutions. Zero category 1 incidents is a major achievement and an outcome of improved incident management processes. There have also been zero serious pollutions from WTW, which follows the improvements seen in category 3 incidents. There has also been only one category 2 pollution from a wastewater pumping station (WPS) in 2020.

Unfortunately, there has been an increase in network-related serious pollutions (two foul sewer (FS) and one rising main (RM)). The two FS pollutions were both related to a blockage caused by sewer misuse. The RM was caused by an error during planned work, and lessons have been learnt and improvements made to avoid a similar incident.

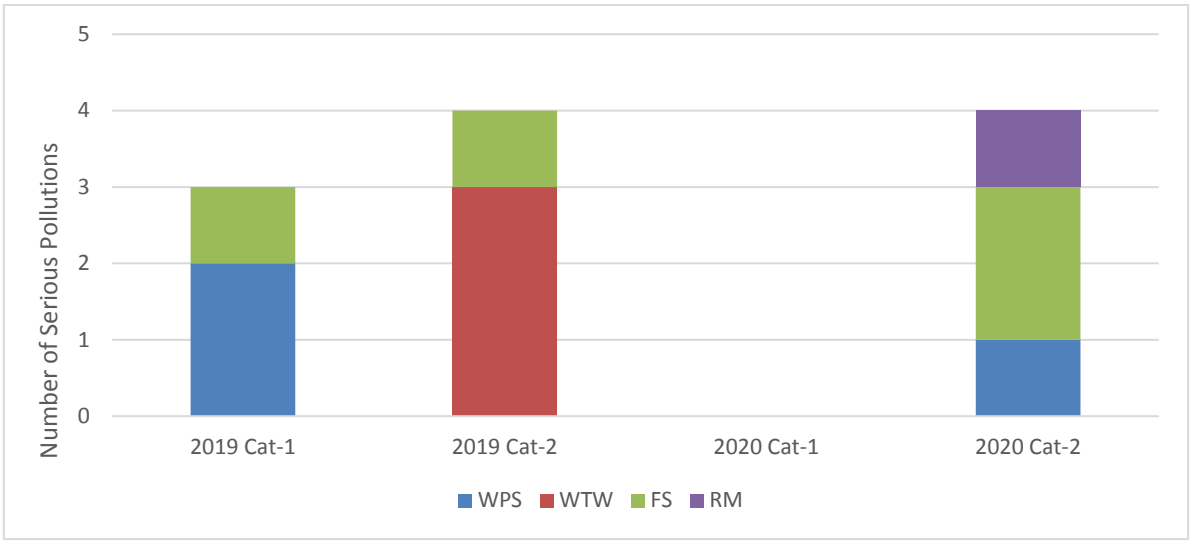

Figure 1 – Serious pollutions

Overall the improvement in serious pollutions is positive, particularly the reduction in non-infrastructure (WPS and WTW) pollutions from five in 2019 to one in 2020 and zero category 1 pollutions in 2020.

1.3. Pollutions by premise

Figure 2 shows the breakdown by premise, which shows the overall improvement in 2020 of circa 10% over 2019. It also highlights the improvements in WTW of approx. 40%. However WPS have not improved and FS performance has slightly degraded in 2020 vs. 2019. Further analysis on the monthly profile and cause is discussed in later sections.

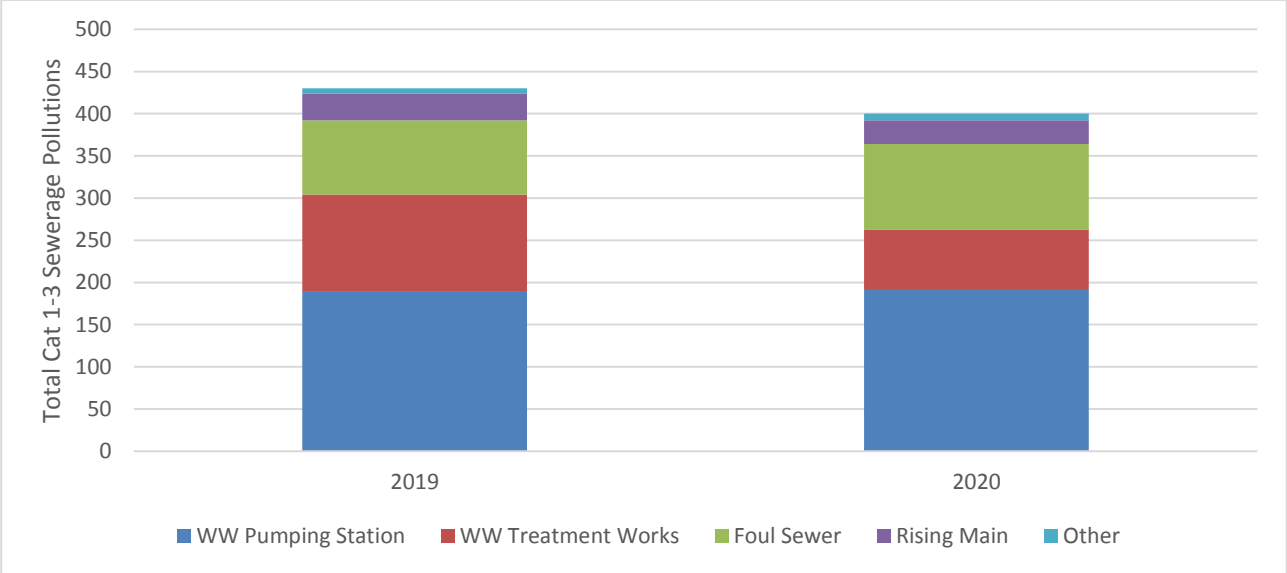

Figure 2 - Pollutions by premise

Other contains:

2019 – Three storm tank pollutions, three from combined sewer overflow pollutions.

2020 – One surface water outfall pollution, six combined sewer overflow pollutions.

1.4. Pollution by month

Figure 3 shows the monthly comparison with 2019. It can be seen that performance at the start of 2020 was worse than the previous period in 2019. As discussed later, the impact of weather was significant in this period. However, from April onwards, every month of 2020 has matched or improved on 2019 performance with the exception of August 2020. Table 2 shows that for the last nine months of the year (Apr–Dec) a 26% improvement has been made. Table 3 shows for the last three months of the year (Sep–Dec) a 46% improvement has been made compared with 2019. In this period large improvements were made to the FS performance. More detail on this can be seen in section 1.5.

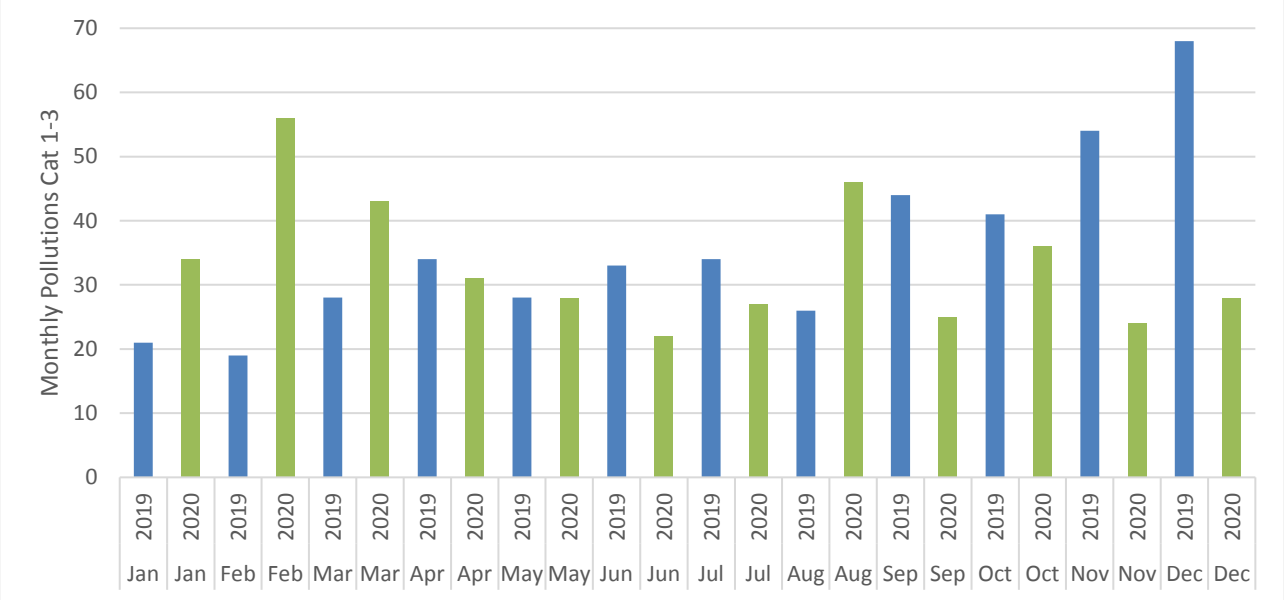

Figure 3 – 2020 monthly performance comparison with 2019

Table 2 – Performance comparison (nine months of 2020 excluding spring (Jan–Mar)

2019 category 1–3 Pollutions (Apr–Dec)	362
2020 category 1–3 Pollutions (Apr–Dec)	267
2020 improvement for period (#)	95
2020 improvement for period (%)	26%

Table 3 - Performance comparison (last quarter)

2019 category 1–3 Pollutions (Sep–Dec)	163
2020 category 1–3 Pollutions (Sep–Dec)	88
2020 improvement for period (#)	75
2020 improvement for period (%)	46%

1.5. Pollution impact from weather

Weather in the spring of 2020 presented tough operating conditions. February was the wettest on record nationally. Figure 4 shows the monthly rainfall for the South East of England (MET office) against our pollution performance by premise for 2019 and 2020. Notable peaks can be seen between Oct-19–Feb-20 and Oct-20 and our performance in the winter of 2020 has improved.

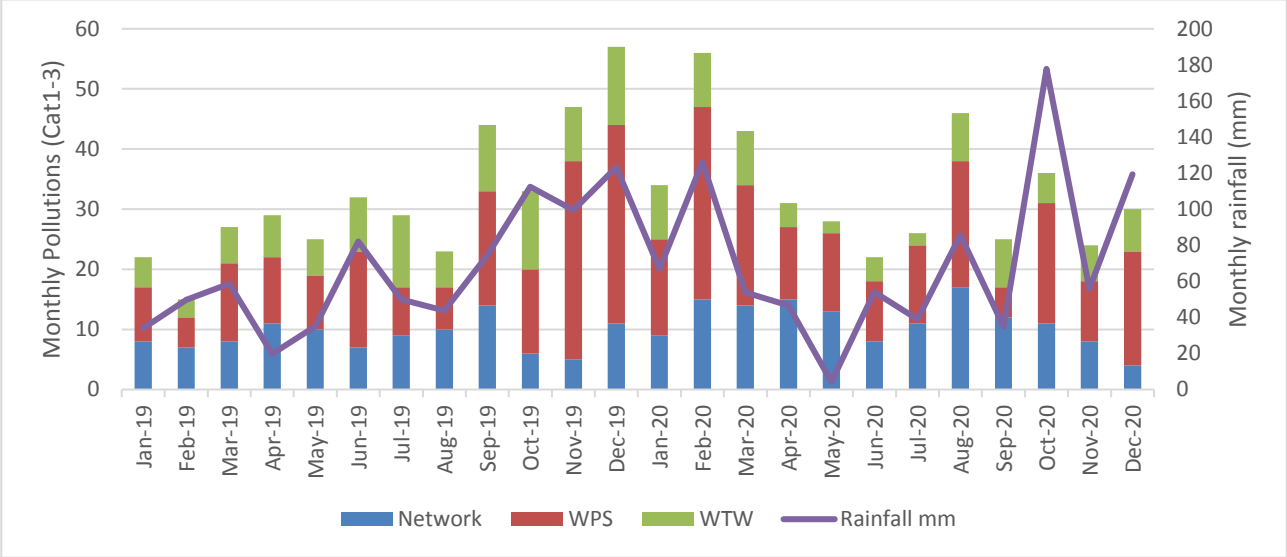

Figure 4 – Pollution performance vs. rainfall

Figure 5 further analyses this and includes a ratio to understand relative performance. This further shows that the Q4 2020 performance at 0.24 pollutions per mm of rainfall was improved over Q4 2019 in which we had 0.41 pollutions per mm of rainfall.

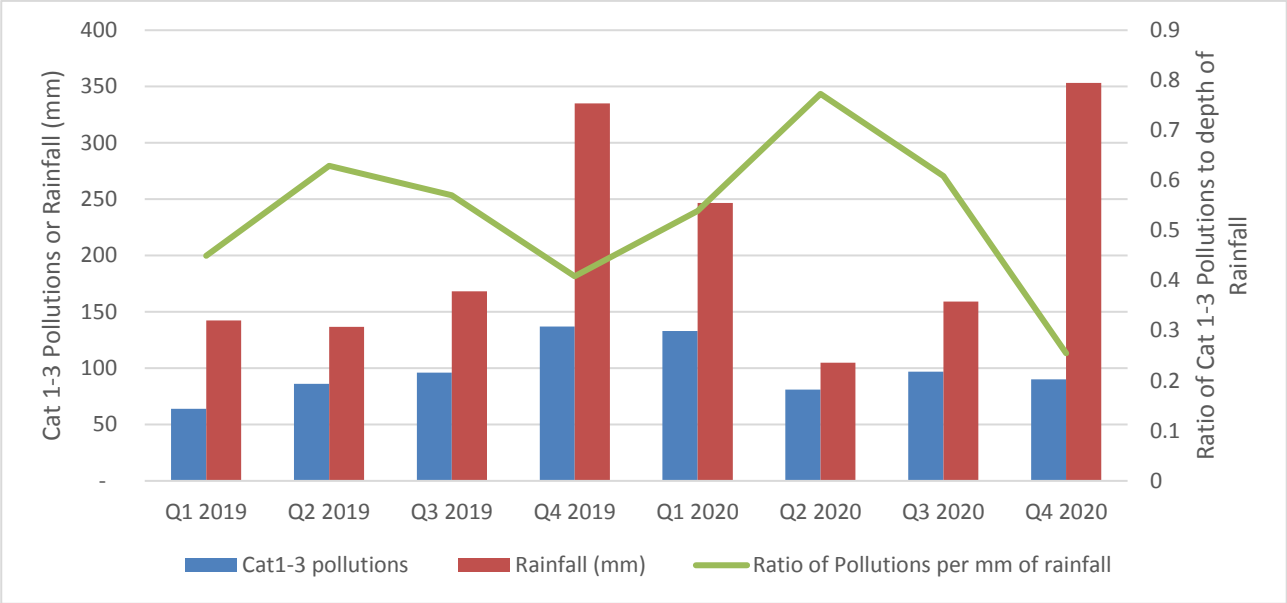

Figure 5 – Quarterly comparison of rainfall on pollutions

1.6. High environmental consequence sites

In the last PIRP we discussed the work focused on high environmental consequence sites, which will have the largest environmental impact if they fail. Figure 6 shows the relative comparison between 2020 and 2019. Overall, a 17% improvement in 2020 has been seen, or 21 category 1–3 pollutions. 29% of pollutions in 2019 were on high environmental consequence sites. In 2020, 26% were on high environmental consequence sites.

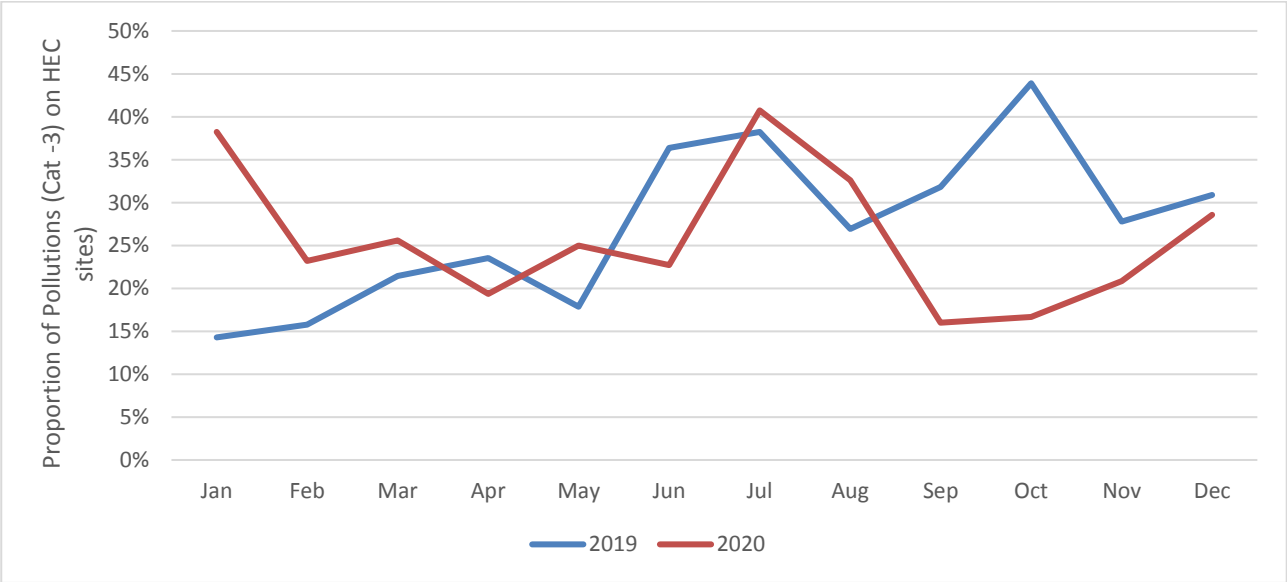

Figure 6 – High environmental consequence WPS and WTW relative performance

1.7. Self-reporting

Large improvements have been made to our culture and reporting processes. The volume of potential pollution incidents rose dramatically midway through 2018 and into 2019. This trend continued in 2020. Although the total volume only rose slightly, the self-reporting remains high and is industry-leading. Figure 7 shows how far we have come since 2015, when self-reporting was just 59%. We are now at 88% overall and 96% of WTW and WPS pollutions were self-reported to the EA.

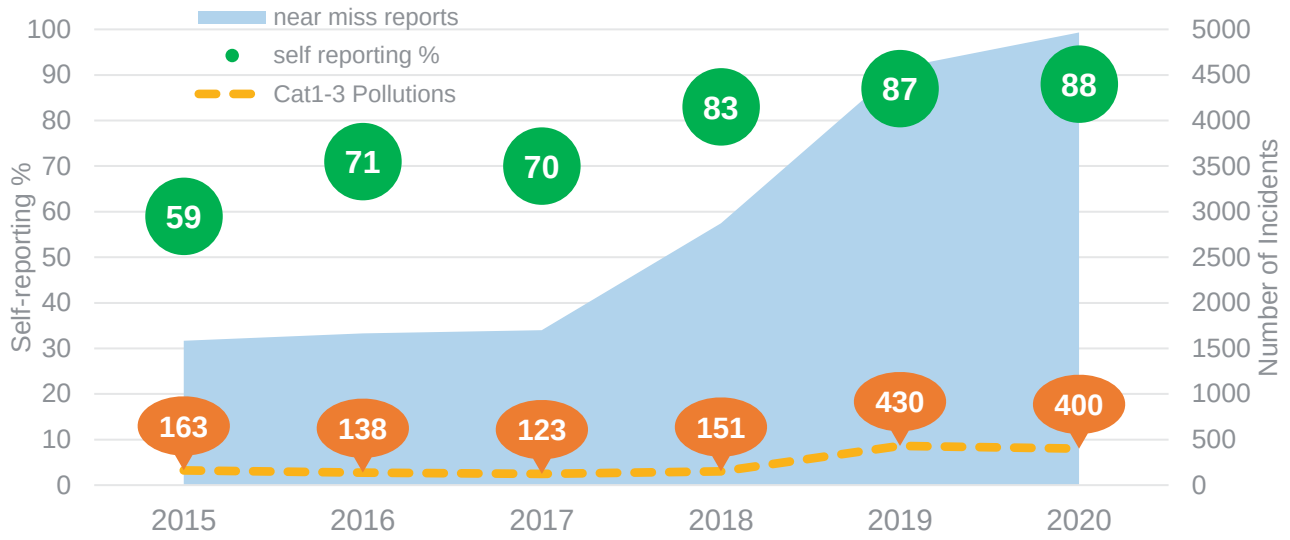

Figure 7 – Historic pollution performance, near miss reporting and self-reporting

1.8. Pollution by fault and cause (WPS and WTW)

As stated in the PIRP published in August, we have improved our investigation process in 2020 (Figure 7 shows this).

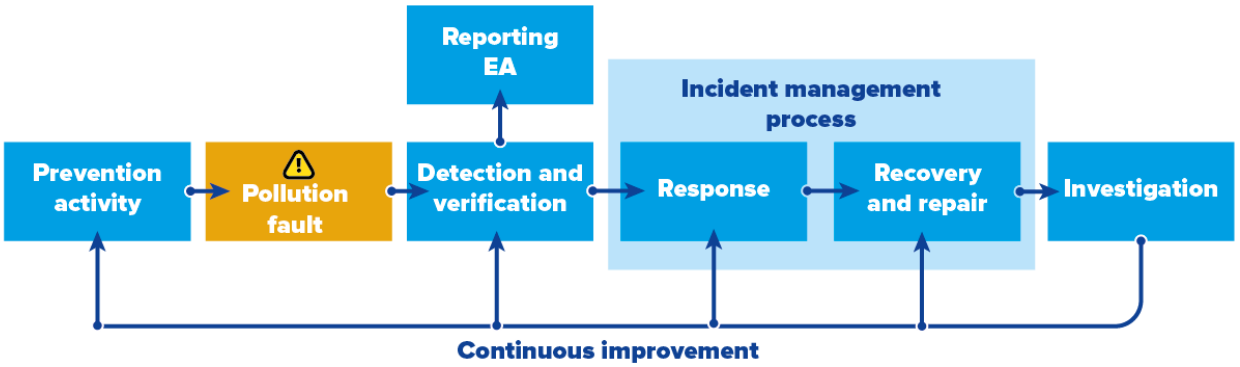

Figure 8 – The pollution process (simplified for causal assessment)

As a result, we now have a much richer set of fault and cause data, which covers more systemic issues in more depth. Broadly these are grouped by:

- Fault – What failed and caused the pollution.
- Prevention – What within the prevention controls failed to prevent the fault.
- Detection and verification – What within the detection controls failed to detect the issue early enough to respond and stop the pollution.
- Response, recovery and repair – What failed in the response to prevent the pollution.

We have initially focused this new investigation technique at WTW, WPS and RM, which started mid-2020, and we will be embedding it into FS pollution investigations in 2021.

WPS fault

The faults from WPS in 2020 are dominated by pump issues and power failures or blips. The top five faults are listed and described below:

1. Pump fault/failure – This could be an electrical or mechanical fault of the pump.
2. Site electric mains failure with incident reference – This is a District Network Operator supply failure of which we have been provided an incident reference number from that District Network Operator.
3. Pump tripped/rest – A pump has tripped and therefore stopped operating and required a manual reset.
4. Pumps air locked – Air has entered the pump bowl, reducing or even stopping the pass forward rate.
5. Site electric mains power blip – A supply issue from the District Network Operator which resulted in a dip in power supply to the WPS.

WPS causes in 2020

The top five WPS prevention control failures (shown in Table 4) were seen in 73% of the pollutions investigated.

Table 4 – Top five WPS 'prevention' control failures

Prevention control failure		Comment
Power resilience asset issues	20%	A power failure/blip could have been prevented if the asset had better resilience
Control, monitoring and telemetry	18%	One or a combination of these systems failed to function to prevent the pollution
Poor pump performance not acted upon	16%	Signs of pump performance issues were evident before the pollution
Equipment out of action	11%	Some of the equipment was out of action and led to the pollution (e.g. a standby pump)
Maintenance issues	8%	Maintenance (e.g. quality) led to the pollution

The top three WPS detection and verification control failures (shown in Table 5) were seen in 80% of the pollutions investigated.

Table 5 - Top three WPS 'detection and verification' control failures

Prevention control failure		Comment
Not detected on site	31%	For example, the pollution was not detected on site by an operator/technician but was later picked up by central control function
Interrogation of alarms	31%	The site that polluted alarmed out but delays in response due to alarm interrogation led to the pollution
Insufficient data to detect issue	19%	The site instrumentation is not sufficient to detect the issue and prevent the pollution

The top four WPS response and repair control failures (shown in Table 5) were seen in 80% of the pollutions investigated.

Table 6 – Top four WPS 'response and repair' control failures

Prevention control failure		Comment
Delays in escalation	38%	Delays in escalation from the first responder led to the pollution
First responder limitations	34%	The first responder wasn't able to resolve the issue and avoid the pollution
Environment impact assessment insufficient	9%	Without a good impact assessment the pollution is likely to defaulted to a category 3 incident
Continuity – plan failure	9%	The emergency plan was not sufficient or had errors to guide the incident service recovery to avoid the pollution

WTW fault

The faults from WTW in 2020 are dominated by pump and inlet issues and power failures or generators. The top five faults are listed and described below:

1. Pump failure/failure – This could be electrical or mechanical fault of one or more pumps on a works.
2. Inlet blockage – This is a blockage at the inlet screen to the works often caused by sewer misuse (e.g. wet wipes).
3. Programmable logical control fault/failure – A control philosophy issue that inhibits pumps running in some conditions.
4. Site electric mains failure with incident reference – This is a District Network Operator supply failure of which we have been provided an incident reference number from that District Network Operator.
5. Electric power outage – For example, a mains or generator issue that resulted in a dip in power supply to the WTW.

The top five WTW prevention control failures (shown in Table 7) were seen in 81% of the pollutions investigated.

Table 7 – Top five WTW 'prevention' control failures

Prevention control failure		Comment
Maintenance issues	31%	Maintenance (e.g. quality) led to the pollution
Control, monitoring and telemetry	14%	One or a combination of these systems failed to function to prevent the pollution
Power resilience asset issues	14%	A power failure/blip could have been prevented if the asset had better resilience
Equipment out of action	14%	Some of the equipment was out of action and led to the pollution (e.g. a standby pump)
Design and build issues	8%	An issue with how the asset was designed or built was identified to have led to the pollution

The top four WTW detection and verification control failures (shown in Table 8) were seen in 86% of the pollutions investigated.

Table 8 – Top four WTW 'detection and verification' control failures

Prevention control failure		Comment
Not detected on site	33%	For example, the pollution was not detected on site by an operator/technician but was later picked up by central control function
Interrogation of alarms	29%	The site that polluted alarmed out but delays in response due to alarm interrogation led to the pollution
Instrumentation fault	14%	Instrumentation equipment failed
Insufficient data to detect issue	10%	The site instrumentation is not sufficient to detect the issue and prevent the pollution

The top four WTW response and repair control failures (shown in Table 5) were seen in 86% of the pollutions investigated.

Table 9 – Top four WTS 'response and repair' control failures

Prevention control failure		Comment
Delays in escalation	32%	Delays in escalation from the first responder led to the pollution
First responder limitations	23%	The first responder wasn't able to resolve the issue and avoid the pollution
Incident management issues	18%	Breakdown in incident management processes led to the pollution
Environment impact assessment insufficient	14%	Without a good impact assessment the pollution is likely to defaulted to a category 3 incident

Network pollutions

Foul sewer (FS) pollutions were predominately caused by blockages in the gravity network from fat, oil and grease (FOG) and unflushables, such as wet wipes. The analysis applied to WPS and WTW shown above is being rolled out to these pollutions in 2021 and further analysis of these pollutions will feature in the 2022 PIRP.

Rising main (RM) pollutions are all from pipe bursts, predominately due to asset age. However, further work is underway in 2021 to determine other contributing factors and interventions that could reduce these events.

1.9. Conclusion from 2020

- The pollution performance has improved in 2020, particularly in the last quarter. The overall year end performance is masked by the poor performance in the first quarter.
- Resilience in wet weather was shown to improve in the last quarter of 2020.
- Near miss reporting and self-reporting improved again in 2020.
- WTW and WPS pollution are responsible for 66% of all pollutions and are an industry outlier.
- The top WPS faults are relating to pump failures/trips, electric mains failures/blips, and pumps being air locked.
- The top WTW faults are pump failures, inlet blockages, control failures or mains/generator failures.
- The top prevention control failures for WPS and WTW were:
  - Power resilience asset issues
  - Control, monitoring and telemetry
  - Poor pump performance not acted upon
  - Equipment out of action
  - Maintenance issues.
- The top detection control failures for WPS and WTW were:
  - Not detected on site
  - Interrogation of alarms
  - Insufficient data to detect issue.
- The top response control failures for WPS and WTW were:
  - Delays in escalation
  - First responder limitations
  - Environment impact assessment insufficient.
- The fault and cause data has provided valuable insight into targeting our next steps and PIRP.

2. Year one plan – delivered

2.1 Delivery against the plan

Southern Water developed a detailed programme of activities to deliver a sustainable reduction in pollution incidents in 2020. This is summarised in Table 10, which shows that we delivered on the plan and, in fact, we have delivered additional activities. Due to COVID-19 training restrictions, delays have been seen with the Think Pollution training and the course was redesigned to be delivered remotely via e-learning tools.

Table 10 – Programme activity summary for year one (position on 15 April 2021)

Swim-lane	Activity description	AMP7 year one target	AMP7 year one actual
Staff and customer participation	Think Pollution training	Supply chain and new starters. Key office staff.	Practical courses: 232 E-learning: 224 Contractors: 78 (Mar 21)
	Establish Clever Nelly competency tracking	New	Live (Dec 20)
	Customer participation – Havant and Hayling Island blockage reduction pilot	Complete the pilot catchment and two more catchments	Completed (Dec 20)
	WPS site continuity plans (no. verified)	350	Completed (Dec 20)
	WTW site continuity plans (no. verified)	364 (all sites)	Completed (Mar 21)
Improving resilience of assets and processes	Health checks (no. of sites – WPS and WTW)	200 WPS	Completed (Mar 21)
	Immediate and high pollution action closure (% closed / target)	90%	Completed
	WPS auto resets (sites with completed installs)	550	Completed (Jul 21)
	Generator resilience (mains failure test, load test and enhanced service)	440	Completed (Feb 21)
	Standby system checks (no. of sites)	Maintain	-
	Air circuit breakers checks (no. of sites)	Maintain	-
	Top 10 WTW repeat sites with Action Plans in place	10	10 WTW (Dec 20) 26 WPS (Dec 20)
	Air lock protection on high risk WPS	New	50 high risk sites (Mar 21)
	Changeover control inhibit fault rectification on high sites – survey	New	179 sites surveyed and 60 faults found and rectified

Trusted monitoring and analysis	Alarm transformation (no. of WPS sites)	300	Completed (Jul 21)
	Underload alarms for screw pumps and aerators (no. installed)	Maintain	-
	Condition based monitoring on critical sites monitored centrally	650 sites	Circa 1,500 sites covered with new capability (see section 3.4)
	New spills system (ASPIRE)	Maintain	Beachbuoy improvements also made (Feb 21) and further improvements in May 21
Smart networks / fast and effective responses	Recruit, train and new Waste Network Coordinator Shift	24 x 7 shift	New shift operational and established
	High pollution risk manholes targeted	Strategy to be developed based on pilot results	8,326
	Pollution spotter signs at high risk network locations	NEW	761

2.2 Additional activities delivered over and above the plan

The plan was and is continuously reviewed and improved against actual performance. As lessons or trends inform us, additional activity is considered and implemented. The following activities were added to the plan this year for these reasons.

Think Pollution – Clever Nelly

As seen in section 1, human error plays a large part in the primary cause of pollution. Therefore, it is was deemed necessary to undertake further reinforcement of the pollution training for first responders. Clever Nelly is an application to ensure that what is trained is learned, therefore increasing employee capability and competency. Through continuous gentle assessment and measurement, it provides detailed insight into knowledge retention of every employee signed up. It also helps to create a culture of continual learning.

We have successfully rolled out Clever Nelly to our field teams to ensure that our staff retain their knowledge of our Think Pollution training. It enables managers to keep track of their teams' progress and engagement into the subject, allowing us to highlight areas for improvements and where a re-sit of the training is necessary.

Air lock protection

Through analysis of the data seen in section 1, it was determined that multiple pollutions could be avoided by enhanced air lock protection at WPS.

Through a detailed site selection process, 50 of our sites most vulnerable to air-locking have been targeted to implement:

- enhanced maintenance and upgrades of air removal equipment to prevent any air locks from occurring.
- installation of an underload monitor to detect when an air lock occurs and trigger an alarm (without this the pump can continue to run without pumping water).

50 sites were complete by the end of March 2021 and another 200 sites will be targeted by the end of March 2022.

Control inhibit rectification

Through analysis of the data seen in section 1, it was determined that multiple pollutions could be avoided by rectifying issues with WPS control philosophy on a sub-set of sites. This control philosophy issue identified inhibits pumps running in some conditions.

Through a detailed site selection process using pollution investigation reports, health checks and pollution history, 60 of our most vulnerable sites with this failure mode were targeted for implementation of control inhibit rectification. All of these sites will have been completed by the end of March 21. A further 75 sites will have the protection added to them by March 22.

Pollution Spotter signs

At the beginning of the AMP, we launched an initiative to harness the support of our customers in identifying potential pollutions. We recognise that many of our sewers and manhole covers are in areas which are not yet monitored by technology and our customers can sometimes be our eyes and ears when a problem occurs. We have deployed more than 700 Pollution Spotter signs this year to encourage members of the public to let us know if they spot signs of possible pollution in a watercourse.

Figure 9 – Typical location of a Pollution Spotter sign

2.3 Pollution benefits seen from the plan

Automatic pump reset (APR)

A number of pollutions have been avoided since the installation of the automatic reset solution at remote WPS. The solution aims to reset circuit protection faults in a controlled manner, rather than waiting for a human-operated reset. This solution provides the benefit of reducing the time taken to reset equipment. Through a detailed site selection process, 550 carefully-selected sites will have an APR system installed by July 2021. From the installation of these 550 sites, the benefit to year two (2021) has been estimated as 19 avoided category 3 WPS pollutions, rising to 36 in year two (2022). A further 170 sites will have the system installed by March 2022.

Fixed/mobile generator resilience

By improving the resilience of our fixed and mobile generator fleet within Southern Water, it has been identified through a full mains fail test that further work and improvements were needed for a number of our generators. These tests were carried out to prove reliability and provide confidence that they would start and maintain supply when needed. We have now completed the full service and mains fail testing across all fixed sets and mobile sets. The benefit to year two (2021) has been estimated as 12 avoided category 3 pollutions across WPS and WTW sites.

Benefits from high risk manholes

Since March 2020, we have had a consistent program of targeted inspections in locations with high risk of blockage and close proximity to a watercourse. More than 8,000 inspections have taken place. Of these, 67 were found to be blocked and at imminent risk of discharging. We believe that this has led to the avoidance of 21 pollutions to a watercourse.

Table 11 – High risk manholes benefits

Phase	Manhole inspections	Significant blockages	Total blockages	Pollutions avoided
1	1650	43	2	10
2	1006	6	0	1
3	1997	7	5	6
4	1263	11	0	2
5	2410	0	2	2
Total	8326	67	9	21

This activity will continue into year two as a structured part of our planned maintenance and network monitoring program.

Benefits from Pollution Spotter signs

It has not been possible to quantify the number of phone calls generated but an email option is available and from this we've received 60 reports. Once investigated, the majority of these were confirmed to not be pollutions. However, 10 were attributed to third party activities and one related to a Southern Water issue that could have resulted in a more serious pollution event.

Table 12 – Pollution Spotter signs benefits

Signs deployed	Customer contacts received	No pollution present (other cause)	Third party responsibility	Southern Water responsibility
761	60	49	10	1

Blockage campaigns / customer feedback

This year, we have completed three targeted blockage campaigns, which included online, digital audio and radio media channels to convey carefully-constructed and demographically-targeted messaging aimed at engaging our customers in helping to prevent blockages. Although our 3 Ps message has been key to this, the structure of the communications has been specific to demographics in certain areas and has also been complemented by leaflet drops in the same places.

Post-campaign surveys have demonstrated a very encouraging response to this activity. A high proportion of customers in the target areas looked upon the campaigns favourably and said that they would change their behaviour. We believe that this activity is a long-term one, but we are working to understand the effect on blockages over time in the targeted areas. At the same time, we are planning and delivering a more targeted campaign of work in 2021 focused on smaller local area catchments.

Culture change

This year, we have done a lot of work to improve our culture and behaviours. Through the data and observations of our regulators, we recognised we could improve our time to report an incident and provide better evidence.

We enabled the right behaviours through training and better information to allow people to do the right thing at the right time. This has been enhanced further through visual prompts such as the 30 minute plan and phone stickers, shown below.

Figure 100 - 30 minute plan phone sticker (left) and poster (right)

In 2020, we have seen an improvement in our reporting time for notifying the Environment Agency of pollution events and this continues to improve. We continue to look to enhance the knowledge and ability of all our teams, both field and office-based, as we recognise providing a culture of learning will reduce human errors.

3. Our plan for year two

3.1. Key lessons from 2020 fault and cause analysis

The key lessons from 2020 can be summarised as:

- Continue with the beneficial activities implemented in year one (2020–21), particularly:
  - High pollution risk manholes
  - Automatic pump resets
- The top WPS faults are:
  - Pump failures/trips
  - Electric mains failures/blips
  - Pumps being air locked
- The top WTW faults are:
  - Pump failures
  - Inlet blockages
  - Control failures
  - Mains/generator failures
- The top prevention control failures for WPS and WTW were:
  - Power resilience asset issues
  - Control, monitoring and telemetry
  - Poor pump performance not acted upon
  - Equipment out of action
  - Maintenance issues
- The top detection control failures for WPS and WTW were:
  - Not detected on site
  - Interrogation of alarms
  - Insufficient data to detect issue
- The top response control failures for WPS and WTW were:
  - Delays in escalation
  - First responder limitations
  - Environment impact assessment insufficient

Therefore, the following activities have been designed into year two (2021–22).

3.2. The year two plan

Table 13 shows the plan in detail and our targets for the end of year two (April 2022).

Table 13 – Programme activity summary for year two

Swim-lane	Activity description	AMP7 year two target (April 2022)
Human error reduction	Think Pollution training	Roll out e-learning training to other contractors
	Clever Nelly	Maintain and continuously improve
	Interactive scenario training	Pilot complete
	WPS site continuity plans	150 WPS 2 deep dive tests of OCPs
	WTW site continuity plans	Maintain 1 deep dive tests of OCPs
	Pollution critical process checklist	Checklist pilot complete 30 Sept 2021 100% adherence of checklists
	Video risk triage	Pilot complete
	Post incident retrospective discussion	100% of category 3 (or greater) incidents

Swim-lane	Activity description	AMP7 year two target (April 2022)
Improving asset resilience	Health checks (no. of sites WPS and WTW)	200
	WPS auto pump resets	170
	WPS condition based monitoring	180
	Black start key risk WTW sites (rectify issues and enhance alarms)	20 high risk WTW sites
	High risk and repeat sites with action plans	10 WTW 30 WPS
	Air lock protection on high risk WPS	200 WPS
	Backup control enhancement and resolution of pump inhibit fault rectification on high sites	75 WPS

	WTW – APR and CBM	APR – 88 equipment sets, 40 sites CBM – 20 equipment sets, 18 sites
	PLC backup control testing and enhancement	108 sites
	Go to green	**WPS** – 123 sites Expected status by Dec 2021 – 71 Green, 48 Amber and 4 Red **WTW** – 38 sites Expected status by Dec 2021 – 22 Green, 15 Amber and 1 Red

Swim-lane	Activity description	AMP7 year two target (April 2022)
Trusted monitoring and analysis	Alarm Transformation (no. of WPS sites)	100 WPS
	Alarm quality review (high risk sites)	60 sites
	Proactive Analytics Centre – WPS proactive intervention	Establish and refine (see next section)
	Spills Reporting System (ASPIRE) – maintain and enhance	Additional 500 outfall profiles implemented Maintain Beachbuoy improvements in line with stakeholder requirements

Swim-lane	Activity description	AMP7 year two target (April 2022)
Customer participation and network	High pollution risk manhole inspections	10,000
	Pollution Spotter Signs at high risk network locations	500
	Customer participation – blockage reduction campaign	Deliver targeted campaigns in nine local area catchments (LACs) alongside other network inspection

Think Pollution training

An online e-learning course for first responders to raise awareness off pollution, ensure evidence is captured and appropriate escalation is made following an event.

We provided classroom-based training to 650 people before COVID-19 restrictions were introduced. An additional 224 field and office-based staff were subsequently trained via an e-learning tool. We have begun capturing our supply chain and continue to roll out the training to other contractors.

Clever Nelly

Engaging micro-assessments that take less than one minute a day to complete are automatically sent out by the tool. It gently improves each employee through spaced learning, repetition and ensures employees are achieving the required level of role-specific competence and improves performance. It objectively measures knowledge and competency in all staff required to complete our Think Pollution training course. Since Clever Nelly went live in Dec 2020, we will now be maintaining and continuously improving on the knowledge, competency and engagement of our staff.

Interactive scenario training

Using past pollutions as scenarios, we will give field staff a way to digitally practise their response to pollutions, enabling them to learn about the consequences of their actions. We aim to develop and deliver a range of interactive experiences of different pollution situations with the aim to increase first responder confidence and adherence to the 30 minute plan. We are working with our learning and development department to explore and test a range of delivery mechanisms. This will include using reporting from Clever Nelly to determine low-scoring participants who we can prioritise for training.

Blockage reduction campaign

Building on our successes in AMP6 with our award-winning FOG and Unflushables team, we have trialled different approaches to stimulate customer participation to reduce blockages in problematic catchments with high blockage-related pollutions in Havant and Hayling Island, Motney Hill and Brighton. Since the success of those completed, we are now looking to deliver targeted campaigns in nine local area catchments (LACs), alongside other network inspections.

WPS operational continuity plans

Operational continuity plans (OCPs) were historically only written following a pollution incident. We engaged with our data team and auto-generated continuity plans for all WPS sites. 350 high environmental consequence sites have now been manually verified and are now being used in emergency scenarios. We are now looking to complete an additional 150 WPS OCPs with two deep-dive tests to measure the accuracy and success.

WTW operational continuity plans

Since completing the enhancement of the WTW OCPs, including additional information to help mitigate and reduce the impact of a pollution event, we are now committing to maintaining those completed and carrying out one deep-dive test to measure the accuracy and success of those completed OCPs.

Pollution critical process checklist with visual aids

We will use checklists to ensure adherence to crucial site checks and to reduce ‘lapse’ based errors on pollution critical processes. We will use visual aids to demonstrate definitions of ‘done’. We aim to deliver the site check checklist and a process of tracking 100% adherence through working collectively with field teams.

Video risk triage

We will use a mobile application to capture images of pollution risk. Machine learning will be used to tag the risks, enabling them to be quickly triaged by site owners or the Pollution team. We will deliver an experiment that validates the value of the platform in flagging more risks, easily and with a greater level of engagement and risk assessment.

Post incident retrospectives

We will conduct in-depth interviews and enable team-led retrospectives, focusing on identification of learnings and actions that can better enable first responders to succeed. We will empower the site owners to conduct retrospective interviews after every incident and for the incident team to conduct in-depth interviews for incidents where there are multiple elements of human error.

Health checks

Proactive health checks on high consequence WPS to identify improvements and to mitigate pollutions risks. 350 WPS and 50 WTW were completed in 2019 and a further 200 sites have since been checked in 2020. We are committing to complete an additional 200 health checks this year.

Black start site testing and enhancement

A project to test the reliability of critical assets within our treatment works from power-related issues. 20 sites have been selected through analysis of historical failures due to power-related issues and multiple work orders for resetting of equipment following a power outage.

The project will deliver controlled mains failure testing on these sites, to identify critical assets which do not re-energise following the failure testing. This project will then focus on installing measures to mitigate against this from happening again, and improve the reliability of these sites in relation to pollution and compliance following power failures.

Air lock protection

Through careful data analysis, it has been identified that multiple category 3 pollutions per year could be avoided by ensuring our assets are protected from air-locking. The protection will be formed from two different activities on site:

1. Maintenance and upgrading of airline pipework to prevent any air locks.
2. Installation of an underload monitor to detect when an air lock occurs and trigger an alarm.

Changeover control inhibit

Through data analysis, it has been identified that multiple category 3 pollutions per year could be avoided by ensuring our control philosophies used at Southern Water's pumping stations are mitigated through control inhibits. This control intervention inhibits pumps running as duty standby, but allows the duty pump to keep running in the event of a failure of the standby pump. 75 sites will have the protection added to them by March 22, following a detailed site selection process using pollution investigation reports, health checks and pollution history.

Alarm transformation

A programme to improve the alarm quality, consistency and volume to allow controllers in and out of hours to prioritise resources and activity appropriately. 10 WPS pilot sites were completed in 2020 with a target to complete 300 in total by July 2021. We will also be committing to an additional 100 sites transformed by April 2022 and a much larger expansion in 2023 when new capability will allow more effective deployment.

Alarm quality reviews

We are planning to undertake alarm quality reviews and improvements on high-risk sites while we wait for some system improvements to our alarm management system. In year three, we hope to be able to undertake significant volumes of alarm transformation.

Spills reporting system (ASPIRE)

A robust and reliable tool, designed to permit effective reporting of spills from multiple data sources to ensure our pollution reporting is compliant and can be confidently used for evidence-based decision making. The new system has been operational since December 2019 and 500 outfall profiles were implemented in 2020. We will maintain, enhance and implement an additional 500 outfall profiles in 2021.

Condition based monitoring (CBM)

Included as part of the resilience project, condition based monitoring, verification and installation will take place over 180 sites across WPS, and 20 equipment sets across WTW throughout the region. The delivery of this project includes verification and end-to-end testing of existing CBM installs to provide accurate data back through telemetry. Where applicable, new CBM will be installed on sites involving current, flow and power monitoring.

3.3. Governance

The project will continue to have a very high profile within the organisation. Monthly reporting to the executive level will be maintained, focusing on the progress against the plan and associated pollution performance.

3.4. Best practice

We were the instigators of the zero pollution conference and remain active members of the steering committee, which is now in its third year. We are also participating in many national forums, which are sharing best practice and solutions to common problems.

3.5. Go to Green

The Go to Green process was mobilised at the end of 2020 as a new way of working with a focus on Pollution and Treatment Compliance risk and the actions required to reduce and mitigate risk. This process is driven weekly by the Wastewater Operation Director and has already started to deliver benefits. A concept diagram is displayed below in Figure 11.

- If a site is at high risk of causing a pollution and is unmitigated, it is classed as red.
- If the site risk can mitigated operationally (e.g. with some temporary hire equipment), it is moved to amber.
- If a site is no longer a risk and has sustainable resilience, it is moved to green.

The actual site performance is tracked weekly against the forecast improvement plans. New batches of sites are added at regular intervals to capture any new sites. This process is followed for WPS and WTW.

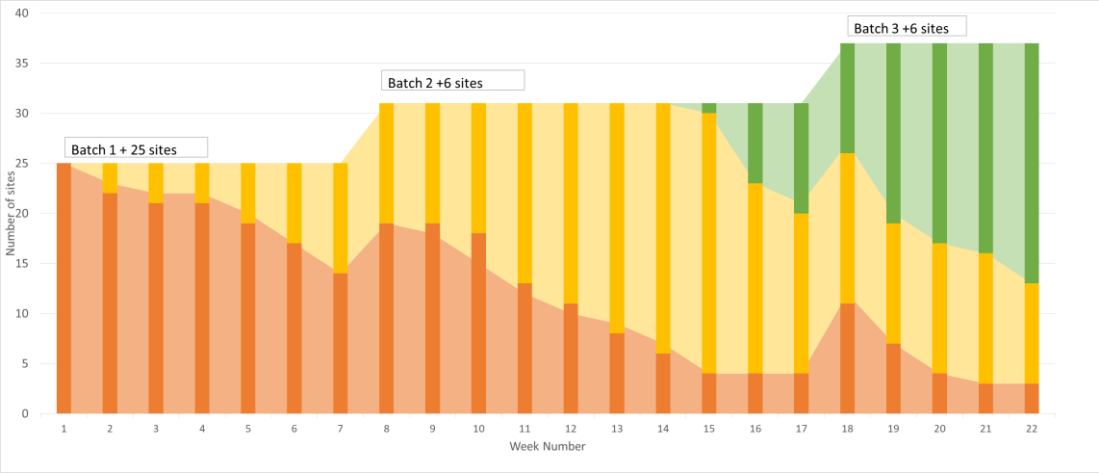

Figure 11 – Go to Green concept – weekly tracking

3.6. Strategic projects

A large portfolio of strategic projects have also been initiated in 2020. These will span a number of areas of the business, including logistics, asset maintenance and digitalisation. These programmes will provide multiple benefits across water and wastewater and there will be significant pollution reduction benefits. The main projects that deliver pollution benefit are the Proactive Analytics Centre, Wastewater Network Digitalisation and Regional Control Centre Transformation. These are described in detail below.

Proactive Analytics Centre

The Proactive Analytics Centre aims to make better use of existing and future data within the business to drive enhanced decision making and prevent asset failures. It will consist of a new team and analytical tools that will effectively introduce a new line of defence that will identify asset deterioration before an alarm is triggered, which would typically need a reactive response. The centre is justified and will be built on a number of uses cases that will be introduced once they are piloted and proven. Due to our concern and relatively poor performance in WPS reliability, the first use case piloted the approach on WPS to drive proactive interventions to reduce pollution.

An existing set of data across approximately 1,700 of our WPS sites was used more proactively to detect performance issues. We have enhanced the analytics that use this data to generate daily exceptions that require manual review. However, the pilot reinforced the importance of ensuring processes are designed appropriately and people are focused and trained accordingly. We are finding a multitude of issues proactively before they cause catastrophic failures and pollutions. These include the detection of wear on pumps, blockages of pumps and non-return valves as seen in Figure 12.

Figure 112 – Pictures of issues identified by the Proactive Analytics Centre: the image on the left demonstrates the impact of wet wipes clogging a non-return valve, while the right shows fat, oil and grease stuck to the pump impeller and reducing efficiency

At the time of writing, we are in the process of moving the WPS use case into business as a permanent capability, while new uses cases are being designed and prepared for piloting. These include rising main burst prevention and targeted interventions on WTW (inlet screens and pumps).

Network Digitalisation

As discussed previously, sewer blockages are the main cause of network pollutions. Currently, the operating model of our gravity sewer network relies heavily upon customer contact to act as alarm for our control centre. We have very limited telemetry and instrumentation on the sewer network. Relying on the customer contact is not a sustainable model. It is too reactive and will not allow us to achieve our environmental ambition. By the time a call is received, a sewer blockage has often already caused a pollution. If we are to improve our network pollution performance, we must detect a blockage before it turns into an event (flooding or pollution). Fortunately, due to changes in the cost of sewer monitors, the business case for mass deployment into the network has recently changed for the positive.

We are now in the process of piloting the new technologies to confirm our business case assumptions. Assuming this is successful, this summer we hope to make a decision on mass deployment of tens of thousands of sewer monitors at high-risk locations to prevent pollution and flooding events.

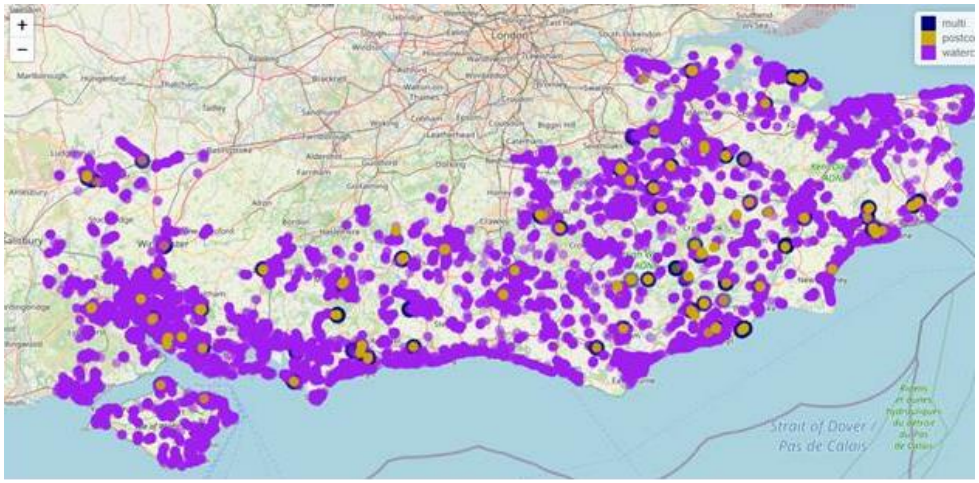

Figure 123 – Sewer monitor deployment modelling

Technology trials and pilots have proven that the new technology is easily deployable.

Figure 134 – Low-cost sewer sensor being installed

Regional Control Centre (RCC) Transformation

The existing RCC is also undergoing a transformation to ensure it is an effective and fit for purpose. The scope of the transformation includes developing the situational awareness to allow multiple, disparate data sets to be displayed in one place to aid decision making and prioritisation. There will also be multiple process and capability enhancements to improve response to events and incidents. The physical space is also in scope to be improved.

3.7. Year two plan mapped to 2020 fault and cause analysis

Mapping these activities against the learning from 2020 shows that the activities have been designed to address each of those highlighted from the 2020 analysis. A combination of cost-benefit analysis and technical assessment was used to prioritise activities.

Faults and causes	Year two PIRP activity
The top WPS faults were: **1. Pump failures/trips** **2. Electric mains failures/blips** **3. Pumps being air-locked**	1. Auto pump resets, WPS action plans, Go to Green, Proactive Analytics Centre 2. Auto pump resets, generator resilience work 3. Targeted air lock protection
The top WTW faults were: **1. Pump failures** **2. Inlet blockages** **3. Control failures** **4. Mains/generator failures**	1. WTW action plans, Go to Green, Proactive Analytics Centre 2. WTW action plans, Go to Green, Proactive Analytics Centre 3. PLC resilience work 4. Generator resilience, black start testing
The top prevention control failures for WPS and WTW were: **1. Power resilience asset issues** **2. Control, monitoring and telemetry** **3. Poor pump performance not acted upon** **4. Equipment out of action** **5. Maintenance issues**	1. Generator resilience, black start testing 2. Control inhibit, alarm transformation, air lock protection, condition based monitoring, Proactive Analytics Centre 3. Go to green, Think Pollution training, Clever Nelly, human error initiatives 4. Go to green 5. Go to green, strategic project – asset maintenance
The top detection control failures for WPS and WTW were: **1. Not detected on site** **2. Interrogation of alarms** **3. Insufficient data to detect issue**	1. Think Pollution training, Clever Nelly, human error initiatives 2. Alarm transformation, Think Pollution training, Clever Nelly 3. Condition based monitoring, Proactive Analytics Centre, air lock protection
The top response control failures for WPS and WTW were: **1. Delays in escalation** **2. First responder limitations** **3. Environment impact assessment insufficient**	1. Conti-plans, Think Pollution training, Clever Nelly and human error initiatives 2. Conti-plans, Think Pollution training, Clever Nelly and human error initiatives 3. Conti-plans, Think Pollution training, Clever Nelly and human error initiatives

4. The activity benefits and forecast

We continue to improve the link between activity and the benefits in terms of pollutions avoided. The method has improved throughout the year and further work is ongoing to improve the technique again. This will be more and more important as we reduce numbers further. Our new forecast takes account of the all activity delivered and all activity scheduled to be delivered. Based on our latest view and causal understanding, our updated forecast for 2021 is now 260.

It can be seen from Figure 15 that, despite the significant improvements, we remain red on EPA in 2021 with our current forecast but expect to move to an amber position by 2022. The impact from strategic projects becomes significant in 2022, along with the sustained benefits from the wider Pollution Incident Reduction Plan.

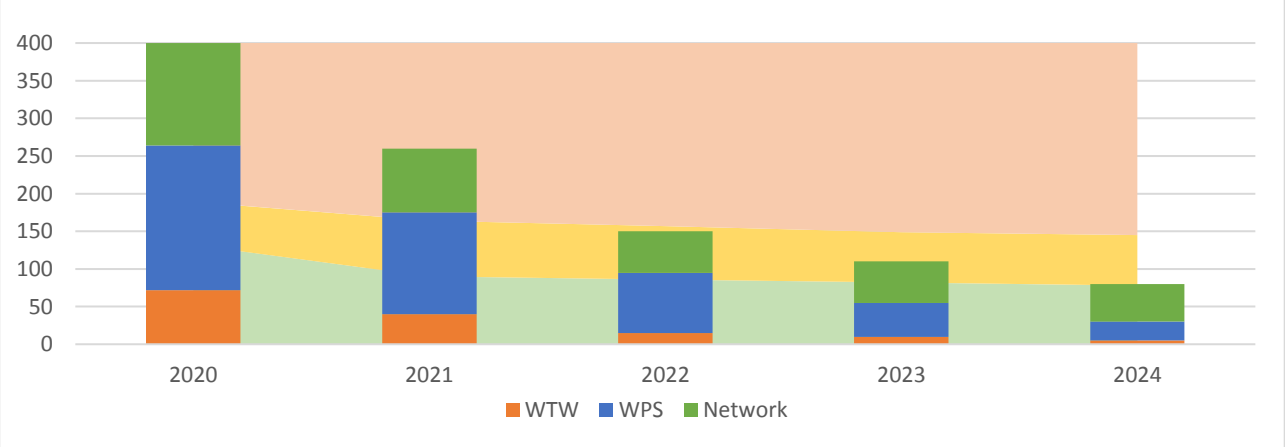

Figure 145 – Forecast EPA performance

Forecast performance	2020	2021	2022	2023	2024
WTW	72	40	15	10	5
WPS	192	135	80	45	25
Network	136	85	55	55	50
Total	400	260	150	110	80

Figure 16 – Forecast pollution performance

Glossary

CAST	Causal assessment based on systems theory
Cat1	CICS category 1 pollution incident
Cat2	CICS category 2 pollution incident
Cat3	CICS category 3 pollution incident
Cat4	CICS category 4 pollution incident
CBM	condition based monitoring
CICS	common incident classification scheme
CSF	Critical success factor
FOG	Fat, oil and grease
FS	Foul sewer
HEC	High environmental consequence
NMC	Network management centre
MH	Man hole
Ofwat	The Water Services Regulation Authority
PIRP	Pollution Incident Reduction Plan
PIRS+	Enhanced Pollution Investigation Report System
PR19	Ofwat's Price Review 2019
PRP	Pollution Reduction Programme
RCA	Root cause analysis
SR	Self-reported incident
TTS	Time to spill
Unflushables	Items which should be disposed of in the bin, not the toilet.
WaSC	Water and Sewerage Companies
WPS	Wastewater pumping station
WTW	Wastewater treatment works