SRN-DDR-050: Resilience - Infiltration

Enhancement Cost Evidence Case

28th August 2024

Version 1.0

Contents

1. Executive Summary

This document sets out our response to Ofwat's Draft Determination on SRN50 Resilience Infiltration submission, which is a core investment within our Business Plan for AMP8.

Since our original submission, we have endeavoured to improve the availability and robustness of evidence to demonstrate that works to reduce the risk of groundwater entering the system to reduce flooding and pollution incidents provides a necessary and efficient enhancement to our infrastructure that is supported by our customers and other critical stakeholders, including Iain Coucher of Ofwat, who visited our East Dean catchment July 31st 2024 and shared our view that that sealing sewers to reduce infiltration constituted enhancement.

This document provides a detailed response to Ofwat's Draft Determination regarding funding for Resilience Infiltration in our AMP8 business plan. We believe Ofwat's rejection of this funding request in its entirety will not allow us to meet what is required to meet the increasing demands of this essential programme.

Specifically, we have responded to the following concerns raised by Ofwat from their deep dive of our enhancement case:

1.1. Need for Enhancement Investment

Ofwat has raised concerns about whether there is an increasing hazard linked to climate change, suggesting that the need for investment relates to just a deterioration in condition of the sewers. In their view this type of work is already funded by base maintenance. We received a reduction adjustment of 100% to our requested funding of £38.9m and a criteria decision of 'fail'.

Our Response: We have provided additional evidence to show that the frequency and severity of these high groundwater events are increasing significantly and that the management options that were previously adequate and accepted by environmental regulators and our customers are no longer viable. There is a need for step change in our approach, involving enhancement rather than maintenance of our sewerage system as originally designed. Sewers were not and still are not designed to be watertight. This is evidenced by the current industry standard Sewers for Adoption (SfA-8-Master-2.pdf (water.org.uk)).Section E7.7 includes a test for infiltration at the time of adoption and the standard to be achieved. However, the document does not state the groundwater condition required at the time of the test. A sewer tested at times of normal groundwater levels could easily pass the test but still allow large quantities of groundwater in at times of high groundwater, i.e. in the conditions which we are particularly concerned about. We therefore conclude that sewers are not designed to be watertight in all conditions and that Botex does not include the cost of maintaining a watertight sewer system. We have also included evidence to demonstrate that our proposals are enhancing our levels of service, and these costs are distinct from more typical approaches which would correctly be funded via botex.

1.2. Best Option for Customer

Ofwat raised some concerns about whether the investment provides the best option for customers, suggesting our evidence of consideration for alternative options was limited and we had not provided sufficient details of cost benefit analysis to demonstrate that the chosen options were the right solutions. We received a reduction adjustment of 20% to our requested funding of £38.9m (had the requested funding passed its need case) and a criteria decision of 'some concerns'.

Our Response: We have provided further detail of the 13 options considered to meet infiltration needs, as well as further details on cost benefit analysis to demonstrate strength of our proposed solutions against other feasible alternatives.

1.3. Cost Efficiency

Ofwat raised some concerns about whether the investment is efficient, suggesting we had not provided sufficient and convincing evidence that our costs were efficient. We received a reduction adjustment of 20% to our requested funding of £38.9m (had the requested funding passed its need case) and a criteria decision of ‘some concerns’.

Our Response: The Industry best practice technique to prevent infiltration is to line sewers with approved lining materials. We have completed benchmarking of our sewer lining framework rate, which has suggested our costs are below comparator costs. For the portion of the programme that will be delivered by [redacted], there is little comparator data available to enable benchmarking, however, we have demonstrated via trials completed by our Pathfinder team, our selected delivery unit rate is sufficiently stretching and efficient.

In light of this evidence, we urge Ofwat to reconsider their proposed allowances for Resilience Infiltration. The evidence included within this document aims to demonstrate a clear need for enhancement, robust evidence of optioneering and efficient costs to ensure we are funded to upgrade the sewer network sufficiently to deliver the step change necessary to create a system resilient to groundwater infiltration and prevent customer issues such as sewer flooding and pollution due to our systems being overwhelmed by groundwater which enters our system through leaking joints in sewers and private drains and the associated disruption these incidents cause our customers..

2. Introduction

The purpose of this document is to provide additional information and evidence to support our previous SRN50 Resilience Infiltration submission. This enhancement case focuses on works to public and private sewers to reduce the amount of groundwater entering the system through joints which were not originally designed to be watertight and should be read in conjunction with the SRN50 submission. This work not only reduces the risk of flooding and pollution incidents due to reduced capacity to convey foul flows but also addresses the nuisance to customers and costs associated with mitigation activities to maintain effective drainage, such as tankering. It supports the actions identified in the Infiltration Reduction Plans approved by the Environment Agency. Our infiltration reduction efforts have been supported by Iain Coucher (Chair of Ofwat), who has visited East Dean in our region to see first-hand the progress made via our work in the village. This work was recognised as enhancement as opposed to botex and encourage Southern Water to challenge this through our response.

Since our original submission in October 2023, we have developed our understanding of the issues and remedies, particularly through our Pathfinder Pilot in Andover, Hampshire (as part of the Pan Parish consortium). This has significantly advanced our knowledge of the extent and causes of the issue, the improvements required and proposed costs, which has informed the evidence presented in this case. The case study on Mullens Pond summarises the work undertaken in the Pan Parish and our work with stakeholders and customers to deliver a solution.
We outline our additional evidence below to further support our original submission and respond to Ofwat’s feedback in its draft determination.

3. Issue

Ofwat set an allowance for this type of investment through deep dive. In its draft determination response, Ofwat focused on the following four areas, which we have summarised below:

3.1 The Need for the Investment

- Ofwat states the submission does not meet the criteria for resilience enhancement and additional customer funding as in its view this type of work is already funded by base maintenance and other WaSCs with similar geology address this through base maintenance.
- Ofwat questions if there is an increasing risk of hazards outside our control.
- Evidence is required to demonstrate the 39% increase in rainfall is linked to climate change.
- Ofwat's states this is not a new risk, as we say conditions will deteriorate over time, so it is one we can plan to address through base maintenance funding.
- Ofwat concludes companies address most resilience risks through base allowances, which has included the costs of addressing historical impacts of climate change. It expects companies to continue to undertake these activities and make improvements to asset health within base. It states it is the company's general duty to maintain its assets so they are in a condition to deliver the outputs they were intended to so the company can meet its statutory obligations. Ofwat states more evidence is required to demonstrate why additional allowances are required for infiltration reduction.

3.2 Best Option for Customers

- Ofwat states there is limited evidence to show alternative options have been considered nor a cost benefit analysis to demonstrate the chosen option is the right solution.
- Ofwat states cost-benefit analysis is required for the unconstrained and constrained list of options, linked to quantified service and therefore benefit. It states some of the unconstrained alternative options would be too costly, although no cost estimates are provided.
- Ofwat states more convincing evidence is required to demonstrate the chosen option presents the best value for customers.

3.3 Cost Efficiency

- Ofwat has concerns whether the investment is efficient.
- Ofwat states evidence of cost benchmarking or external assurance of costs would be required to demonstrate the unit rate of cost for the chosen investment is efficient.

3.4 Customer Protection

- Ofwat states there is no price control deliverable (PCD) proposed for this investment.

4. Our Response

Our response provides additional evidence to answer the challenges made by Ofwat in its draft determination and builds on our original submission, supported by additional evidence from our on-going activities and investigations since submission in October 2023. The table 1 below provides a summary of our original submitted case:

Summary of Enhancement Case

Name of Enhancement Case	PR24 EC – Infiltration Enhancement Case
Summary of Case	Our plan for Infiltration management will reduce Groundwater Infiltration (GI) into wastewater collection systems to acceptable rates[1]. To achieve this, we will enhance the 'watertightness' properties of the collection systems, to above industry standard design, in high groundwater infiltration areas which have a formal Infiltration Reduction Plan as agreed with the Environment Agency. We will approach this using a large-scale deployment of interventions both on public and private sewers and a long-term enhanced monitoring approach to ensure the optimum level of activity is undertaken to allow us to address infiltration reduction.
Expected Benefits (catchments)	Infiltration Reduction plans will be reduced from 18 to 15 with full measures being installed at 3 sites. 117km of watertight measures to be deployed at: • LAVANT • PAN PARISH • ST MARYBOURNE A further 105 km of watertight measures to be deployed at the 6 systems below. We are planning for 20% of each system to be made watertight with the remainder to follow as appropriate in future AMPs: • LOWER NAILBOURNE • GOODWORTH CLAITFORD • SIDLESHAM • BARNHAM • WINCHELSEA BEACH • UPPER NAILBOURNE Indirect benefits will include reduction in pollution incidents, flooding, restricted toilet use, disruptive tanker movements, "dry day" discharges.
Associated Price Control	Wastewater Network +
Enhancement TOTEX	£38,898,574.71
Enhancement OPEX	£0
Enhancement CAPEX	£38,898,575
Is this enhancement proposed for a direct procurement for customer (DPC)?	No - DPC has not been proposed for this enhancement case as the Capex investment is less than £200m, so it does not pass the materiality threshold for DPC.

Table 1: Summary of submitted investment case

Our original submission is based on a split of investment with £22.6m for public sewers and £16.2m for private sewers.

Before we respond directly to the specific challenges on our original enhancement case, it is worth explaining that this case is not about normal infiltration seen in all sewers. During periods of very high groundwater, sewers become inundated with groundwater causing significant disruption to the affected areas, flooding of customers for extensive periods of time and pollution of sensitive rivers.

The last three major groundwater events[1] have shown the duration is typically from January through to June and normally run over two winter seasons. The disruption to local communities is extensive during these periods, as extensive tankering operations are required to prevent pollution, protect customers' homes and ensure customers can continue to use their toilets. Over the winter of 2023/24 there were 120 tankers in operation over the period, causing major disruption with ongoing road closures and nighttime operations close to residential homes. We have included three case studies at the end of this document to describe the impact on our communities.

These additional tankering costs have not been included within our botex submission, even though our AMP7 botex expenditure is significantly higher than that allowed for at PR19. These costs have been removed from our AMP8 submission on the basis that the funding for this enhancement case is allowed for Final Determination.

We have structured our response in line with Ofwat's areas of challenge.

5. Need for Enhancement Investment

5.1 Ofwat's Draft Determination

Ofwat has raised concerns about whether there is an increasing hazard linked to climate change, suggesting that the need for investment relates to just a deterioration in condition of the sewers. In their view this type of work is already funded by base maintenance.

5.2 Our Response

In this section by analysing long period rainfall and groundwater data over a 50-year period and by referencing external expert authored publications, we provide evidence that the frequency and severity of these high groundwater events are increasing significantly. At the same time, management options that were previously accepted by environmental regulators and our customers are no longer viable. There is a need for step change in our approach, requiring an upgrade to the existing sewerage system which was not designed to be watertight at all groundwater levels, as evidenced in the industry standard Sewers for Adoption document section E7.7 (SfA-8-Master-2.pdf (water.org.uk)).

Secondly, we will demonstrate that our proposals are enhancing our levels of service, and the proposed technique is innovative, and these costs are distinct from more typical approaches which would correctly be funded via botex.

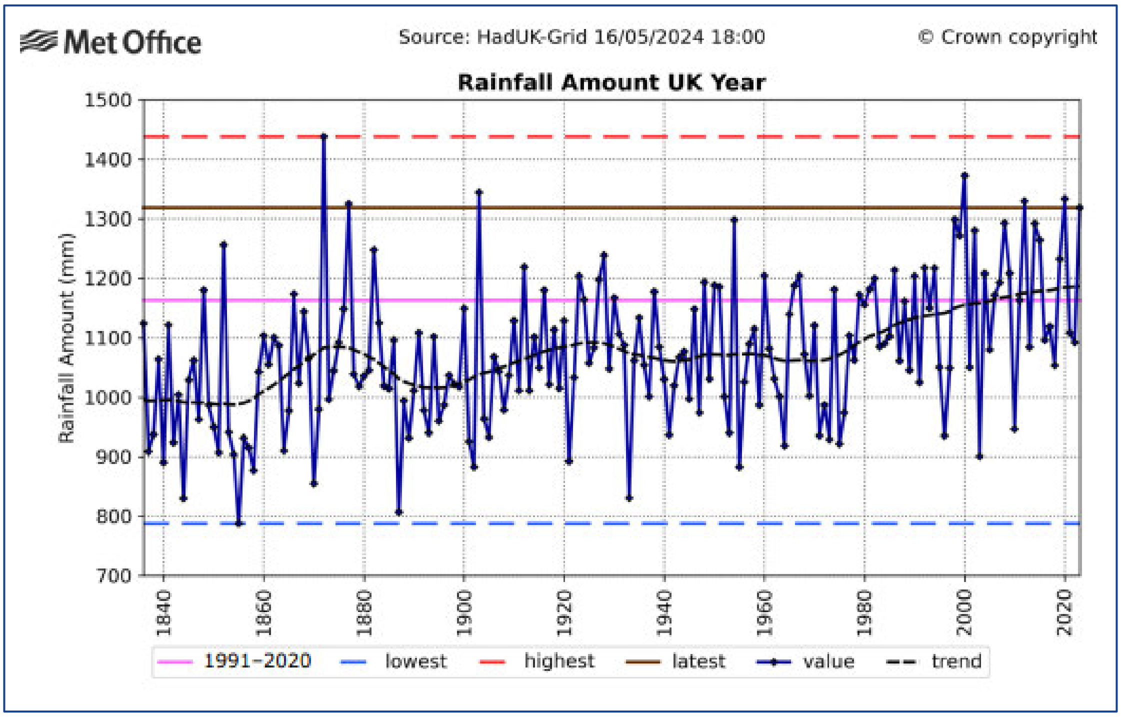
[1] 2013 to 2015, 2019 to 2020 and 2023/24

Hazards outside our control and link to climate change

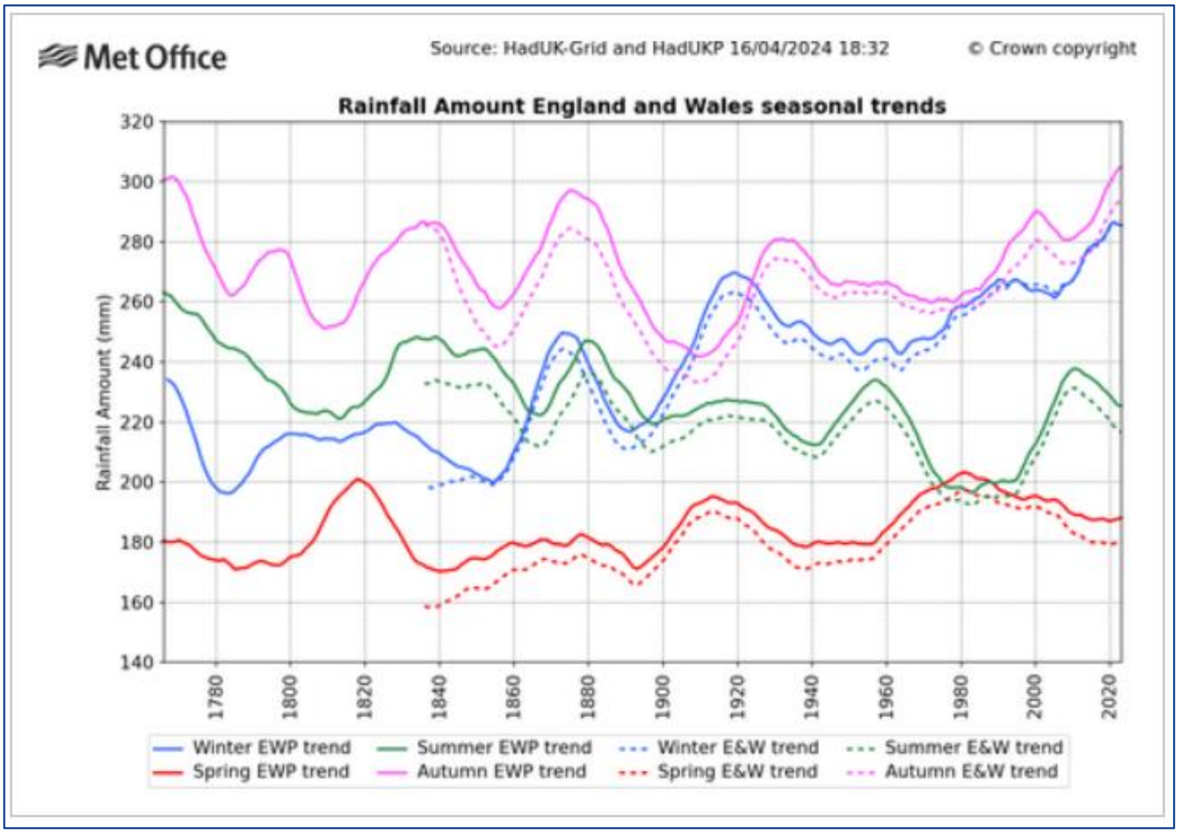
The groundwater events are becoming more frequent and more severe. This is because we are seeing more rainfall, particularly in the winter months. The recently published report by the Royal Meteorological Society (State of the UK Climate 2023 (wiley.com), concludes for rainfall that:

- 2023 was the seventh wettest year on record for the UK in the series from 1836, with 113% of the 1991– 2020 average. Large areas of the UK exceeded 125%.
- March, July, October, and December 2023 were all top ten wettest months in the UK monthly rainfall series from 1836; the first year this has happened for four separate months.
- Five of the 10 wettest years for the UK in the series from 1836 have occurred in the 21st century.
- The most recent decade (2014–2023) has been 2% wetter than 1991–2020 and 10% wetter than 1961–1990.
- UK winters for the most recent decade (2014–2023) have been 9% wetter than 1991–2020 and 24% wetter than 1961–1990, with smaller increases in summer and autumn and none in spring.
- For rainfall series for all counties of the UK from 1836, the number of top-ten wettest annual values is markedly higher in each of the last three decades (1994– 2023) compared with earlier decades. However, the increase in top-ten wettest values is much less apparent in the respective monthly and seasonal series.
- There has been a slight increase in heavy rainfall across the UK in recent decades.

Graph 1 from the State of the UK Climate report demonstrates that across the United Kingdom annual precipitation has been trending up year on year, meaning we need to consider rainfall amounts in absolute terms across our infrastructure. Graph 2 shows that seasonally, the greatest increase occurs within the winter months (blue and pink lines in graph 2 are trending upwards denoting wetter autumn and winter seasons in con). This means not only are groundwater events becoming more likely to occur as the groundwater is linked to rainfall volumes in absolute terms, but that the duration of each event is likely to extend, as a higher proportion of this additional rainfall occurs within the winter months. Unless the base maintenance models account for and adjust allowances to accommodate for this increase in rainfall, we must enhance our infrastructure to meet these requirements on behalf of the customer. We recognise that Ofwat have provided an uplift of 0.7% of base costs to provide enhancements specifically associated with power and flood resilience (fluvial and pluvial).However, the climate change described above is also driving a distinct need for infiltration reduction through pipe joints due to increased winter rainfall. This is leading to more frequently elevated and prolonged groundwater events at subterranean levels, even when these do not result in surface flooding. This causes our sewers to act as land drains, not a purpose they were designed to fulfil. We have put in place a programme of work designed to future proof the system, which we consider to be sector leading, having exhausted traditional management responses and we do not consider the 0.7% uplift is sufficient to accommodate the distinct needs outlined within this case. .For wastewater the 0.7% climate change uplift equates to £13.9m. This is a general uplift that has been applied to all companies with a focus on power and flooding resilience. The need to reduce infiltration at scale in private and public sewers is specific to Southern Water as not all companies are impacted by high groundwater and it is outside the more typical risk of pluvial / fluvial flooding and power for which the 0.7% uplift applies.



Graph 1 – United Kingdom Annual Precipitation



Graph 2 – United Kingdom Seasonal Precipitation

Further to the National perspective our local data supports that this wetter winters trend is happening now. Figure 1 below shows the full period data for a groundwater borehole in the Chichester area from 1999 to 2024 extracted from the environmentdata.gov.uk data source. This also shows **an increasing frequency of high-groundwater events**. The Clanville Gate borehole is used in some of our infiltration reduction plans and when levels rise to 70mAOD this is a trigger point to alert that mitigation measures such as tankering may be required to enable a sewerage service during high groundwater. In the last 5 years there have been 4 events of groundwater above 70 mAOD. This is unprecedented in any previous rolling 5-year period. The intervening period between high groundwater seasons is therefore reducing. Taking this data we have produced a graph in Figure 2 to show the number of high groundwater events above 70mAOD for each 5-year period. The trend line for these events shows that the frequency of events is increasing.

Taking the data in Graph 2 and Figure 2 it can be clearly seen that not only is winter rainfall increasing nationally, this increase is resulting in high groundwater events occurring more frequently in the south of England.

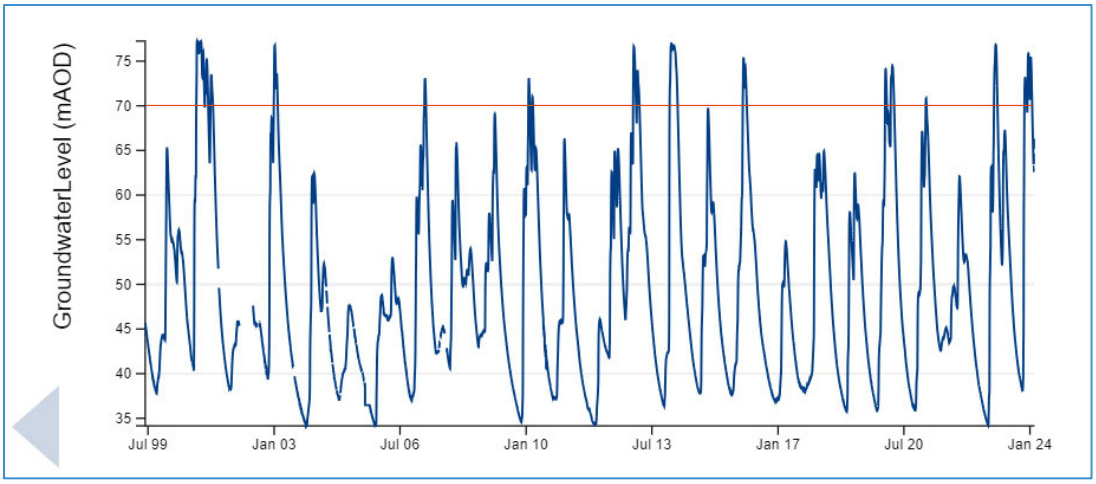


Figure 1: Clanville Gate borehole data

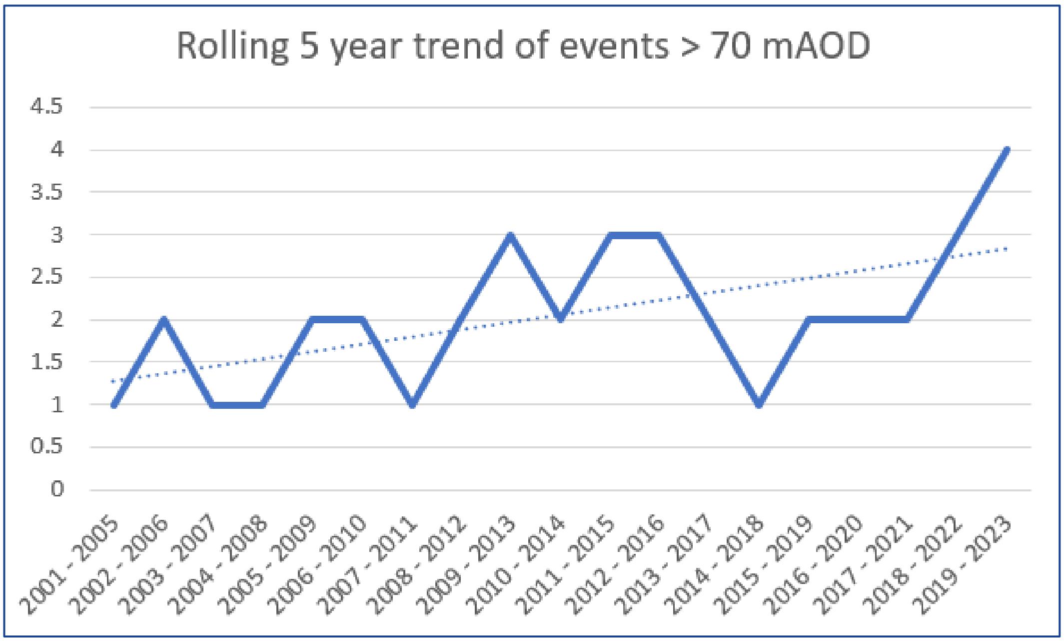


Figure 2: Rolling 5-year trend of groundwater events at Clanville Gate

The borehole data records at Clanville Gate, as shown in Figure 1, go back to 1999. For a longer record we have used information from the British Geological Survey for another borehole in our region, Chilgrove House (https://www2.bgs.ac.uk/groundwater/datainfo/levels/sites/ChilgroveHouse.html). The images in Figures 3 and 4 show the last 74 years from 1950 to present day (Figure 3) with each decade from 1970 presented in 10-year intervals (Figure 4). In our infiltration reduction plans the trigger threshold at Chilgrove House is 75mAOD and this is shown in Figure 3 as a red horizontal line. It can be clearly seen that the incidents of groundwater exceeding 75 mAOD is increasing over time which we believe supports our assertion that this is related to climate change and not an existing unchanging risk. Figure 4 shows that in the 1970s and 80s, there was an average of one high groundwater season per 10 years. This frequency has steadily increased such that in the next 20-year period the average increases to 2 per decade and the most recent 20 years averages at 3 events per decade. It is significant that in the current decade we have already experienced 3 high groundwater events in the first 4 years.

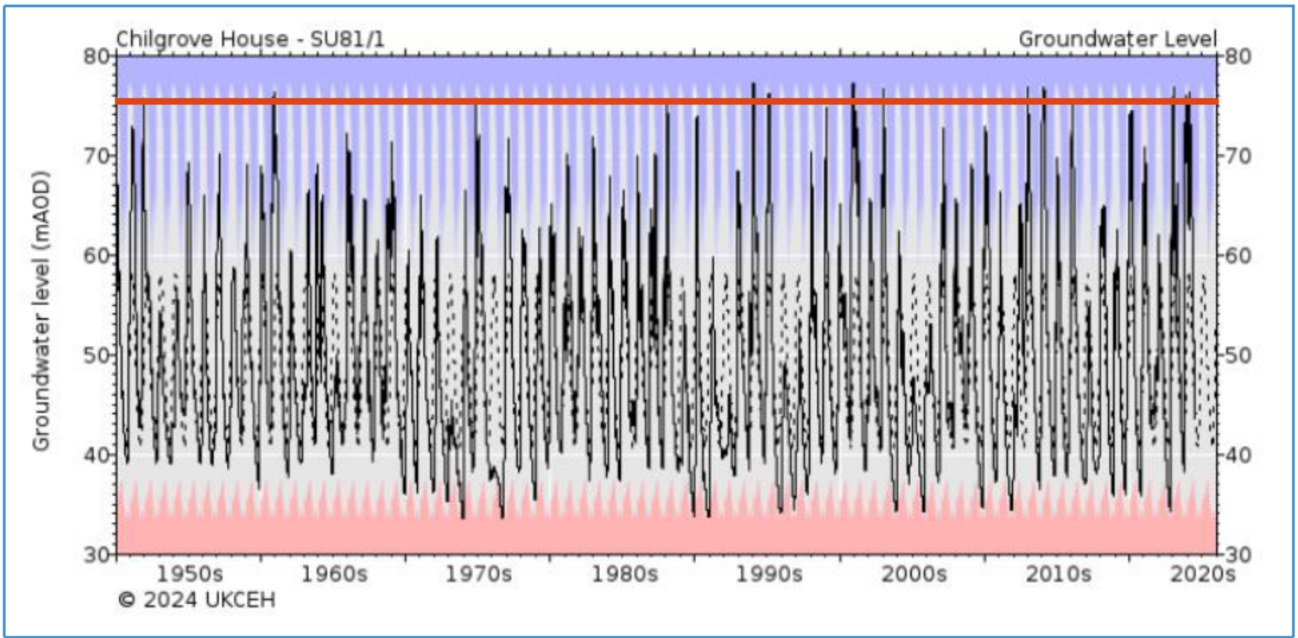


Figure 3: 74-year borehole data history for Chilgrove House

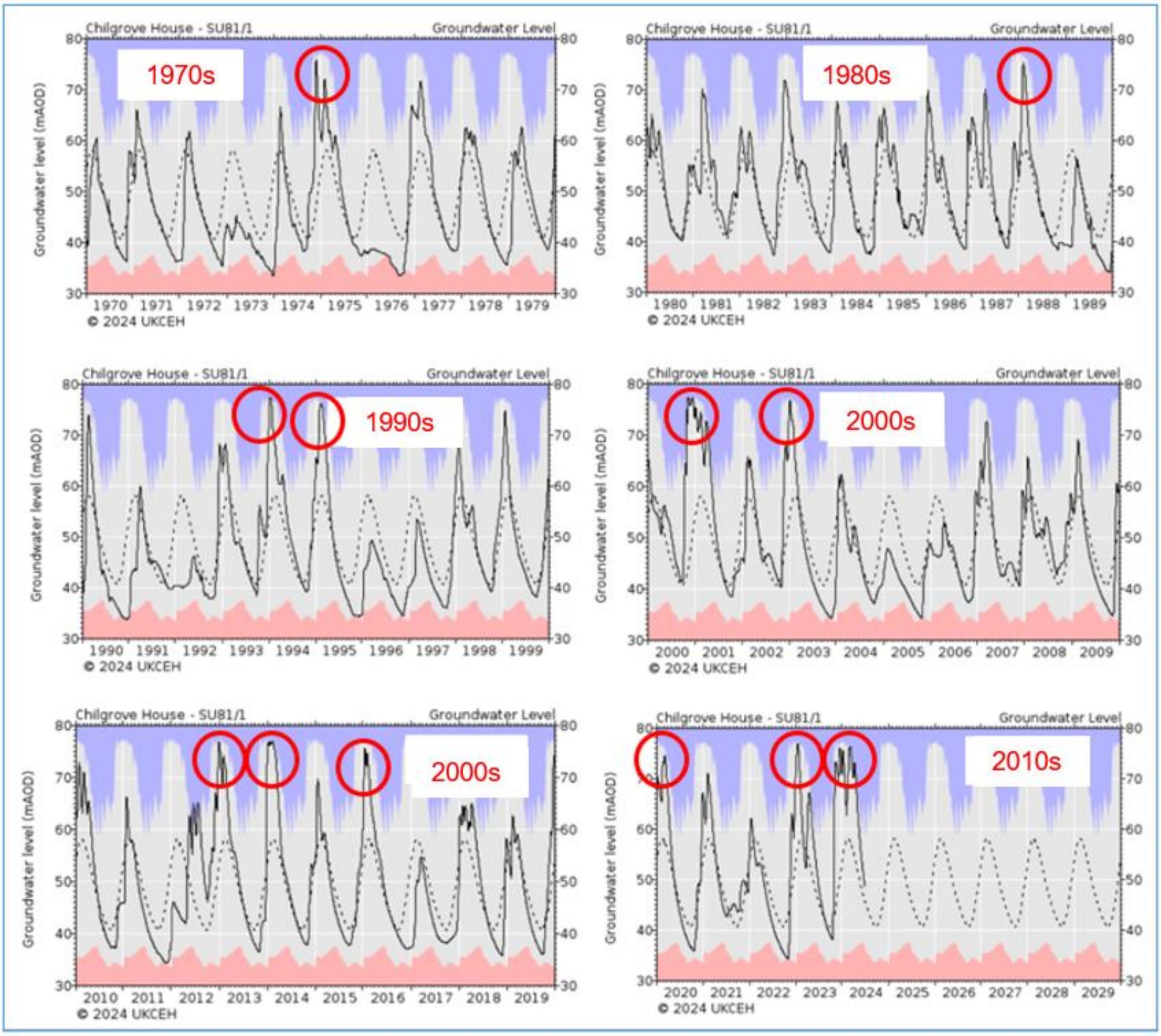


Figure 4: Long term ground water data at Chilgrove House borehole, Hampshire

In addition to wetter winters and more frequent high groundwater events we must also consider that summers are predicted by the Meteorological Office (https://www.metoffice.gov.uk/weather/climate-change/effects-of-climate-change) to become drier with a greater likelihood of droughts. This is relevant because the impact of extreme wetting and drying of soils will cause ground movement through swelling and shrinking of soils. This movement is particularly prevalent in clay soils and maps available through the British Geological Survey (Aquifer, shale and clay maps | Aquifers and shales | Groundwater | Our research | British Geological Survey (BGS)) e.g. Figure 5 below show these to be common across South East England. This is likely to further disturb pipe joints and make sewers more prone to infiltration in the high groundwater events.

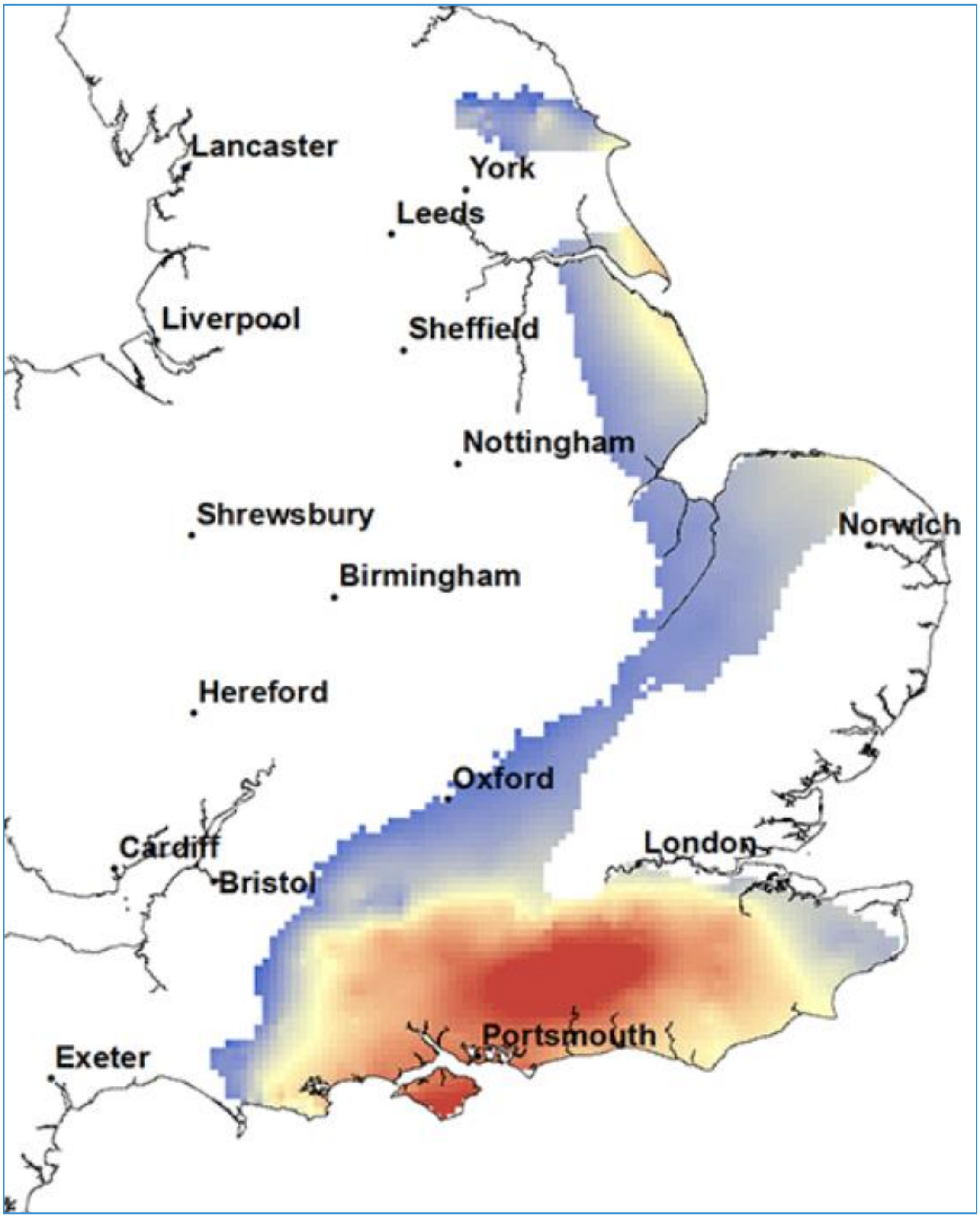


Figure 5: BGS map of Shales and Clay deposit where red denotes deposits at greatest depth.

Long-term borehole data collected for our Infiltration Reduction Plans (IRPs) shows an increase in the frequency of high-groundwater seasons. Figure 6 below is extracted from one of our IRPs and shows the groundwater profile and our trigger level for tankering in the catchment.

There are two key points to note:

- **the likelihood of high groundwater is increasing**, in the most recent 5 years we have seen three winters breach the trigger level. This has not been observed before in any rolling 5-year period.
- **the annual low groundwater level is on a rising trend** due to the more frequent wetter winters.

The groundwater level across our region last winter (2023/24) was the equal to the highest ever experienced with the added factor that the ground water levels stayed high for longer. Our customers were badly affected by this in two ways: firstly, directly by the disruption to the wastewater service due to high levels in sewers which prevented the normal use of facilities and secondly, indirectly by the disruption caused by deploying tankers to small villages to manage the situation so as to prevent sewers backing up into people's homes. See Case Studies at the end of the document which give evidence of disruption caused and customer dissatisfaction 2023/24 was the most impactful we have experienced, with over 120 tankers operating 24 hours a day for 6 months at a total cost of £29m. Using 2013/14 as a comparator which had a similar peak groundwater level recorded, our total mitigation cost was £13.8m and this equates to around 65 tankers for a 4-month period. For context, in 2023/24 all commercially available tankers in the South East were supporting our operations during this time.

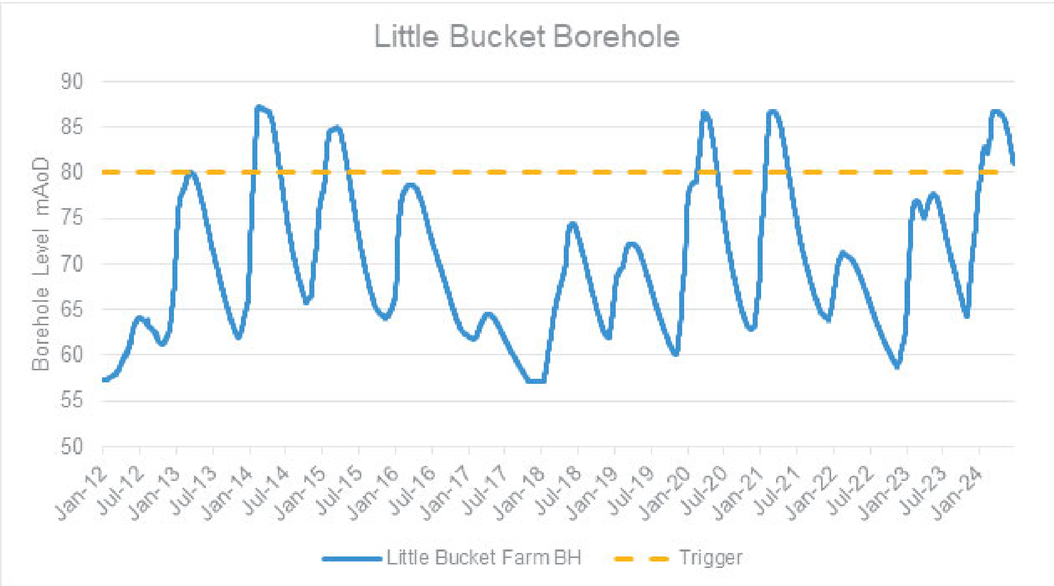


Figure 6: Borehole data from Little Bucket, Kent.

In summary:

- average annual rainfall is increasing
- winter rainfall totals are increasing at a higher rate than other seasons
- as a result, the frequency of high groundwater events is increasing
- our trigger levels to invoke mitigation actions are being breached more often
- our mitigation actions to enable a sewerage service are required more frequently, for more prolonged periods, at higher cost and disruption to customer and communities

5.3 The difference between base maintenance and enhancement funding

Recognising the increasing challenge we face from more frequent groundwater events; we have been undertaking large scale investigations into best practice through our Pathfinder pilot in Hampshire. These started in 2022 as part of our Storm Overflow accelerated programme but the lessons are equally applicable to this programme of work where there are no overflows. One of our systems particularly affected is Lavant near Chichester. Iain Coucher, (Chair of Ofwat) visited East Dean, a village in the Lavant system, on 31 July to see sewer sealing works in progress on site. He saw first-hand how we are sealing the public and customer sewers in East Dean. He recognised this work as enhancement activity as opposed to botex, encouraging us to challenge this through our Draft Determination response.

There are three distinct types of activity required to seal sewers to a standard that provides the required level of resilience to the growing groundwater issue:

1. Ensuring the public sewers are in good condition, addressing pipe cracks or fractures which can exacerbate infiltration into the system. Sewers need to be structurally sound, and we would agree that this level of activity should be funded via base maintenance and the botex allowance. Asset health is monitored through the performance commitment for collapses and bursts.
2. Catchments in areas vulnerable to high ground water infiltration often suffer from watertightness challenges, the process whereby sections of sewer pipeline deteriorate on the joints and allow ground water to ingress into the pipeline. This process of watertightness remediation involves taking measures to retrospectively re-seal the failing joints. This is an intervention that goes beyond industry construction standards, and is only necessary for sewers in high groundwater areas. The industry standard Sewers for Adoption (SfA-8-Master-2.pdf (water.org.uk)) in Section E7.7 includes a test for infiltration at the time of adoption and the standard to be achieved. However, the document does not state the groundwater condition required at the time of the test. A sewer tested at times of normal groundwater levels could easily pass the test but still allow large quantities of groundwater in at times of high groundwater, i.e. in the conditions which we are particularly concerned about. We therefore conclude that sewers are not designed to be watertight in all conditions and that Botex does not include for maintain a watertight sewer system.
3. The additional step for sealing sewers is the recognition that addressing the public system alone is not adequate to provide the level of sealing required to address the consequences. Once the public system is sealed the groundwater does not drain via the sewerage network but rises further to the next weakest link which is the extensive private system closer to customers' homes. Without addressing the private systems, the sewerage system continues to be inundated from infiltration to the private system.
4. Finally, we consider whether the submission overlaps with other programmes of work either as Botex or other enhancement

The current measurement of Asset Health and previous Serviceability assessments are based on the failure of assets to perform their function. In the case of sewers, this is determined by the number of sewer collapses, rising main bursts and sewer blockages. Base investment is identified through modelling to deliver a normalised failure rate against which all companies performance can be assessed. The water tightness of sewers, particularly in otherwise structurally sound sewers with condition grades of 1-3, is not included in the assessment for base maintenance. As Ofwat have stated, base maintenance investment should be addressed by the botex models and allowances. There is no investment included within this enhancement case relating to just maintaining the structural integrity of the public sewers. The company is not aware of any other company delivering watertight sewage infrastructure at scale to its customers through Botex.

In our original submission we evidenced that infiltration in good condition sewers is an issue which requires mitigation measures to prevent sewer flooding and pollution incidents. Providing watertight sewers is a higher level of service than currently funded through base maintenance and therefore an enhancement. It is an enhancement our customers and stakeholders, such as parish, district, county councils and Members of Parliament, are pressing for. When preparing this document, we analysed in detail two sewerage systems in which sewer lining work had been undertaken to address infiltration. These are Lavant Valley in the West of our region and Newnham Valley in the East. Both systems have the similar characteristics in that they serve village communities situated adjacent to winterbourne streams with a trunk sewer system running through the valley which links the villages. The sewers in these systems are clayware with the same jointing system and are both rural with minimal traffic loading. These are typical of the type of system in which infiltration occurs and are catchments where most sewer lining has been undertaken. We believe that the proportions of good to poor condition sewers found here are representative of the overall sewer condition and can be extrapolated to provide an indication of the overall average proportion of poor condition sewers which have been addressed as part of the infiltration reduction work, Table 2 below shows the structural condition of sewers sealed in the last 10 years in Lavant and Nailbourne systems. The table shows the number of sewers addressed and the length of sewer addressed per year. It also shows the length of good condition sewers lined where condition grade is 1-3 and the length of poor condition sewers lined, grades 4 or 5. This demonstrates that to address infiltration we need to invest in sewers which are condition grade 1 – 3 and structurally sound with a low risk of collapse. Only 17% of sewers by length are in poor structural condition. In this revised submission we have reduced the cost of sealing public sewers by 17% in recognition that this would be funded through Botex. A list of sewers repaired in Lavant and Nailbourne (aka Newnham Valley) with condition grades, is included in Appendix A at the end of this document.

Year	No. sewers sealed in Nailbourne	No. sewers sealed in Lavant	total number sealed	Total length sealed (km)	length of good condition sealed (km)	length of poor condition sealed (km)	% poor condition sealed
2013/14	51	3	54	2.38	2.22	0.16	6.72
2014/15	2	12	14	0.9	0.59	0.31	34.44
2015/16	1	6	7	0.34	0.08	0.26	76.47
2016/17	6	4	10	0.56	0.56	0	0.00
2017/18	0	6	6	0.22	0.08	0.14	63.64
2018/19	0	3	3	0.1	0.08	0.02	20.00
2019/20	0	0	0	0	0	0	0.00
2020/21	0	0	0	0	0	0	0.00
2021/22	0	0	0	0	0	0	0.00
2022/23	1	0	1	0.05	0.05	0	0.00
2023/24	13	7	20	0.9	0.86	0.04	4.44
TOTALS	74	41	115	5.45	4.52	0.93	**17.06**

Table 2: Sewers sealed in Lavant and Nailbourne

Our proposed activity is in systems and sub-catchments where there is no storm overflow to relieve the system of excess flow as evidenced by the mitigation activity required to maintain a sewerage service. There is therefore no duplication with the sewer sealing work proposed for the storm overflow programme.

In our submission we evidenced that despite good progress and long lengths of public sewer being sealed in villages, we still see issues in some locations at times of very high groundwater. Figures 6 and 7 below show flows in the sewerage system plotted against groundwater levels. A general trend can be seen here in that flows in sewers increase as ground water levels rise.

Taking Figure 7 the orange and blue lines show the relationship between groundwater level and flow and are based on the orange and blue values represented by dots which are flows at different groundwater levels.

The blue values are pre any sealing work the orange are post-sealing. The diagonal blue trend line in Figure 7 is before any sewer sealing work was undertaken, the diagonal orange line is post sealing. Comparing the blue and orange lines allows the benefit of sewer sealing to be quantified. Looking at the red line in Figure 7 we can see that prior to sealing a flow rate of 80 l/s was achieved when groundwater was around 72mAOD and since sealing the groundwater has to be around 75 mAOD (red dotted line) before flows are at 80 l/s. An alternative way of interpreting this is by looking at the green dotted line, when ground water levels are at around 75 m AOD the sewer sealing has reduced flow in the system by around 12 l/s from 92 l/s to 80 l/s. This benefits our customers as the onset of issues such as restricted toilet use and flooding in the system is reduced as groundwater needs to increase by 3m before having the same impact. This delays the start of any disruptive mitigation and in some seasons may be the difference between mitigation being needed or not.

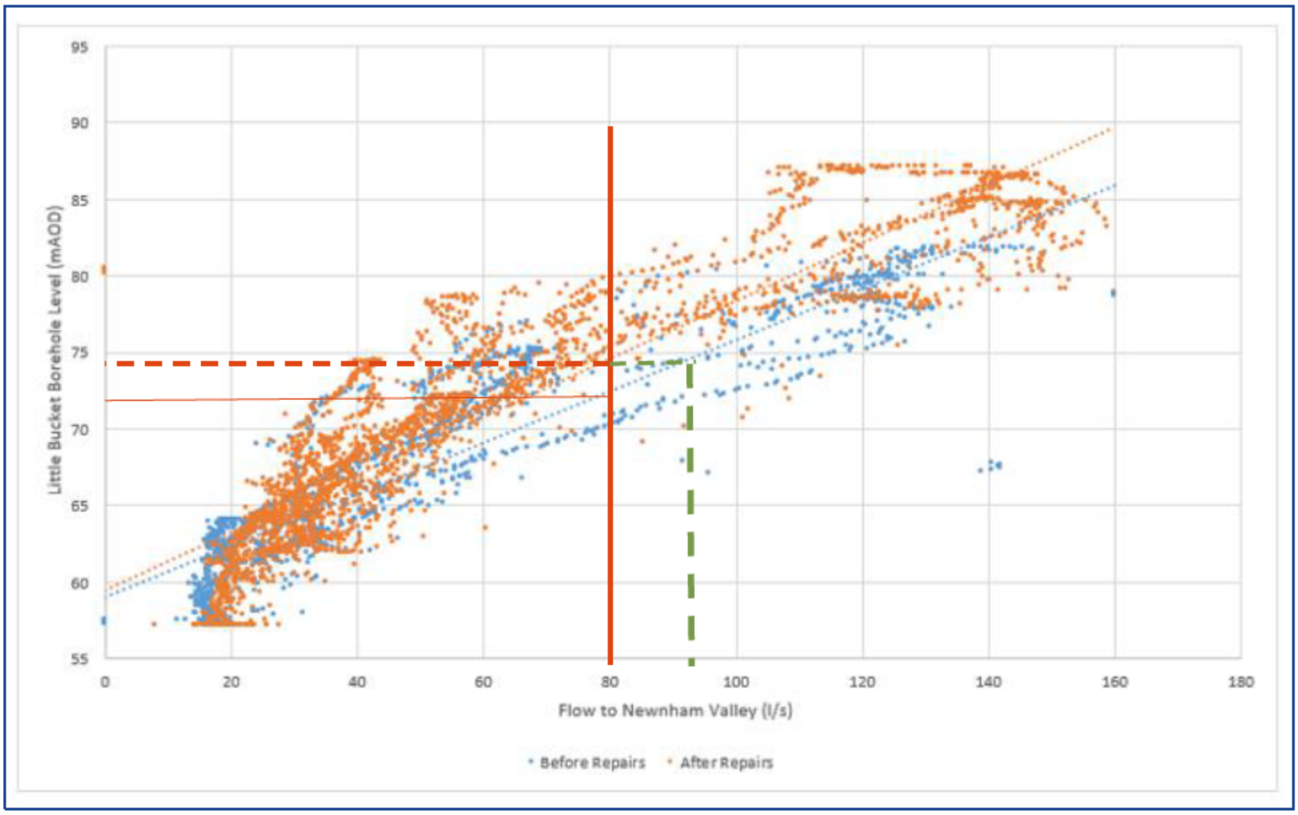


Figure 7: Groundwater and flow data pre and post sealing – Newnham Valley

Now taking Figure 8. A similar effect can be seen in that sewer flow is influenced by groundwater level. The blue trend line is based on the individual green/blue values pre any sealing, the brown trend line is based on the orange values post-sealing. As shown on the graph the diagonal trend lines show the benefit of sewer sealing of the public sewers and the ground water need to be 3m higher now than before sealing work which has the benefit of delaying the onset of customer issues and disruptive mitigation. The system can withstand higher levels of groundwater before issues are experienced and therefore service is enhanced. However, Figure 8 also shows that as ground water increases to even higher levels flow increases. Our conclusion from this is that this is where ground water comes into contact with the extensive private sewer network, flows in the system increase due to more sewers being in contact with groundwater. This evidence shows that to address the infiltration issue in the longer-term Private sewers will need to also be sealed. Although we get initial benefit from sealing public sewers this is not the end of the sealing there is more to do here to provide sustained resilience to increasing groundwater levels.

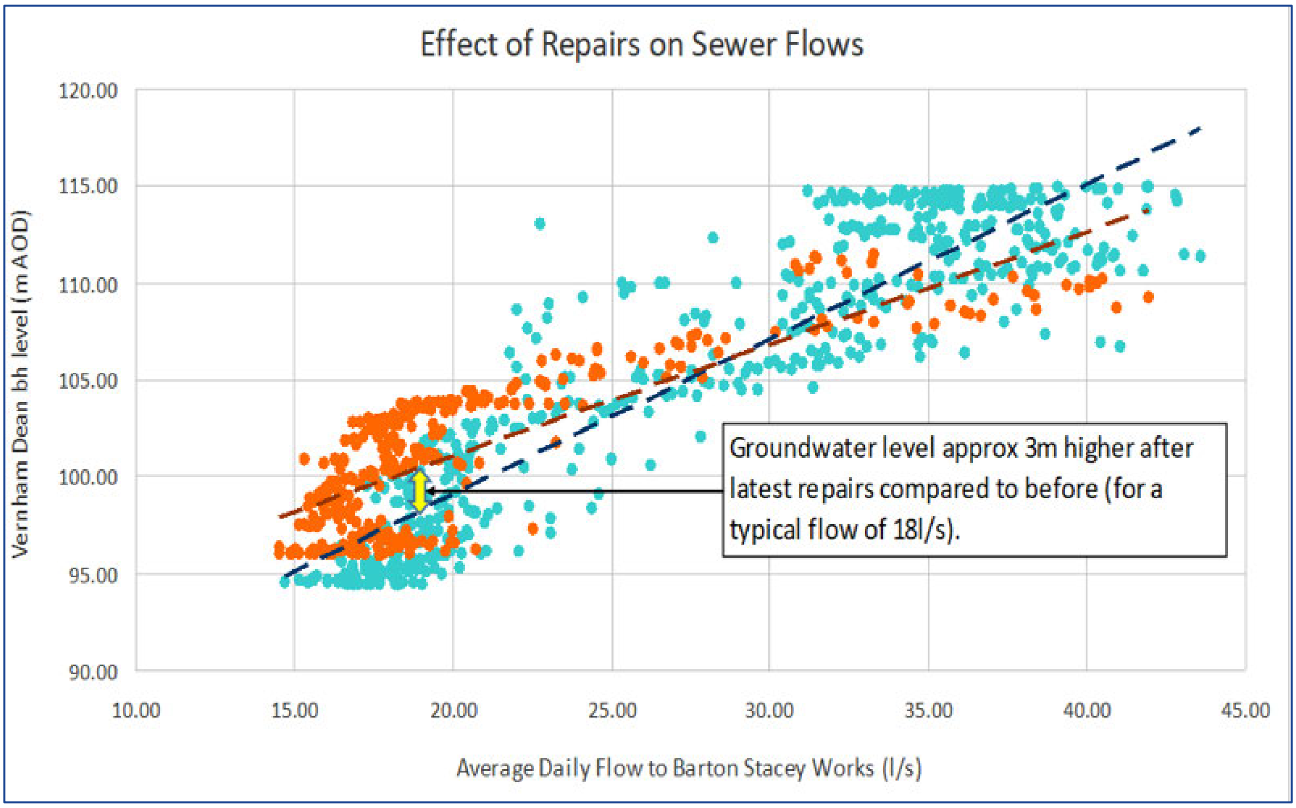


Figure 8: Groundwater and flow data pre and post sealing – Barton Stacey

From our Pan Parish pilot we have also observed infiltration into private drains as the photos in Figure 9 confirm. The groundwater can no longer be entering the public sewers as they are sealed. From this evidence we conclude that to address the impact of continuing infiltration and its impact on the level of service we provide the private drains also need to be sealed. Photos 1-3 show infiltration at manholes and clear flow in the private drains. Photo 4 is footage from a CCTV survey showing infiltration gushing in at a non-watertight joint in a private drain.

Figure 9: Infiltration into Private manholes

Water companies do not have powers over the private system and cannot insist on third-party assets being improved. Yet once the flow is in the public system, we are responsible for conveying that flow and dealing with the impacts. It is Southern Water's understanding that the model which Ofwat uses to determine base maintenance allowance does not allow for sealing the private network. This activity has not previously been carried out routinely in the industry so there would be no historic costs within the botex models. This is a new requirement, addressing third-party assets, there is no other mechanism through which Southern Water can recover these costs. It is appropriate that Southern Water address issues within the private system where the wider customer base is impacted by loss of service. Therefore, our view is this additional work to create a watertight system needs to be funded through enhancement.

In developing our submissions, we have considered our statutory duties and how to deliver them most effectively and efficiently in the context of the rises in groundwater level evidenced above. In our review of the draft determination, we have considered the extent to which watertight sewers are included as part of Asset Health and whether base maintenance funding allows for sewers to be maintained as watertight. Our conclusions are:

Section 94 of the Water Industry Act of 1991 provides it shall be the duty of every sewerage undertaker to provide and maintain a system of public sewers to ensure the area is and continues to be effectively drained. We agree this is our duty and with that duty comes the requirement to invest and maintain the public sewerage system.

However, this duty does not extend to maintaining the private drainage system which communicates with the public system. The duty in respect of the private system is only to permit connection. Thereafter the maintenance obligation belongs to the private sewer owner. If they don't maintain or upgrade a sewer owned by them as required, infiltration to it may cause a flooding nuisance to householders and landowners downstream of the public sewers owned by the company.

We have no control over the inflow from private systems, but we are obligated to convey flow once it has entered the public sewers. Therefore, to deliver our duty effectively in the context of rising groundwater levels we do need to make these sewers watertight. The company has no specific power to force the private sewer owner to do this work [2]and we believe that the cost of work on the private sewer system is necessarily outside the base maintenance allowance which is predicated on the extent of the company's own assets. For these reasons we consider that the £16.2m investment to seal private systems as set out in our submission is valid. As stated previously, we also believe we are not already funded to ensure public sewers are watertight.

[**Report of a review of the arrangements for determining responsibility for surface water and water and drainage assets**, published by DEFRA in 2020 can be found here (Report of a review of the arrangements for determining responsibility for surface water and drainage assets (publishing.service.gov.uk)). This report set out the complexities of sewer ownership and maintenance and how no single entity is properly obliged or empowered to solve problems associated with drainage assets. This evidence supports our conclusion that work on the private system is an efficient way to enhance levels of service to customers who are not the owners of the private sewers concerned, but who are impacted adversely by infiltration to them during high groundwater events.

In the case of the Pan Parish Pathfinder example as summarised in Case Study 1 in this document, since 2022 we have changed our historical working practice of working only on assets owned by the company and have begun to seal private sewers at the same time as the public ones in a 50:50 ratio. We sealed 2,541m of public sewer and 2,457m of private sewers. This way of working removes the need for disputes between customers affected by the condition of the private sewer network and those responsible for maintaining it and the benefit of the work to the private sewers accrues directly to our customers at an efficient price. Although necessary to solve the high groundwater infiltration problems that affect our customers, the work on private sewers was not factored into existing base allowances and produces no increase in the value of the company's assets. Therefore, the company argues that work to the private system is properly enhancement not base cost.

Figure 10 below further demonstrates the need and benefits of addressing infiltration via private drains. These graphs show the time in minutes per day which pumps run (red line) at different levels of groundwater (blue line). The Clanville Gate borehole is the borehole closest to Mullens Pond and is our reference point for understanding the need for mitigation measures. In general, pump run time in minutes per day increases as groundwater levels rise until a point where the pumps are running constantly. On the graphs this is when the red line flattens out at 1440 minutes per day. Where the red-line at 1440 mins this means a pump is running constantly.

[2] Report of a review of the arrangements for determining responsibility for surface water and drainage assets (publishing.service.gov.uk

The date ranges on the graphs shows the chronological order and the below explains what we are seeing.

- **2006-2013**: This precedes any major sealing work on either public or private systems. The pump run times and therefore the volume of water entering the system increase as groundwater rises. We see flows significantly increase when groundwater rises to 78mAOD and the system is at capacity when groundwater is at 86m.
- **2013-2022**: This period includes very high groundwater in 2013-14. We have undertaken sealing of public sewers. Run times start to increase significantly at groundwater levels of 80m and the system is at capacity at 86m.
- **2023-2024**: Private sewers are sealed. There is an increase in pump activity at 82m and the system is at capacity when groundwater is at 89m.

We conclude from this that sealing public sewers delays the onset of infiltration into the system but at times of high groundwater the system will fill due to leaks into sewers at a higher level. Sealing the private sewers further delays the onset of infiltration and groundwater must rise to higher levels before the system is at capacity. Applying these values to our trigger levels in Figure 11 (red line is 86mAOD, green line is 89mAOD). In terms of risk, we can say that the likelihood of high groundwater causing the system to run at capacity and therefore cause customer issues has reduced from 8 in 12 years to 4 in 12.

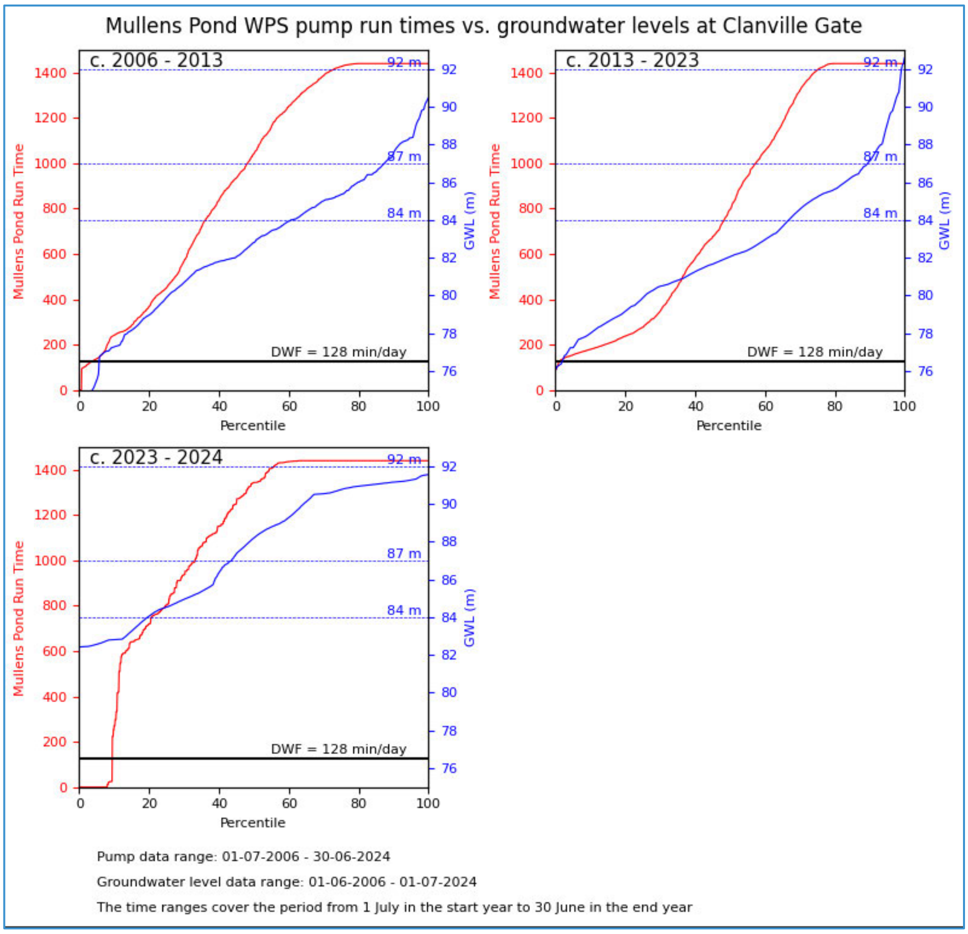


Figure 10: Sequencing of pump run time versus rising groundwater levels

.

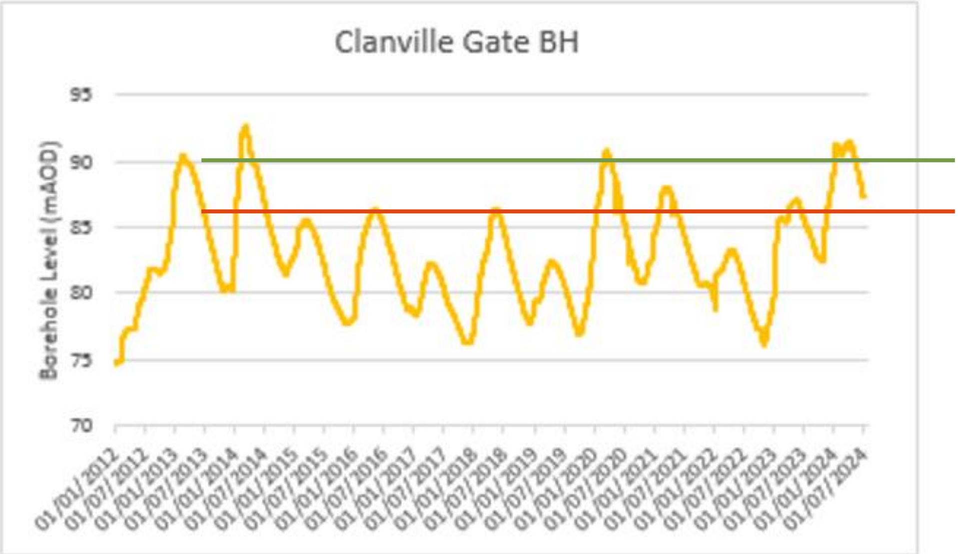


Figure 11: 12-year record of borehole data for Clanville Gate

5.4 Conclusions from the Mullens Pond and Clanville Gate borehole example

1. Sealing public sewers alone provides benefit at low groundwater levels. However, when groundwater continues to rise to higher levels and attains the level of private drains, infiltration significantly increases, and the system fills to capacity.
2. Sealing private sewers means the groundwater can rise by a further 3m before the system fills to capacity.
3. Applying the results from sealing private sewers to Clanville Gate borehole (Figure 11) reduces the likelihood of significant issues by half.

What does this mean in practice? Mullen's Pond is an area that has historically required significant tankering to manage flows during these groundwater events. In 2021/22 there were 38 tankers in operation at this site for long periods of time. Following the sealing of the public and private network, this was reduced to just 5 tankers. Further work is planned but this significantly reduced the nuisance for the community and our customers during a major groundwater event.

Further evidence is available from the private sewer investigations undertaken in our Pan Parish Pathfinder pilot in Hampshire and is summarised in case study 1 at the end of this document. These show chronic infiltration in the private system which in turn leads to surcharging of the downstream system and standing clear water which prevent effective drainage throughout.

These real-life examples evidence that infiltration into the private drains which communicate with our public sewers is significant and outside of Southern Water's control to prevent or resolve. Yet, its impact on the levels of service we provide is significant.

As high groundwater events become more frequent the risk of sewers becoming inundated and unable to fulfil their intended purpose also increases. The evidence above shows that this is not a static risk but a risk which is increasing over time and requires a step change in approach f to effectively address the source of the issue.

The evidence in the above combined with our original submission demonstrates there is an increasing risk of groundwater infiltration and the funds allowed through base maintenance do not extend to achieving a watertight system.

6. Best Option for Customers

6.1 Ofwat's Draft Determination

Ofwat raised some concerns about whether the investment provides the best option for customers, suggesting our evidence of consideration for alternative options was limited and we had not provided sufficient details of cost benefit analysis to demonstrate that the chosen options were the right solutions. We received a reduction adjustment of 20% to our requested funding of £38.9m (had the requested funding passed its need case) and a criteria decision of 'some concerns'.

6.2 Our Response

We have provided further detail of the 13 options considered to meet infiltration needs, as well as further details on cost benefit analysis to demonstrate strength of our proposed solutions against other feasible alternatives.

Alternative Options and Cost Benefit Analysis

In Section 3 of our original submission, SRN50, we identify 13 options to address infiltration, including 'Do Nothing'. From these, 6 options were taken forward and considered in more detail. These can be seen in table 3 below:

Option considered (Unconstrained)	Unconstrained to Constrained	Rationale
Tactical system relining	Yes	Preferred option – adaptive solution. Effective, relatively low cost and low carbon
Reduce other inflows	Yes	May be partially effective due to being site specific. Potentially low cost. Would need to be used in conjunction with relining option to address all mechanisms.
Natural Flood Management (NFM)	Yes	Possible solution for the 25-year plan. Would need to be used in conjunction with sewer sealing options to address all mechanisms and will be site specific.
End of pipe solutions (in catchment or at STW)	Yes	Not currently permitted by the EA for 'Excessive Infiltration' systems. Possible future technology may enable this as a more feasible solution
Flood grout sealing	Yes	Unproven technique in UK conditions, but possible to investigate as an alternative to CIPP in option P3.
Whole System Relining	No	Prohibitively expensive, high carbon, not good value and disruptive

Combined sewer separation.	No	Convert existing combined sewers to surface water only and construct new foul water sewers. Prohibitively expensive
Infiltration reduction - Reduce groundwater levels	No	Prohibitively expensive / limited benefit and would need to be sustainable (in line with drought plans)
Do nothing/Maintain Status Quo	Yes	Taken forward for comparative purposes. Includes Tankering
Find and Fix relining	No	10 years of using this approach with no retired IRPs
Storage tanks	No	Not feasible as storage of any size will eventually fill and not be able to drain. The root cause does not lend itself to this solution type.
Tankering	No	Included in Maintain Status Quo option
New Combined Sewer Overflow	Not feasible	Not feasible as the EA discount this as an option in para 1.4 of their Regulatory Position Statement on Discharges made from groundwater surcharged sewers.(Appendix 2 PR24 - supporting data - All Documents (sharepoint.com))

Table 3: AMP8 Resilience Infiltration options considered.

Of this comprehensive long-list of options, the preferred best-value option is to address the root cause by creating a watertight system through a combination of sewer sealing techniques. We identified for most interventions (80%) the appropriate route would be to seal the system using an innovative method of sealing called [redacted]. This is costed at a lower unit rate than more traditional techniques. All other options to prevent infiltration to the network cost more and other types of measures, such as improving land drainage, do not have the same certainty of delivered benefit.

End of pipe solutions would require further technical discussions with the Environment Agency regarding treatment and discharge. In most of these cases, the capacity of the sewerage systems would need to be increased to deliver the increased flow for treatment. This would further increase costs above our current proposal. Based on our submission, the split of investment between system types is £22.6m for public sewers and £16.2m for private sewers.

It is important to note that following the high groundwater season in 2013/14 one of our approved mitigation measures was to over pump excess heavily dilute wastewater flow from the sewer to local watercourses via a screening, settlement and filtration system to minimise any environmental impact. This did work well and allowed customers to continue to use the sewerage facilities, whilst the impact on the environment was monitored and managed and disruption due to tanker movements was reduced. However, what was acceptable 10 years ago is not acceptable now. The perceived pollution arising from the principle of invoking this technique; the requirement of the infiltration reduction plan to address root cause and not rely on mitigation; and the recently tightened standards and national intolerance regarding “dry day spills” mean this temporary though effective and relatively low cost and low impact mitigation measure, is no longer an option.

Best value and cost benefit analysis

Full cost benefit analysis of the identified interventions is challenging as there is insufficient data to build a full relationship between the investment and the monetary benefit. It is apparent from our Pathfinder work the benefit plateaus when groundwater reaches extremely high levels. The table 4 below lists the six constrained options and comments on the relative cost of providing the same level of benefit as the preferred sewer sealing approach.

Constrained Option	Relative cost	Certainty of success	Confidence of delivery	Preferred (y/n)	Comment
Tactical System lining	Included in £38.9m	High	High	Y	20% of submitted proposal
Reduce other inflows	Higher	Low	Medium	N	Does not address cause. Insufficient in itself to deliver required benefit
Natural flood management	Higher	Low	Low	N	Does not address cause. Insufficient in itself to deliver required benefit. Unlikely to be permitted by stakeholders
End of pipe solutions	Higher	Low	Low	N	Cause not addressed. All systems require upsize to convey flows forward including WTW upgrades. Treated effluent quality compromised. May draw more ground water in.
Flood grout sealing [redacted]	Included in £38.9m	High	High	Y	80% of submitted proposal
Do nothing more/tankering	Highest	Medium	Medium	N	Not sustainable on all fronts: cost, performance, environment, customer, stakeholder

Table 4: summary of constrained options

Our average mitigation costs across all years are around £5m a year. However, while in some years there may be no additional costs as the groundwater doesn't rise sufficiently to cause an issue, in other years, our mitigation costs are around £15m. However, these historic costs are dwarfed by the 2023/24 winter period where, due to the high and prolonged high groundwater period our mitigation activity has cost £29m as shown in Table 5. This level of spend and disruption to communities is not sustainable. Our customers through their local Parish Councillors and MPs are demanding a change now in order to eradicate tankering as a means of sewage collection (see Case Study 1 – Mullens Pond).

In addition to the prolonged wet period in 2023/24 being an issue, our handling of incidents changed to exclude groundwater treatment and discharges to local watercourses. This was due to the change in what customer and stakeholder groups deemed to be acceptable practice. Although our infiltration reduction plans include groundwater treatment as an option, in reality when these discharges are to sensitive waters such as the pristine chalk stream River Test, this is not appropriate. The 2023/24 mitigation costs are the cost of maintaining service by tankering and will be more representative of future costs...

This only takes account of our operational costs to deal with the increased flow. It does not factor in the cost or distress of customer impact in terms of flooding incidents. Based on our Pathfinder project described above, we could expect the likelihood of the system becoming overwhelmed to the extent of previous years to halve and that in an average year mitigation may not be required.

Our submission focuses on addressing the sewers in Lavant, Pan Parish and Barton Stacey, in Hampshire, as these are the systems at greatest risk in terms of likelihood and consequence. In the winter of 2023-24 the reactive mitigation cost in these three areas alone was £13.7m. Although not quantified separately, the additional costs of restricted toilet use for customers, handling complaints around tankering and the impact of the mitigation activities on the environment would not be insignificant, bringing the total reactive cost to at least £15m.

Location	2023/24 Mitigation cost (£k)
Barton Stacey	£7,456
Appleshaw	£5,218
Pan Parish	£4,269
Nailbourne	£3,430
Lavant	£2,122
Lidsey	£1,596
Hambledon	£1,389
Lancing	£720
Hursley	£697
Bromley Green	£573
Kings Somborne	£505
Chilbolton	£485
Harestock	£397
Overton	£326
Southwick	£248
2023/24 Total	£29,432

Table 5: Unplanned mitigation costs 2023-24

If we assume that by undertaking the proposed sealing work, we will halve the likelihood of incurring these peak reactive costs, and we assume this moves from a once in 2-year occurrence to one in 4, then over 30 years our reactive costs would be reduced from £205m to £102m at a capital cost of £20.431m.

In the other areas we propose sealing 20% of all sewers (public and private) in 6 wastewater systems at a cost of £18.467m. Our reactive costs in these areas in 2023-24 were around £8m. This investment will reduce the likelihood of future incidents, although not to the same extent as the systems we propose to fully seal. Our assumption is this would reduce the likelihood of incurring reactive costs from once in 2 years to once in 3 years. On this basis over 30 years, we should see reactive costs reduce from £120m to £80m, a reduction of £40m for £18.5m invested. We would continue work in these areas in future AMPs to deliver a greater benefit to our customers.

Due to the annual variability in rainfall and groundwater across our region the systems with greatest impact can change from one year to the next. Table 5 shows the villages of Appleshaw and Hambledon were badly affected in 2023-24. Although we are not proposing to increase the level of resilience funds to address these areas in our plan, we will prioritise the investment to ensure we are delivering the greatest benefit to our customers per £ invested. The 3 highest priority systems to be fully sealed will not change but we may undertake some priority sealing work in villages in addition to the 6 stated in our plan within the £38.8m.

7. Cost Efficiency

7.1 Ofwat's Draft Determination

Ofwat raised some concerns about whether the investment is efficient, suggesting we had not provided sufficient and convincing evidence that our costs were efficient. We received a reduction adjustment of 20% to our requested funding of £38.9m (had the requested funding passed its need case) and a criteria decision of 'some concerns'.

7.2 Our Response

We have completed benchmarking of our traditional sewer lining framework rate, which has suggested our costs are below comparator costs. For the portion of the programme that will be delivered by [redacted], there is little comparator data available to enable benchmarking, however, we have demonstrated via trials completed by our Pathfinder team, our selected delivery unit rate is sufficiently stretching and efficient.

Cost benchmarking and recent delivery out-turn costs

Our preferred method to deliver the enhanced level of service expected by our customers is a combination of innovative [redacted]l sealing (used in Europe) and more traditional sewer lining. [redacted] is a method not tried in the UK previously so there is limited information available on the cost of delivering the application, however, it has been used extensively for some years to address private drainage issues in Germany.

We have assumed we can deploy it at an average rate of [redacted] and, because there has been limited application in the UK, we are applying the manufacturers guidance of a 30-year asset life.

Our work in the Pan Parish pilot has so far returned a unit rate much higher than our assumed rate and we are out-turning at [redacted] following the sealing of 2.5km using the [redacted] technique. This higher unit rate was always anticipated due to this being a pilot and first-time deployment with logistical lessons learnt. Our proposal is to seal 177.4 km of sewer by [redacted] technique, and we expect to see economies of scale to deliver our anticipated [redacted] rate.

Our unit rate for sewer lining is consistent with our standard framework rates for this type of work at [redacted] Traditional sewer lining techniques have more extensive industry delivery rates available to enable benchmarking. Our Cost Intelligence Team have undertaken a benchmarking exercise to compare our unit rate to provide further confidence in the efficiency of our traditional sewer programme, shown in Figure 12 below:

[redacted]

Figure 12: Benchmark comparison of SWS sewer lining unit rate

The benchmark exercise compared our business plan rate with 2 industry peers and found our rate compares favourably with the benchmark of [redacted] for sewers less than 275mm diameter with our costs being 3% below the benchmark. Comparator unit rates have been normalised with respect to inflation (to 22/23 pricing) and for location to South-East England, to ensure comparison is fair.

We have planned for 80% of our infiltration work to be delivered by the innovative sealing technique - [redacted] with an ambitious rate of [redacted], with the remaining 20% to be delivered via traditional sewer lining that compares favourably within the industry. We consider that the evidence above demonstrates that our delivery costs represent efficient costs and best value.

Efficiency challenge to account for existing sewer condition

We are aware that any public grade 4 and 5 sewers which are found to be leaking should be addressed by our capital maintenance activity and it is correct to take account of this. As described in Section 4 page 14 when preparing this document, we analysed in detail two sewerage systems in which sewer lining work had been undertaken to address infiltration. Our findings are that 17% of all assets lined in Lavant and Newnham Valley (aka Nailbourne) were of structural condition grade 4 or 5 i.e. poor condition and sewers which ought to be addressed through planned rehabilitation(see Table 2). We have therefore assumed that 17% of all public sewers we plan to line will be funded through base maintenance. Our proposal is therefore to reduce the funds required for public sewers from £22.6m to £18.7m giving a total proposed submission of £34.9m.

8. Customer Protection

Southern Water and Ofwat are aligned in their view that a price control deliverable (PCD) is not applicable for this investment.

9. Conclusion

Following a review of our October 2023 submission and through the presentation of new evidence and information we conclude we have demonstrated:

- The incidence of high groundwater seasons is increasing and will continue to due to climate change. Additionally, the severity of the groundwater seasons is increasing.
- It is necessary to seal sewers which are in good condition in order to prevent inundation caused by the increase in high groundwater events.
- Our proposal to make public sewerage systems which are in good condition watertight and less vulnerable to high groundwater is an enhancement above the level to which we are funded through base maintenance. We have made a 17% adjustment to account for sewers which are in poor condition.
- Infiltration to private sewers is a significant contributor to the issue.
- Our base funding does not allow for rectification of defects on or work to upgrade the watertightness of private sewers and therefore both elements need to be funded through enhancement.
- The most sustainable and best value method of reducing flows is to prevent ingress at source.
- Our submitted costs are ambitious and represent good value for customers.
- We estimate that in the catchments to be fully addressed the likelihood of high groundwater events triggering mitigation interventions will reduce from once in 2 years to once per 5 years or less frequent.
- We estimate that this will lead to a 50% reduction in flooding and pollution incidents in the catchments fully addressed where infiltration is the cause of incidents and an unplanned reactive mitigation cost reduction of £103m over a 30-year period. In addition, we estimate an 80% reduction in tanker movements and associated carbon impact in the catchments where infiltration is fully addressed.

10. Supporting Evidence

The bulk of evidence to further support our case is contained in the original submission documentation and further highlighted in this response.

The additional documents referred to are:

- Surface Water Drainage Review – DEFRA 2020

11. Business Plan Dependencies

The table below shows links to our original submission and other relevant information.

Chapters	Enhancement
Business cases	Infiltration Resilience
Technical annexes	
Enhancement cases	SRN50
Cost adjustment claims	
Ofwat test areas	
Assurance	

Other – please specify	

Data Tables impacted by the representation:

Table/s Impacted	Data Lines Impacted
CWW3	168, 170

All documents and tables referenced above can be found on our website here: Business Plan 2025-30 - Southern Water

12. Case Study 1: Mullens Pond

12.1 Background

Mullens Pond is a sub-catchment of the wastewater system draining to Fullerton WTW. Wastewater flow from the villages of Kimpton, Fyfield, Thruxton and East Cholderton drain to a pumping station at Mullens Pond which pumps flow forward to connect with flow from other villages ultimately draining to the WTW. The villages are located close to the spring line of the chalk downs adjacent to the watercourse which drains to Pillhill Brook and Mullens Pond. In winter periods the ground water rises through the chalk and on attaining the spring line, groundwater reaches the surface and is drained by the watercourse through the village. In wetter than average winter periods groundwater rises at a higher rate than the watercourse can drain, and groundwater continues to rise. It is in these conditions that groundwater comes into contact with buried assets such as basements and also the sewerage system, which is normally the utility asset buried at the greatest depth. Groundwater can enter the sewers through leaking joints in both the public and privately owned assets and as groundwater continues to rise the sewer network, which would not generally be running full, will act as a land-drain and convey groundwater downstream. This would continue until the capacity of the system is exceeded and flow in is greater than flow out. In Mullens Pond the capacity is first breached at the pumping station. When this happens flows back-up in the sewerage system and eventually fills the system to the point where customers are unable to use their drainage facilities as levels continue to rise flooding may occur both externally in highways and gardens and internally to properties. As groundwater events are long-lived, unlike rainfall events, the system can remain full for months.

This has been an issue for many years though it came to a head in the very wet winter of 2013/14.

12.2 Mitigation

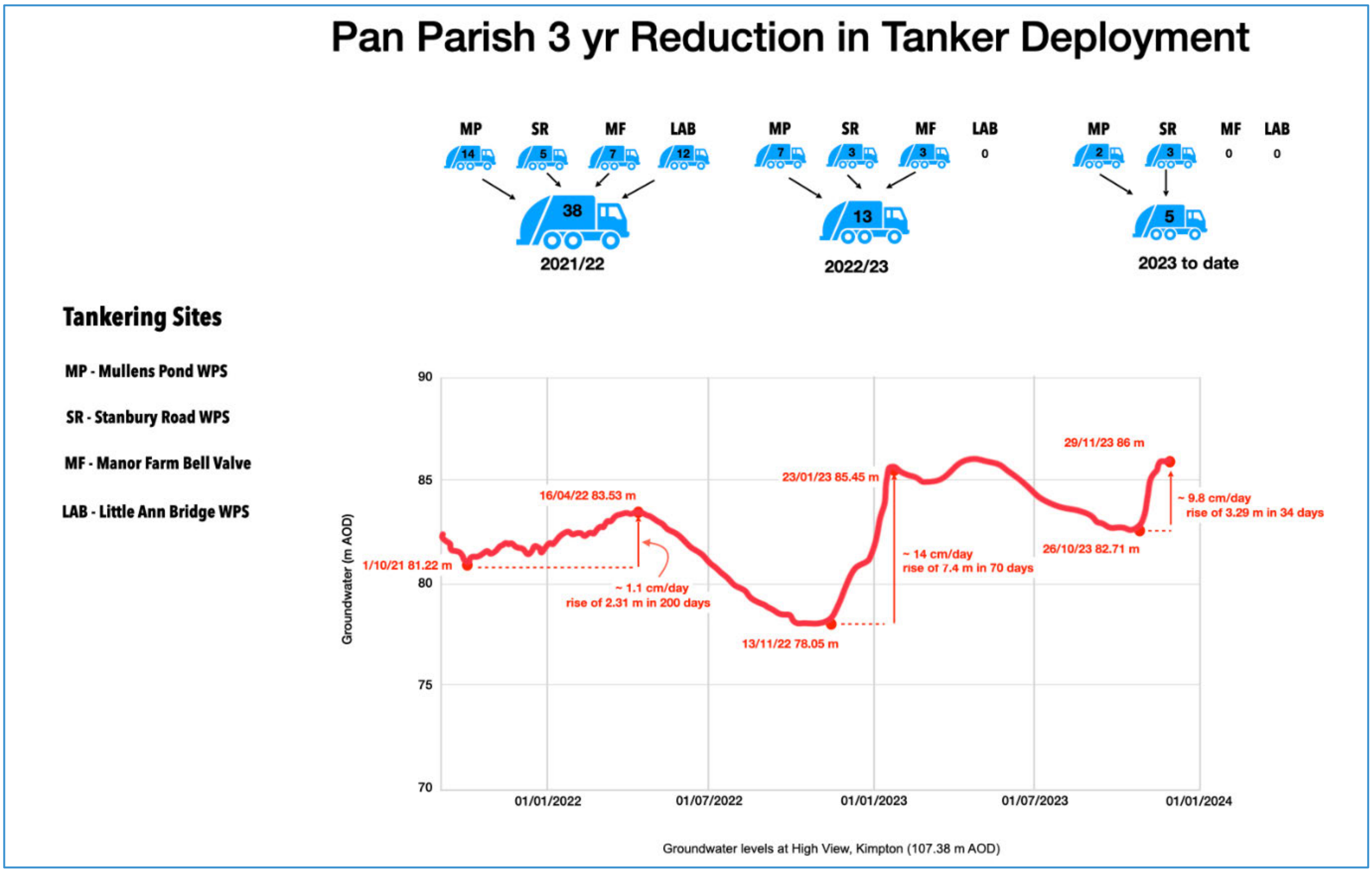
Our mitigation plan to ensure customers can use their facilities and to protect properties and the environment has two phases. Initially we will despatch tankers to the villages to suck flow out of the sewers at strategic points and create sufficient capacity to facilitate drainage. The tankers when full will travel to wastewater treatment works where the load will be discharged at the inlet to the treatment process and flow will be treated to normal standards. However, sometimes the nearest WTW with available capacity is some distance away and whilst the tanker is on the road it is not removing flow from the sewer. The sewer in the meantime because of the constant groundwater inflow is running full very shortly after the tanker leaves site so for every location which we extract flow from we need a chain of tankers queued up awaiting their turn to extract flow. For this operation to run successfully there must always be at least one tanker extracting flow at each strategic point at all times, 24 hours a day 7 days a week and for as many weeks as the groundwater is high. In 2020/21 we needed to deploy 38 tankers to the Mullens Pond area to manage flows for four months. An aerial view of Fyfield and Kimpton villages is shown below which gives some indication of the disruption that 38 tankers would cause. Also below are photographs of roads in the villages which tankers would negotiate and examples of fleets of tankers in village settings.

If groundwater continues to rise and flow cannot be managed successfully by tankering then by agreement with the Environment Agency we may extract flows from the sewer and discharge the highly diluted wastewater to the local watercourse. These flows must first pass through a settlement tank, sand filter and screen before discharging to the watercourse. This groundwater treatment process does hold the water level in the system stable and allows the tanker operation to then keep up with flow. Monitoring is in place in the watercourse to ensure no water quality issues are created by the discharge. In the period 2013 to 2021 this was an acceptable practice as last resort. However, since 2021 driven largely by the concerns nationally over river water quality this practice is no longer accepted as an appropriate method of managing flow and both local and national groups are vehemently protesting against this use as evident from many local and national news articles (photos below from the Andover Echo and ITV News).

In particularly sensitive areas such as where these discharges would be to chalk streams, we have discontinued this practice and only manage flow by tankering.

12.3 Permanent solution

Our customers, Parish Councils and Members of Parliament in our affected areas are insistent that tankering each wet winter is not sustainable due to the disruption and damage caused by tankers, and we share that view. In the Mullens Pond area seven Parish Councils formed a Pan Parish partnership to hold Southern Water to account and also to work with us to seek a solution to the problem. We have worked with the councils and together we have forged a good working relationship in our efforts to remove groundwater from the whole sewerage system both public and private sewers. This has been delivered through a combination of lining the public system with materials which have been tested by the Water Research Council to be leak tight, and sealing leaking joints in manholes and the private system by use of a product called [redacted]. This product is a resin which seeps into cracks and pipe joints and sets in the joint and voids and prevents groundwater from entering the system. Using these two methods we have sealed around 5km of sewer in Kimpton and Fyfield in 2023. In the winter of 2023/24, the groundwater levels rose to the same height as experienced in 2020/21 and in 2013/14, though levels stayed high for longer due to the prolonged wet period. We found that due to the sewer sealing undertaken the number of tankers that were required to manage flows reduced from 38 in 2020/21 to just 5 this winter. The graphic below summarises this.



12.4 Conclusion

It can be concluded from this that managing flows at times of high groundwater by tankering and discharge to watercourses is no longer acceptable to our customers and stakeholders. They rightly expect to be able to use drainage facilities at all times of the year. Creating a watertight system by sewer sealing and lining is effective and is the only way to achieve the required outcome. To deliver this requires joined up working with stakeholders, customers and individual property owners.

13. Case Study 2: St Marybourne

13.1 Background

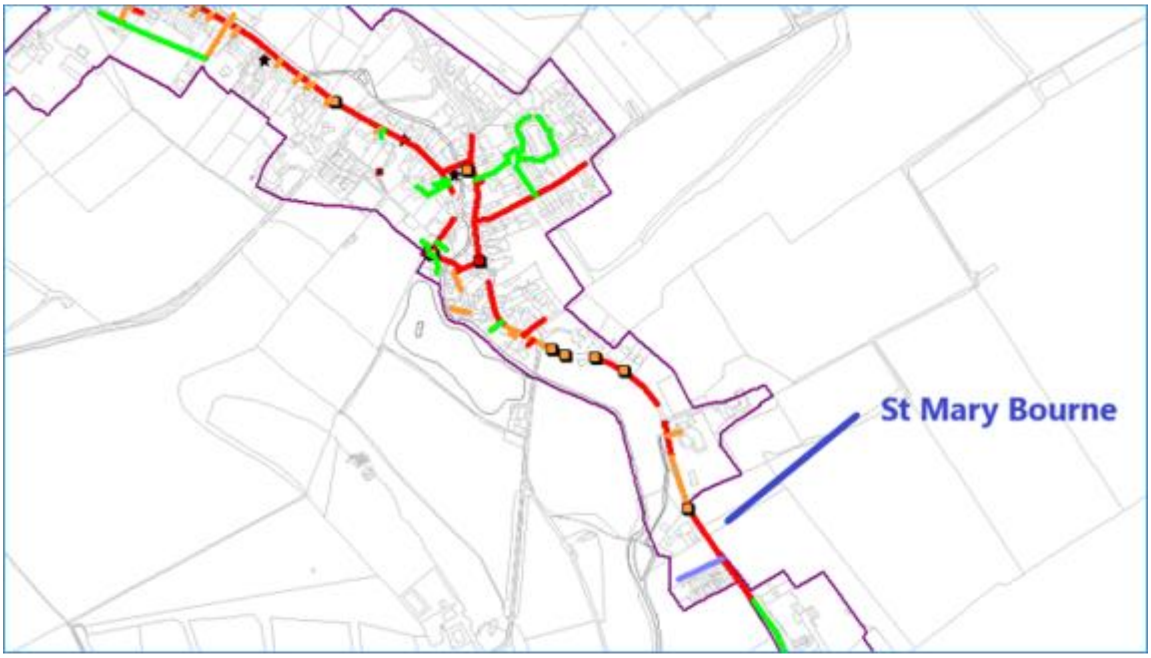
Similar to Mullens Pond the village of St Marybourne is situated adjacent to a chalk winterborne stream. The stream rises in winter once ground water has risen to the spring line. In wet winters the sewerage system becomes full due to groundwater entering the system and if groundwater reaches the surface, flow can enter the system through inspection covers.

The high groundwater experienced in winter of 2013/14 raised the profile of this system and we needed to deploy tankers to the village to manage flows. Photos below show the rural nature of St Marybourne village. As can be seen there would be a high level of disruption caused by tankers running through the village but the third photo in the series shows the impact that high groundwater actually has on the village should tankers not be deployed.

In our infiltration reduction plan, we did include an option to discharge flow to the local watercourse at times that tankers are insufficient to manage flows. However, as this is a rare chalk stream connecting to the River Test the use of this as a last resort is not acceptable. In addition to this there is a Vitacress food production business downstream of the village which requires a constant flow of non-contaminated water. This further restricts the mitigation actions we are able to undertake and increases the priority for creating a watertight system. As with Mullens Pond our customers and stakeholders and the MP Kit Malthouse are insisting we do more in this area to eradicate tankers from the village.

13.2 What we have done

The figure below shows in red the public sewers in the village which we have sealed since 2013. I addition we have surveyed and sealed where required public sewers in the villages of Stoke and Ibthorpe which drain into the St Marybourne village system. In total 10.6 km of a total of 15km of public sewer has been surveyed and sealed.

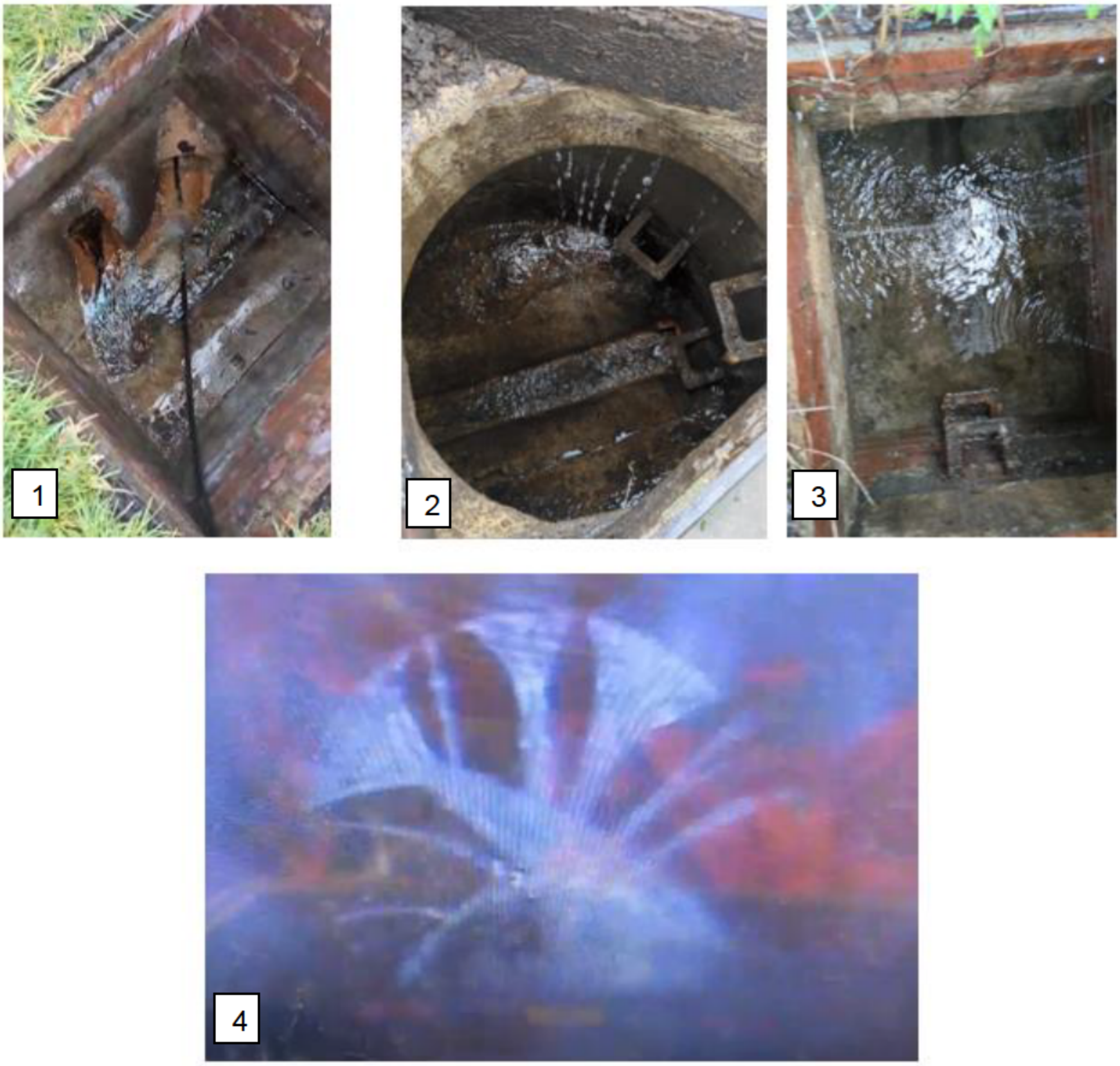


13.3 Groundwater in 2023/24

In winter 2023/24 the groundwater level rose to the same level as 2013 and we needed to deploy the same number of tankers to the village despite all efforts leading up to this. This is because the ground water has risen to a level where private drainage is affected, and surface flooding is occurring which is getting into the system and overwhelming. The photos below are examples of infiltration into private drains. Photos 1-3 show infiltration at manholes and clear flow in the private drains. Photo 4 is footage from a CCTV survey showing infiltration gushing in at a non-watertight joint in a private drain.

13.4 Conclusion

We need to adopt the same process here as Mullens Pond to create a watertight system including private laterals. Only addressing public sewers does not reduce the risk of loss of service to the extent required or the level of service expected by our customers.


1
2
3
4

14. Case Study 3: Southwick

14.1 Background

Southwick town is on the south coast of Sussex between Worthing to the west and Brighton and Hove to the east. It is not a typical groundwater affected system in that it does not sit on the spring line at the base of the Downs. However, at times of very high groundwater the geology of the area is such that an underground stream below The Green becomes active. Levels increase to impact the sewerage system draining Southwick and impedes property drainage. The Green also floods directly from the groundwater. As in other areas the groundwater is entering the system through leaking joints in private systems as well as public sewers.

14.2 Mitigation

To mitigate the effect of groundwater is very disruptive to the community, including road closures to enable tankering, laying of overland hoses to link drainage systems and the installation of pump sets in recreational areas. In 2023/24 these remained in situ for weeks until the groundwater subsided and the various installations can be seen in the photos below. The area of operation is very close to properties and customers have raised concerns with us about being kept awake all night due to the noise of tankers as they are extracting flows. This Southwick issue will occur to this extent on average once in 7 years and although this is less frequent than other areas in Hampshire, the impact and disruption caused is so high that our customers are very keen to see this resolved.

14.3 Conclusion

Mitigation is impactful on residents and even at a current frequency of once in 7 years this does not meet the expectations of our customers.

15. Appendix A – Sewers lined with condition grade.

JR Year	Catchment	Scheme I	WorkIt	Scheme Type	Icg	Completion Icg	Scheme	County	Scheme Name	Height	sewer length	Kpi Year	Asset Ty	Date Creat	Material
2013/14	Lavant	13794	25925	No DIG Repair	5	2	LAVA0036	S	LAVANT	150	97.6	JR14 (2013/14	Sewer	22-May-13	Polyvinyl chloride
		13794	27654	No DIG Reline	1	1	LAVA0036	S	LAVANT	100	9.7	JR14 (2013/14	Sewer	13-Nov-13	Unallocated
		13794	25905	No DIG Reline	1	1	LAVA0036	S	LAVANT	150	25.6	JR14 (2013/14	Sewer	20-May-13	Unallocated
	Nailbourne	11960	21283	No DIG Reline	4	1	NEWN0012	K	NEWNHAM VALLEY	150	11.7	JR14 (2013/14	Sewer	10-May-11	Concrete (in-situ)
		13883	26190	No DIG Reline	1	1	NEWN0014	K	NEWNHAM VALLEY	150	24.3	JR14 (2013/14	Sewer	17-Jun-13	Vitrified clay
		13883	26189	No DIG Reline	1	1	NEWN0014	K	NEWNHAM VALLEY	150	39.4	JR14 (2013/14	Sewer	17-Jun-13	Vitrified clay
		13883	26188	No DIG Reline	1	1	NEWN0014	K	NEWNHAM VALLEY	300	29.6	JR14 (2013/14	Sewer	17-Jun-13	Concrete (pre-cast)
		13883	26187	No DIG Reline	1	1	NEWN0014	K	NEWNHAM VALLEY	300	41.6	JR14 (2013/14	Sewer	17-Jun-13	Concrete (pre-cast)
		13883	26185	No DIG Reline	1	1	NEWN0014	K	NEWNHAM VALLEY	300	70.9	JR14 (2013/14	Sewer	17-Jun-13	Concrete (pre-cast)
		13883	26184	No DIG Reline	1	1	NEWN0014	K	NEWNHAM VALLEY	300	30.8	JR14 (2013/14	Sewer	17-Jun-13	Concrete (pre-cast)
		13883	26186	No DIG Reline	1	1	NEWN0014	K	NEWNHAM VALLEY	300	57.2	JR14 (2013/14	Sewer	17-Jun-13	Concrete (pre-cast)
		13883	26191	No DIG Reline	1	1	NEWN0014	K	NEWNHAM VALLEY	300	15.2	JR14 (2013/14	Sewer	17-Jun-13	Concrete (pre-cast)
		13883	26192	No DIG Reline	1	1	NEWN0014	K	NEWNHAM VALLEY	300	72.4	JR14 (2013/14	Sewer	17-Jun-13	Concrete (pre-cast)
		13883	26193	No DIG Reline	1	1	NEWN0014	K	NEWNHAM VALLEY	300	73.4	JR14 (2013/14	Sewer	17-Jun-13	Concrete (pre-cast)
		13883	26183	No DIG Reline	1	1	NEWN0014	K	NEWNHAM VALLEY	150	51.2	JR14 (2013/14	Sewer	17-Jun-13	Vitrified clay
		13883	26197	No DIG Reline	1	1	NEWN0014	K	NEWNHAM VALLEY	300	90.3	JR14 (2013/14	Sewer	17-Jun-13	Concrete (pre-cast)
		13883	26171	No DIG Repair	1	1	NEWN0014	K	NEWNHAM VALLEY	300	69.9	JR14 (2013/14	Sewer	17-Jun-13	Concrete (pre-cast)
		13883	26194	No DIG Reline	1	1	NEWN0014	K	NEWNHAM VALLEY	300	54.4	JR14 (2013/14	Sewer	17-Jun-13	Concrete (pre-cast)
		13883	26196	No DIG Reline	1	1	NEWN0014	K	NEWNHAM VALLEY	300	71.7	JR14 (2013/14	Sewer	17-Jun-13	Concrete (pre-cast)
		13883	26212	No DIG Reline	1	1	NEWN0014	K	NEWNHAM VALLEY	150	39.8	JR14 (2013/14	Sewer	19-Jun-13	Vitrified clay
		13883	26165	No DIG Reline	1	1	NEWN0014	K	NEWNHAM VALLEY	225	29.9	JR14 (2013/14	Sewer	17-Jun-13	Vitrified clay
		13883	26169	No DIG Repair	1	1	NEWN0014	K	NEWNHAM VALLEY	300	16.0	JR14 (2013/14	Sewer	17-Jun-13	Concrete (pre-cast)
		13883	26176	No DIG Reline	1	1	NEWN0014	K	NEWNHAM VALLEY	300	87.1	JR14 (2013/14	Sewer	17-Jun-13	Concrete (pre-cast)
		13883	26159	No DIG Repair	1	1	NEWN0014	K	NEWNHAM VALLEY	150	44.5	JR14 (2013/14	Sewer	17-Jun-13	Spun iron
		13883	26182	No DIG Reline	1	1	NEWN0014	K	NEWNHAM VALLEY	300	89.0	JR14 (2013/14	Sewer	17-Jun-13	Concrete (pre-cast)
		13883	26201	No DIG Reline	1	1	NEWN0014	K	NEWNHAM VALLEY	150	45.2	JR14 (2013/14	Sewer	17-Jun-13	Vitrified clay
		13883	26170	No DIG Reline	1	1	NEWN0014	K	NEWNHAM VALLEY	300	16.1	JR14 (2013/14	Sewer	17-Jun-13	Concrete (pre-cast)
		13883	26163	No DIG Repair	1	1	NEWN0014	K	NEWNHAM VALLEY	225	45.9	JR14 (2013/14	Sewer	17-Jun-13	Spun iron
		13883	26172	No DIG Repair	1	1	NEWN0014	K	NEWNHAM VALLEY	300	64.4	JR14 (2013/14	Sewer	17-Jun-13	Concrete (pre-cast)
		13883	26177	No DIG Repair	1	1	NEWN0014	K	NEWNHAM VALLEY	300	46.5	JR14 (2013/14	Sewer	17-Jun-13	Concrete (pre-cast)
		13883	26178	No DIG Repair	1	1	NEWN0014	K	NEWNHAM VALLEY	300	87.7	JR14 (2013/14	Sewer	17-Jun-13	Concrete (pre-cast)
		13883	26180	No DIG Reline	1	1	NEWN0014	K	NEWNHAM VALLEY	300	71.6	JR14 (2013/14	Sewer	17-Jun-13	Concrete (pre-cast)
		13883	26181	No DIG Reline	1	1	NEWN0014	K	NEWNHAM VALLEY	300	82.4	JR14 (2013/14	Sewer	17-Jun-13	Concrete (pre-cast)
		13883	26203	No DIG Reline	1	1	NEWN0014	K	NEWNHAM VALLEY	150	35.0	JR14 (2013/14	Sewer	17-Jun-13	Vitrified clay
		13883	26204	No DIG Reline	1	1	NEWN0014	K	NEWNHAM VALLEY	150	26.7	JR14 (2013/14	Sewer	17-Jun-13	Vitrified clay
		13883	26205	No DIG Repair	1	1	NEWN0014	K	NEWNHAM VALLEY	225	18.8	JR14 (2013/14	Sewer	18-Jun-13	Vitrified clay
		13883	26206	No DIG Repair	1	1	NEWN0014	K	NEWNHAM VALLEY	300	68.5	JR14 (2013/14	Sewer	18-Jun-13	Concrete (pre-cast)
		13883	26211	No DIG Repair	2	2	NEWN0014	K	NEWNHAM VALLEY	225	65.5	JR14 (2013/14	Sewer	18-Jun-13	Vitrified clay
		13883	27653	No DIG Repair	1	1	NEWN0014	K	NEWNHAM VALLEY	150	50.8	JR14 (2013/14	Sewer	12-Nov-13	Vitrified clay
		13883	26202	No DIG Reline	1	1	NEWN0014	K	NEWNHAM VALLEY	150	32.7	JR14 (2013/14	Sewer	17-Jun-13	Vitrified clay
		13974	26541	No DIG Reline	3	1	NEWN0015	K	NEWNHAM VALLEY	225	12.5	JR14 (2013/14	Sewer	05-Sep-13	Vitrified clay
		13974	26524	No DIG Reline	1	1	NEWN0015	K	NEWNHAM VALLEY	375	7.3	JR14 (2013/14	Manhole	30-Aug-13	Vitrified clay
		13974	26523	No DIG Repair	3	1	NEWN0015	K	NEWNHAM VALLEY	150	57.3	JR14 (2013/14	Sewer	30-Aug-13	Vitrified clay
		13974	26522	DIG Repair	4	1	NEWN0015	K	NEWNHAM VALLEY	150	46.8	JR14 (2013/14	Sewer	30-Aug-13	Vitrified clay
		13974	26514	No DIG Reline	3	1	NEWN0015	K	NEWNHAM VALLEY	225	22.9	JR14 (2013/14	Sewer	28-Aug-13	Vitrified clay
		13974	26513	No DIG Reline	1	1	NEWN0015	K	NEWNHAM VALLEY	225	33.4	JR14 (2013/14	Sewer	28-Aug-13	Vitrified clay
		13974	26511	No DIG Reline	3	1	NEWN0015	K	NEWNHAM VALLEY	375	27.2	JR14 (2013/14	Sewer	28-Aug-13	Concrete (pre-cast)
		13974	26510	No DIG Reline	3	1	NEWN0015	K	NEWNHAM VALLEY	375	28.3	JR14 (2013/14	Sewer	28-Aug-13	Concrete (pre-cast)
		13974	26505	No DIG Repair	1	1	NEWN0015	K	NEWNHAM VALLEY	375	34.0	JR14 (2013/14	Sewer	28-Aug-13	Concrete (pre-cast)
		13974	26504	No DIG Reline	1	1	NEWN0015	K	NEWNHAM VALLEY	375	28.0	JR14 (2013/14	Sewer	28-Aug-13	Concrete (pre-cast)
		13883	26164	No DIG Repair	1	0	NEWN0014	K	NEWNHAM VALLEY	150	52.7	JR14 (2013/14	Sewer	17-Jun-13	Vitrified clay
		13883	26208	No DIG Repair	1	1	NEWN0014	K	NEWNHAM VALLEY	150	10.3	JR14 (2013/14	Sewer	18-Jun-13	Vitrified clay
		13883	26209	No DIG Repair	1	1	NEWN0014	K	NEWNHAM VALLEY	150	5.9	JR14 (2013/14	Sewer	18-Jun-13	Vitrified clay
		13974	26519	No DIG Repair	1	1	NEWN0015	K	NEWNHAM VALLEY	100	14.3	JR14 (2013/14	Sewer	30-Aug-13	Vitrified clay
										Total	2381.0				
										ICG1-3	2225.0				
										ICG4-5	156.0				

JR Year	Catchment	Scheme I	WorkIt	Scheme Type	Icg	Completion Icg	Scheme	County	Scheme Name	Height	sewer length	Kpi Year	Asset Ty	Date Creat	Material
2014/15	Lavant	13995	26660	No DIG Reline	1	1	LAVA0037	S	LAVANT	150	21.8	JR15 (2014/15	Sewer	03-Oct-13	Vitrified clay
		13995	26673	No DIG Repair	1	1	LAVA0037	S	LAVANT	150	44.7	JR15 (2014/15	Sewer	04-Oct-13	Vitrified clay
		13995	26678	No DIG Reline	1	1	LAVA0037	S	LAVANT	150	38.3	JR15 (2014/15	Sewer	04-Oct-13	Vitrified clay
		13995	26594	No DIG Reline	1	1	LAVA0037	S	LAVANT	225	51.9	JR15 (2014/15	Sewer	30-Sep-13	Vitrified clay
		13995	26665	No DIG Repair	4	1	LAVA0037	S	LAVANT	150	79.4	JR15 (2014/15	Sewer	03-Oct-13	FRC
		13995	26617	No DIG Reline	1	1	LAVA0037	S	LAVANT	225	134.0	JR15 (2014/15	Sewer	01-Oct-13	Vitrified clay
		13995	26635	No DIG Repair	4	1	LAVA0037	S	LAVANT	250	35.2	JR15 (2014/15	Sewer	02-Oct-13	FRC
		13995	26593	No DIG Reline	1	1	LAVA0037	S	LAVANT	225	85.5	JR15 (2014/15	Sewer	30-Sep-13	Vitrified clay
		13995	26590	No DIG Reline	1	1	LAVA0037	S	LAVANT	175	67.6	JR15 (2014/15	Sewer	30-Sep-13	Vitrified clay
		13995	26632	No DIG Reline	4	1	LAVA0037	S	LAVANT	175	111.3	JR15 (2014/15	Sewer	02-Oct-13	Vitrified clay
		13995	26625	No DIG Reline	5	1	LAVA0037	S	LAVANT	150	77.2	JR15 (2014/15	Sewer	01-Oct-13	Pitch fibre
		13995	26592	No DIG Reline	1	1	LAVA0037	S	LAVANT	225	79.97213	JR15 (2014/15	Sewer	41547	Vitrified clay
	Nailbourn	13974	26507	No DIG Reline	1	1	NEWN0015	K	NEWNHAM VALLEY	150	46.51526	JR15 (2014/15	Sewer	41514	Vitrified clay
		13974	26509	DIG Repair	3	1	NEWN0015	K	NEWNHAM VALLEY	150	35.61333	JR15 (2014/15	Sewer	41514	Vitrified clay
										Total	**909.0**				
										ICG1-3	**571.0**				
										ICG4-5	**338.0**				
2015/16	Lavant	13995	26628	No DIG Reline	5	1	LAVA0037	S	LAVANT	175	70.1	JR16 (2015/16	Sewer	01-Oct-13	Vitrified clay
		13995	26929	No DIG Reline	1	1	LAVA0037	S	LAVANT	100	11.0	JR16 (2015/16	Sewer	15-Oct-13	Vitrified clay
		13995	26627	No DIG Reline	4	1	LAVA0037	S	LAVANT	175	49.0	JR16 (2015/16	Sewer	01-Oct-13	Vitrified clay
		13995	26626	No DIG Reline	5	1	LAVA0037	S	LAVANT	175	89.2	JR16 (2015/16	Sewer	01-Oct-13	Vitrified clay
		13995	26669	DIG Repair	1	1	LAVA0037	S	LAVANT	150	41.1	JR16 (2015/16	Sewer	04-Oct-13	Unallocated
		13995	26928	DIG Repair	5	1	LAVA0037	S	LAVANT	150	19.5	JR16 (2015/16	Sewer	15-Oct-13	Pitch fibre
	Nailbourn	13974	26512	No DIG Reline	1	1	NEWN0015	K	NEWNHAM VALLEY	150	35.28444	JR16 (2015/16	Sewer	41514	Vitrified clay
										Total	**315.2**				
										ICG1-3	**87.4**				
										ICG4-5	**227.8**				
2016/17	Lavant	15060	28457	No DIG Repair	1	1	LAVA0038	S	LAVANT	150	56.1	JR17 (2016/17	Sewer	19-May-14	Vitrified clay
		15060	31813	No DIG Reline	1	1	LAVA0038	S	LAVANT	150	30.8	JR17 (2016/17	Sewer	05-Sep-16	Vitrified clay
		15060	31815	No DIG Repair	1	1	LAVA0038	S	LAVANT	150	46.4	JR17 (2016/17	Sewer	05-Sep-16	Vitrified clay
		16823	31795	No DIG Reline	1	1	LAVA0042	S	LAVANT	150	59.0	JR17 (2016/17	Sewer	01-Sep-16	Vitrified clay
	Nailbourn	13974	28952	No DIG Reline	1	1	NEWN0015	K	NEWNHAM VALLEY	150	34.00253	JR17 (2016/17	Sewer	41823	Vitrified clay
		16822	31791	No DIG Reline	1	1	NEWN0019	K	NEWNHAM VALLEY	300	76	JR17 (2016/17	Sewer	42612	Concrete (pre-cast)
		16822	31789	No DIG Reline	1	1	NEWN0019	K	NEWNHAM VALLEY	300	55.8	JR17 (2016/17	Sewer	42612	Concrete (pre-cast)
		16822	31788	No DIG Reline	1	1	NEWN0019	K	NEWNHAM VALLEY	300	117.968	JR17 (2016/17	Sewer	42612	Concrete (pre-cast)
		16822	31790	No DIG Reline	1	1	NEWN0019	K	NEWNHAM VALLEY	150	46.77866	JR17 (2016/17	Sewer	42612	Vitrified clay
		16822	31787	No DIG Reline	1	1	NEWN0019	K	NEWNHAM VALLEY	150	33.7086	JR17 (2016/17	Sewer	42612	Vitrified clay
										Total	**557.0**				
										ICG1-3	**557.0**				
										ICG4-5	**0.0**				

JR Year	Catchment	Scheme I	WorkIt	Scheme Type	Icg	Completion Icg	Scheme	County	Scheme Name	Height	sewer length	Kpi Year	Asset Ty	Date Creat	Material
2017/18	Lavant	9091	31593	No DIG Reline	1	1	LAVA0031	S	LAVANT	100	5.4	JR18 (2017/18	Sewer	07-Jul-16	Vitrified clay
		15985	30229	No DIG Replace	5	1	LAVA0039	S	LAVANT	175	89.3	JR18 (2017/18	Sewer	19-Jan-15	Pitch fibre
		16363	30854	No DIG Repair	4	2	LAVA0040	S	LAVANT	150	60.58994	JR18 (2017/18	Sewer	01-Sep-15	Vitrified clay
		16534	31768	No DIG Reline	1	1	LAVA0041	S	LAVANT	150	36.17436	JR18 (2017/18	Sewer	23-Aug-16	FRC
		16534	31770	No DIG Reline	1	1	LAVA0041	S	LAVANT	100	5	JR18 (2017/18	Sewer	23-Aug-16	Vitrified clay
		16534	31769	No DIG Reline	1	1	LAVA0041	S	LAVANT	150	32.9821	JR18 (2017/18	Sewer	23-Aug-16	FRC
	Nailbourn	None								Total	229.4				
										ICG1-3	80.4				
										ICG4-5	149.0				
2018/19	Lavant	16823	31807	No DIG Repair	1	1	LAVA0042	S	LAVANT	175	92.3	JR19 (2018/19	Sewer	01-Sep-16	Polyvinyl chloride
		17966	34318	No DIG Repair	4	1	LAVA0043	S	LAVANT	100	10.8	JR19 (2018/19	Sewer	16-Mar-18	Vitrified clay
		17966	34299	No DIG Reline	4	1	LAVA0043	S	LAVANT	100	10.0	JR19 (2018/19	Sewer	16-Mar-18	Vitrified clay
	Nailbourn	None								Total	113.1				
										ICG1-3	92.3				
										ICG4-5	20.8				
2019/20	None														
2020/21	None														
2021/22	None														
2022/23	Lavant	None													
	Nailbourn	18982	36786	No DIG Reline	1	1	NEWN0030	K	NEWNHAM VALLEY	150	45.8812	JR23 (2022/2	Sewer	44972	Vitrified clay
2023/24	Lavant	18771	36295	No DIG Replace	5	3	LAVA0045	S	LAVANT	150	37.2	JR24 (2023/2	Sewer	24-Feb-22	Pitch fibre
		18771	36294	No DIG Repair	1	3	LAVA0045	S	LAVANT	150	17.4	JR24 (2023/2	Sewer	24-Feb-22	Pitch fibre
		18771	36308	No DIG Repair	1	1	LAVA0045	S	LAVANT	150	62.3	JR24 (2023/2	Sewer	24-Feb-22	FRC
		18771	36306	No DIG Reline	2	1	LAVA0045	S	LAVANT	150	66.3	JR24 (2023/2	Sewer	24-Feb-22	FRC
		18771	36303	No DIG Reline	1	1	LAVA0045	S	LAVANT	150	10.0	JR24 (2023/2	Sewer	24-Feb-22	Pitch fibre
		18771	36299	No DIG Repair	1	3	LAVA0045	S	LAVANT	150	19.5	JR24 (2023/2	Sewer	24-Feb-22	Pitch fibre
		18771	36301	No DIG Reline	1	1	LAVA0045	S	LAVANT	150	15.1	JR24 (2023/2	Sewer	24-Feb-22	Pitch fibre
	Nailbourn	18680	35944	No DIG Reline	1	1	NEWN0028	K	NEWNHAM VALLEY	150	13.28366	JR24 (2023/2	Sewer	44400	Vitrified clay
		18680	35950	No DIG Repair	1	1	NEWN0028	K	NEWNHAM VALLEY	150	86.86817	JR24 (2023/2	Sewer	44400	Vitrified clay
		18680	35937	No DIG Repair	1	1	NEWN0028	K	NEWNHAM VALLEY	225	82.30125	JR24 (2023/2	Sewer	44399	Vitrified clay
		18754	36229	No DIG Reline	1	1	NEWN0029	K	NEWNHAM VALLEY	300	36.69905	JR24 (2023/2	Sewer	44599	Concrete (pre-cast)
		18754	36233	No DIG Repair	1	1	NEWN0029	K	NEWNHAM VALLEY	150	5.69865	JR24 (2023/2	Sewer	44599	Vitrified clay
		18754	36223	No DIG Reline	1	1	NEWN0029	K	NEWNHAM VALLEY	300	64.8799	JR24 (2023/2	Sewer	44596	Concrete (pre-cast)
		18754	36186	No DIG Repair	1	1	NEWN0029	K	NEWNHAM VALLEY	150	27.59473	JR24 (2023/2	Sewer	44593	Vitrified clay
		18754	36194	No DIG Reline	1	1	NEWN0029	K	NEWNHAM VALLEY	225	78.15209	JR24 (2023/2	Sewer	44593	Vitrified clay
		18754	36224	No DIG Reline	1	1	NEWN0029	K	NEWNHAM VALLEY	300	31.2361	JR24 (2023/2	Sewer	44596	Concrete (pre-cast)
		18754	36187	No DIG Reline	2	1	NEWN0029	K	NEWNHAM VALLEY	150	58.4	JR24 (2023/2	Sewer	44593	Vitrified clay
		18754	36188	No DIG Reline	1	1	NEWN0029	K	NEWNHAM VALLEY	150	28.93273	JR24 (2023/2	Sewer	44593	Vitrified clay
		18754	36189	No DIG Reline	2	1	NEWN0029	K	NEWNHAM VALLEY	150	93.88303	JR24 (2023/2	Sewer	44593	Vitrified clay
		18754	36221	No DIG Reline	1	1	NEWN0029	K	NEWNHAM VALLEY	300	71.36045	JR24 (2023/2	Sewer	44596	Concrete (pre-cast)
										Total	904.2				
										ICG1-3	867.0				
										ICG4-5	37.2				