Groundwater Impacted System Management Plan

Basingstoke, River Loddon

September 2021

Version control

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1-d1	11/08/2021	Draft for EA	AJ	SE	DJ
1-d2	25/08/2021	Final Draft for EA	AJ	SE	DJ
1-V1	24/09/2021	Version 1	AJ	SE/JO	DJ
Annual Update 2022	October 2022	Addition of Annual Update 2022	MB/JH	DJ	DJ
Annual Update 2023	October 2023	Addition of Annual Update 2023	MB	DJ	DJ
Annual Update 2024	October 2024	Addition of Annual Update 2024	CW/MW	DJ	DJ
Annual Update 2025	Nov 2025	Draft for EA	AF/PP	BT/JE	MH/DS

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Introduction

This document sets out Thames Water's approach to the management of groundwater infiltration in sewerage systems where the influence of groundwater infiltration is viewed as significant likely leading to the sewerage system, on occasions, to become overwhelmed.

All sewerage systems combined and separate will experience some groundwater infiltration[1] and a nominal allowance in design will be made for this. However, in some catchments the impact of groundwater infiltration can be considerable leading to impacts on service during periods of high groundwater, typically during the winter.

Groundwater can enter the sewerage system through the pipes and manholes, this may occur at a defect (crack, hole, displaced joint) or on a normal joint on the sewer or in the manhole. A key point to note is that where infiltration occurs it is not necessarily an indicator that the sewer is in poor structural state simply that jointing techniques used are not completely watertight.

Ingress of groundwater is not limited to the public system that Thames Water owns and maintains but potentially the private drains, manholes and sewers that connect to our system.

Preventing and reducing the impact of groundwater infiltration is predominately achieved through the lining of sewers and sealing of manholes. This entails the application of a synthetic liner within the pipe that creates a contiguous membrane for the length of the pipe or possibly section if the source of ingress can be narrowed down.

For manholes it will typically entail sealing in a similar manner.

To line all sewers and manholes within most catchments would be prohibitively expensive to do so. Our approach to

date has been centered on a 'find and fix' basis which has involved monitoring and investigating the networks in periods of high groundwater to identify sources of ingress and fix as we find them. This approach is constrained for the reason that investigations are typically limited to periods of high groundwater and when high groundwater occurs there are

limited windows of time in which investigations can be successfully undertaken before flows either subside or the system is fully surcharged meaning CCTV surveys are not possible[2]. Once sections of sewers have been lined, it will be a case of waiting until high groundwater levels reoccur to assess the effectiveness of the work undertaken, which may not be the subsequent winter but several years later.

It is recognised that the find and fix approach to date lacks a degree of certainty of resolution and for this reason

Thames Water in 2020 undertook a different approach for long term management of groundwater, which is covered within this

[1] Sewers for Adoption makes an allowance for 10% of peak wastewater flow to allow for unaccounted flows such as groundwater infiltration.

[2] On occasions it is possible to over-pump between manholes to isolate sections of sewer to survey, this is not always feasible when the flows involved are simply too great to over-pump or the location prohibits this approach.

document under the plan section. These plans require significant investment which Thames Water will seek to secure through the price review process as service enhancement. In the meantime, we will continue to investigate sources of infiltration when it occurs and where feasible, undertake the work through our capital maintenance budgets. We refer to these as minor jobs' opportunities i.e. where we have high degree of certainty of reducing point sources of infiltration and can do so with reasonable costs and time.

The structure of this document has been created with input from the Environment Agency. Sections covered in this document include our 'Outline Plan' with timescales, Mitigation i.e. how we intend to manage the risk our plan is fully implemented and when we will publish future updates on progress against this plan.

Brief description of Basingstoke catchment

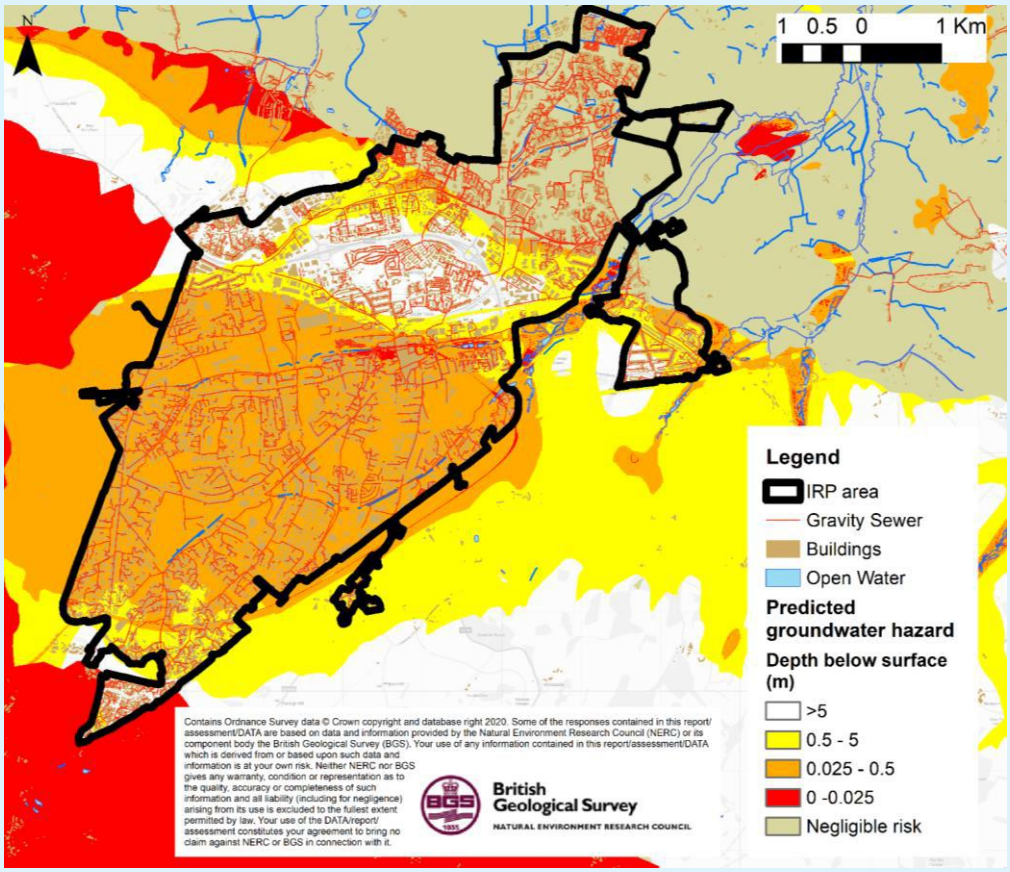


Figure 1.0 – Basingstoke catchment

Basingstoke is located in Hampshire, England, approximately 14 miles south-west of Reading at the source of the River Loddon. Basingstoke serves a population equivalent[3] of 137,003 with a predominantly separate sewerage network totaling some 808 km in length excluding private drains and sewers. The extent of the catchment is shown in Figure 1.0 above.

Problem characterisation

Groundwater has potential to enter our sewers when levels are high and a positive head above the soffit of the sewer is created. Significant groundwater ingress can impact sewer capacity and increase the risk of the sewer becoming overwhelmed.

On occasion, prolonged, heavy rainfall and raised groundwater levels have resulted in extensive groundwater flooding to properties and highways, and the overwhelming of the local drainage systems; including the public foul sewer network.

3 Population equivalent based on unit per capita loading (PE), in waste-water treatment is the number expressing the ratio of the sum of the pollution load produced during 24 hours by industrial facilities and services to the individual pollution load in household sewage produce one person in the same time.

The sewerage system is identified on the public sewer records as being a largely separate foul system, rather than a combined system. It should therefore, in theory, accept foul drainage rather than the combination of foul and surface water, however, there are a limited number of public surface water sewers in the area.

We believe that significant volumes of surface water runoff from surrounding saturated fields and built-up land have entered the foul sewerage network during recent wet winters, causing the network to become overloaded and surcharge (mainly through submerged manholes).

The surveys we have carried out have detected that there is some evidence of unwanted flows in the foul sewer network when groundwater levels are high, and surface water inundation from highways, public spaces and properties and fluvial flooding from local watercourses. Sur- face water misconnections (i.e. down pipes from roofs into the sewer network) are also suspected to be a contributing factor, hence further analysis is required to determine the extent to which this has contributed to sewer flooding.

A number of our sewage systems include for overflows; these structures are there to protect against sewer flooding as a result of rainfall or equipment failure where appropriate. Discharges from these structures should not be impacted by excessive infiltration as detailed by the EA Regulatory Position Statement on groundwater impacted sewerage systems. The use of storm sewage overflows is accepted by our regulators, subject to conditions.

Previous drainage strategies for Basingstoke have focused on the Buckskin subcatchment which is underlain by chalk and is prone to significant changes in groundwater levels. The root causes of sewer surcharges require all stakeholders responsible for drainage in the catchment to resolve them together. A groundwater management scheme has recently been installed in the area by Hampshire County Council to alleviate flooding issues through groundwater emergence and will aid in the management of groundwater infiltration into the foul system.

Groundwater impact in the Basingstoke system is localised and therefore does not have a significant impact on spills from the STW. Our permit conditions for Basingstoke STW state: *"The discharge shall only occur when and only for as long as the flow passed forward is equal to or greater than the overflow setting indicated due to rainfall and/or snow melt." and "Off-line storm storage must be fully utilised before a discharge occurs. It shall only fill when the flow passed forward is equal to or greater than the overflow setting indicated due to rainfall and/or snow melt and shall be emptied and its contents returned to the continuation flow as soon as reasonably practicable."*

The Flood and Water Management Act 2010 places a responsibility on Lead Local Flood Authorities (LLFAs), to manage flood risk from surface and groundwater, plus a duty on all Risk Management Authorities (RMAs), to cooperate regarding flood risk. In our role as an RMA, Thames Water will work with Basingstoke and Deane District Council as Lower Tier 1 and Hampshire County Council as the Higher Tier Council, Lead Local Flood Authority and Planning Authority, in addition to the

Environment Agency to ensure that a collaborative approach can be developed to address the problems.

Thames Water also has a statutory obligation to comply with environmental legislation. The Water Framework Directive establishes a strategic approach to managing the water environment, which the Environment Agency achieves through River Basin Management Plans and setting environmental objectives for groundwater and surface water. The environment is also protected from adverse effects of discharges of urban wastewater through the Urban Wastewater Treatment Directive, which requires us to improve and extend the sewerage system according to section 94 of the Water Industry Act (1991).

Anticipated unavoidable discharges

Within recent years there have been unavoidable sewerage escapes in the network as a result of surcharging manholes causing pollution. This has been as a direct result of the influence of unwanted flows including but not limited to groundwater infiltration. The Hampshire County Council Groundwater Management scheme in Buckskin will improve localised groundwater levels.

We will continue to monitor the effectiveness of this scheme and its impact on the groundwater entering the foul sewerage system.

General outline plan & timescale

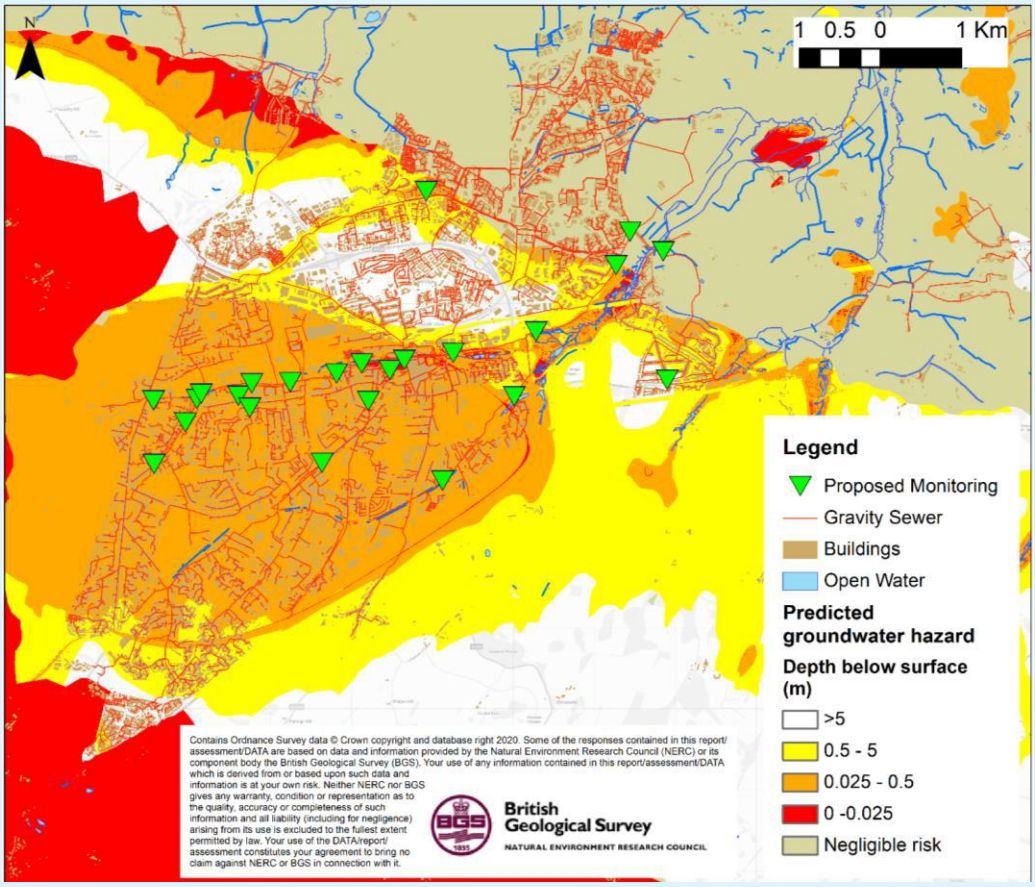


Figure 2.0 – Basingstoke monitoring plan area and infiltration zones

Key to bringing the impact of groundwater infiltration under control is an enhanced monitoring regime. We have identified zones and areas over which telemetered depth monitoring will be installed. Figure 2.0 presents a plan of currently proposed installation locations.

Complementing the flow [at the treatment works] and depth measurement [in the sewer network] we will use pumping station run time data, rainfall data, river level data, and groundwater level data to create a full picture of movement and source of flows around the catchment.

Zones of Groundwater Risk

We engaged with JBA Consulting to develop plans for Basingstoke that identify zones of groundwater risk, see Figure 2.0. These zones are modelled areas where the groundwater has been determined to be above the sewer and hence pose a potential risk for groundwater ingress.

The sewer depth monitors referred to earlier will be sited in and around these zones to verify and calibrate the risk in each of the zones.

If following the proposal to the sealing in part or wholly[4] of the high-risk zones, should it be required, the system is found to be still experiencing excessive infiltration we would then look to potentially seal 'private' laterals and/or drains along with starting to seal the medium to low risk zones.

This document sets out an unconstrained approach to resolving the impact of groundwater infiltration within the system.

Investment to address infiltration will be assessed and prioritised against other drivers e.g. STW upgrades, both in the catchment and across the region at each price review.

With this plan we remain committed to minimising the impact of groundwater on the sewerage system in Basingstoke.

Our general medium-to-long-term plan is therefore to apply a hierarchy to sealing the sewer as follows:

Model Zones	2020/21	JBA have been engaged to undertake modelling activities to identify the areas (zones) to be targeted for sealing in the 56 systems identified as being impacted by infiltration in the Thames Water region.
Install monitors	2021-2023	Monitor plans are being developed to help calibrate and validate the zones. Each year completeness / coverage monitors will be reviewed and added to / or modified as
Calibrate zones	Refined each year	Following each winter, we intend to review the data from the monitors and if necessary, redefine the zones.
Look & Lift	Each winter	The look & lift surveys have two purposes, firstly to complement the monitoring and secondly to identify 'quick fixes' that we would address through our normal capital maintenance.
CCTV	2020-2023	Required to confirm sewer condition and provide information to assist with costing any sewer lining.

[4] Decision of extent of sealing will be based on outcomes of works undertaken to date, result of monitoring and successful submission of our plans for investment.

Activity	When	Description
Minor works	2020-2023	As mentioned, if we detect minor works being required, we will look to resolve these as and when we find them.
PR24 / Price review	2023/24	Ideally through monitoring and on-going investigations work towards managing the infiltration risk, in AMP7, will be successful. However, in the absence of evidence justifying the need not undertake sealing of the high-risk zone this is to be included as part of PR24 investment plan. This work will be subject to Cost Benefit Analysis and Best Technical Knowledge Not Entailing Excessive Cost (BTKNEEC assessments).
High risk zone sealing	2025-30	Sealing of high-risk zone undertaken subject to need being demonstrated.

Basingstoke Infiltration Management Plan

As detailed above, the impact of infiltration is experienced in the network, mainly localised in the Buckskin area of Basingstoke.

Our approach to the resolution of infiltration impacting the Basingstoke sewerage system is outlined below.

High level approach statement

For Basingstoke our approach to tackling infiltration will be undertaken as follows:

1. We will investigate the network further with a view to identifying sources of ingress of infiltration that are cost effective[5] to address. To investigate the network, we have:

- Undertaken a desktop analysis to determine infiltration high to low-risk zones (October 2020);

To investigate the network, we will:

- Install monitoring to back up the analysis and to aid focusing of locations for identification of infiltration (2021 to 2023). Each year we will assess the completeness of monitoring and if required add to or modify the current locations.

- Undertake sample CCTV in the high to low-risk zones to assess the general asset health of the sewers and manholes (ongoing).

We will also review results of Winter 2019/20 and 2020/21 with historic data to build up evidence to support interventions in the network (Autumn 2021).

2. Where interventions can be undertaken as part of normal sewer maintenance activities these will be communicated and progressed.

3. If significant investment is identified as being required, then this will need to be considered in terms of relative need compared to other systems being investigated for infiltration reduction. However, where viable opportunities are identified these will be included in our AMP9 (2030-35) programme of investment. Significant investment needs may need to be included in our future investment cycles.

[5] Assessment of cost effectiveness is based on assessment of the ratio of the cost of a solution to the monetised benefit gained from implementing the solution i.e. reduction in flood/pollution risk and/or reduced operating costs.

Investigations

As mentioned above JBA Consulting have been supporting by undertaking an exercise involving assessing groundwater elevation data to determine which areas of the network are potentially below the groundwater table during high groundwater periods.

Site investigations, undertaken by Dene-Tech and our Customer Field Services (Thames Water Operations) will include 'look & lift' surveys, CCTV and where necessary dye tracing to confirm connectivity.

A table of the work undertaken is included in the appendix to this report.

Monitoring

Sewer Depth Monitors will be installed in the catchment in between 2021 and 2023. These devices are telemetered and provide real time data on the level of flow in the sewer.

The purpose of these units is to act as alerts for high groundwater impact in the sewer, calibration of the zones of infiltration risk and to demonstrate benefit gained from work undertaken to reduce infiltration. They will also provide
evidence in the future of further need to manage the impact of infiltration.

Mitigation

On occasions to avoid flooding of properties or to manage the risk of damage to the environment we may undertake tankering from (manholes) points on the network, make use of pumps to manage flows or deploy settlement tanks to part treat sewage before release to the environment.

With regard to Basingstoke, we do not envisage needing to undertake mitigation work beyond tankering within the network.

Updates

Work on the Groundwater infiltration management plan will continue, and we will aim to provide updates annually by the end of October each year.

Appendix

Groundwater infiltration potential analysis

The sewer network is classified by the groundwater infiltration risk zones. The lengths of sewers within these zones are presented in the table below.

Risk category	Description	Length (km)	Percentage
High	Predicted groundwater extreme >1m above pipe invert	158.56	47.6
Medium	Predicted groundwater extreme 0-1m above pipe invert	28.82	8.7
Low	Predicted groundwater extreme 0-1m below pipe invert	25.99	7.8
Very Low	Predicted groundwater extreme >1m below pipe invert	119.73	35.9
Total		333.10[6]	100

In addition, the table below presents the surface water flood risk classification for manholes within the catchment.

Manholes by Surface Water Inundation Risk Category

Risk category	Description	Number	Percentage
High	Inundation risk in 3.3% AEP fluvial or pluvial event	737	6.3
Medium	Inundation risk in 1% AEP fluvial or pluvial event	841	7.1
Low	Inundation risk in 0.1% AEP fluvial or pluvial event	1888	16.0
Very Low	All other manholes	8322	70.6
Total		11788	100

[6] Total of sewer length is for length of mapped sewers only and will not include unmapped S105a transferred sewers in all cases.

Investigations & remedial work undertaken since 2019/20 and future plans

Lift and Look and CCTV surveys have not yet commenced in the Basingstoke system. A summary of findings will be provided in the next update of this report.

Glossary of terms

AEP – Annual Exceedance Potential

AMP – Asset Management Plan

CCTV – Closed Circuit Television

EA - Environment Agency

IRP – Infiltration Reduction Plans

MH – Manhole

STW – Sewage Treatment Works

WINEP – Water Industry National Environment Programme

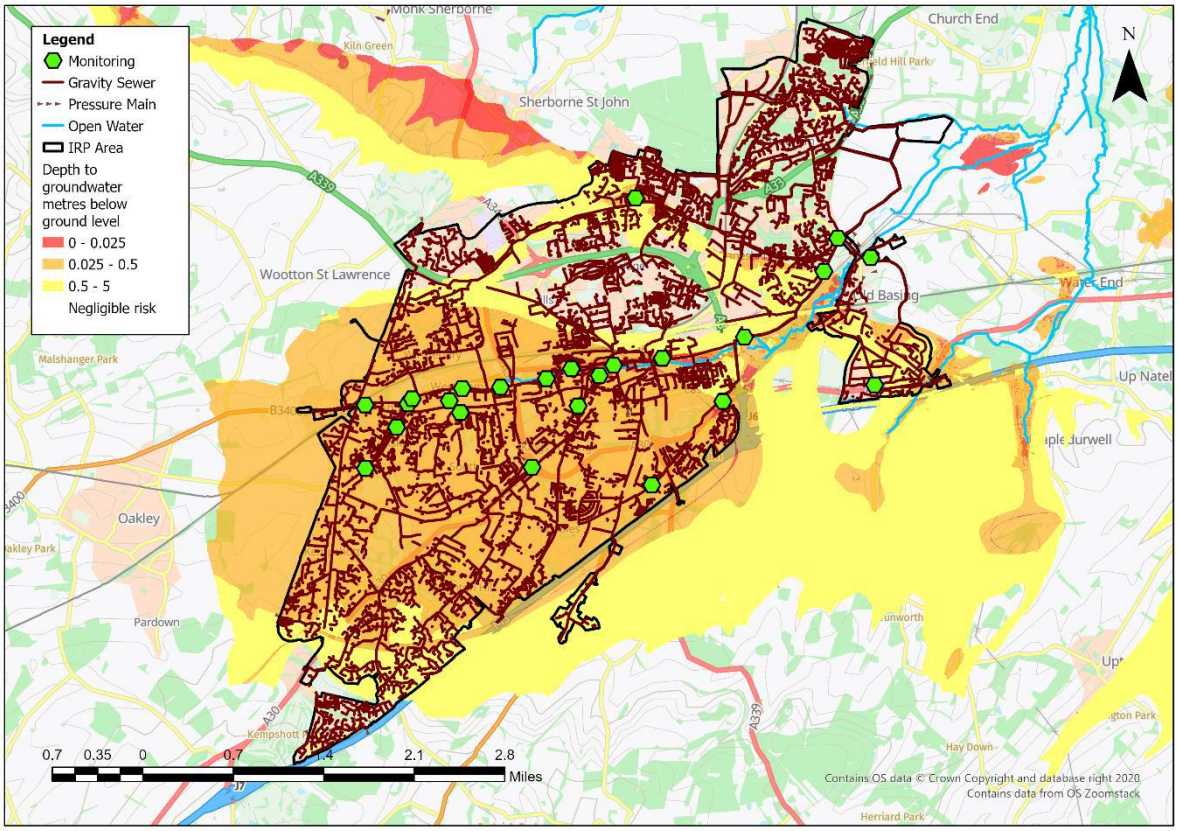
Addendum – Annual Update 2022 Table of contents

Overview

This addendum to the Basingstoke Groundwater Impacted System Management Plan 2021 (GISMP) provides an update on performance/work undertaken in the Hydrological Year October 2021 to September 2022. The key points covered include:

- Hydrological conditions
- How the sewerage system has performed over this period
- Mitigation / remedial measures progressed over the last year and being planned
- Summary and plan for 2022/23

Figure 1 – Basingstoke monitoring plan



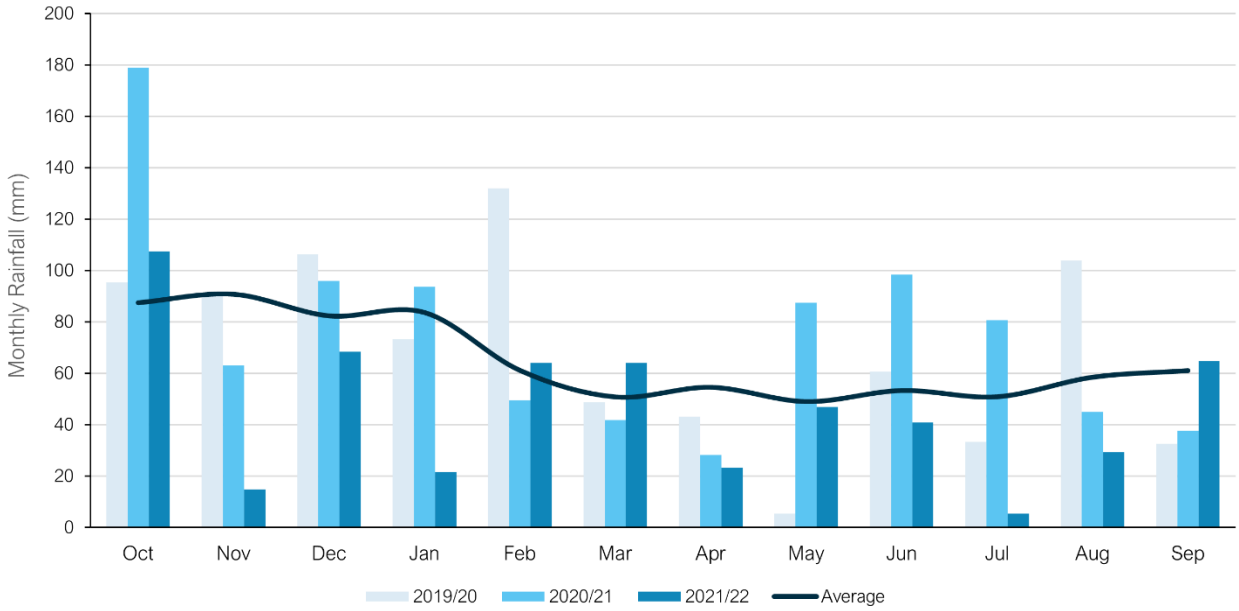
Hydrological Review – 2021-2022

This section summaries the hydrological conditions within the Basingstoke catchment within the period under investigation and provides comparison against previous year's performance to put the annual performance into context. The hydrological review has been undertaken based on the Hydrological Year, which runs from October 1st to September 30th.

Catchment Rainfall

Representative Radar rainfall has been used to generate monthly data at catchment level for comparison with average data generated by local Met Office Weather Station Records. Figure 2 presents the comparison of this data for the last three hydrological years to support longer term trends within the local system.

Figure 2 – Monthly Rainfall Performance



Average Values taken from Met Office Weather Station at Odiham based on the period 1991-2020

The total rainfall for the 2021/22 hydrological year is 29% below the annual average total. Total rainfall values are presented in Table 3 below.

Table 3 –Total Rainfall Based on Hydrological Year

Average (mm)	2019/20 (mm)	2020/21 (mm)	2021/22 (mm)
783	825	900	556

Groundwater / Local River Level

The Basingstoke catchment is situated in the North Downs - Hampshire water resources area as well as in the Loddon water resources area. It primarily sits in the Seaford Chalk Formation, generally comprising carbonate material forming distinctive beds of chalk. A smaller part of the catchment sits in the London Clay Formation, comprising course to fine grained slurries of debris. The Seaford Chalk formation is a designated principal aquifer within the UK.

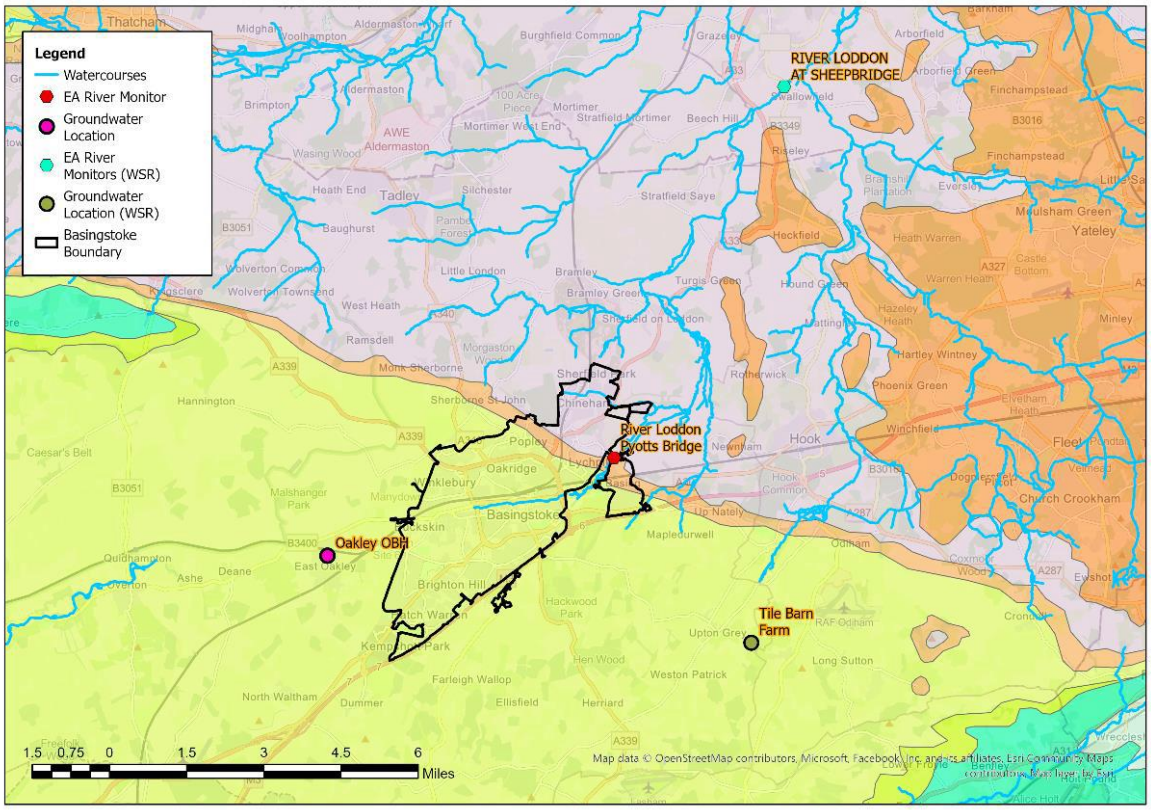
The Environment Agency has gauging stations on local watercourses measuring stages and observation boreholes measuring groundwater levels locally to the catchment which can be used to provide indicative local groundwater performance.

From previous investigations we have identified the following sites are good indicators of groundwater levels within the catchment.

- River Loddon, Pyotts Bridge
- Oakley OBH

These sites are illustrated in Figure 4 below, alongside the closest groundwater reference station and closest gauging station from the Water Situation Report.

Figure 4 – Local Monitoring Stations



The following figures represent the last three hydrological years of level information at the indicator site to build a picture of the relative conditions prevalent in the current year. It is presented against both the daily total rainfall values for the catchment and a rolling 15-day total
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Figure 5A – River Loddon at Pyotts Bridge

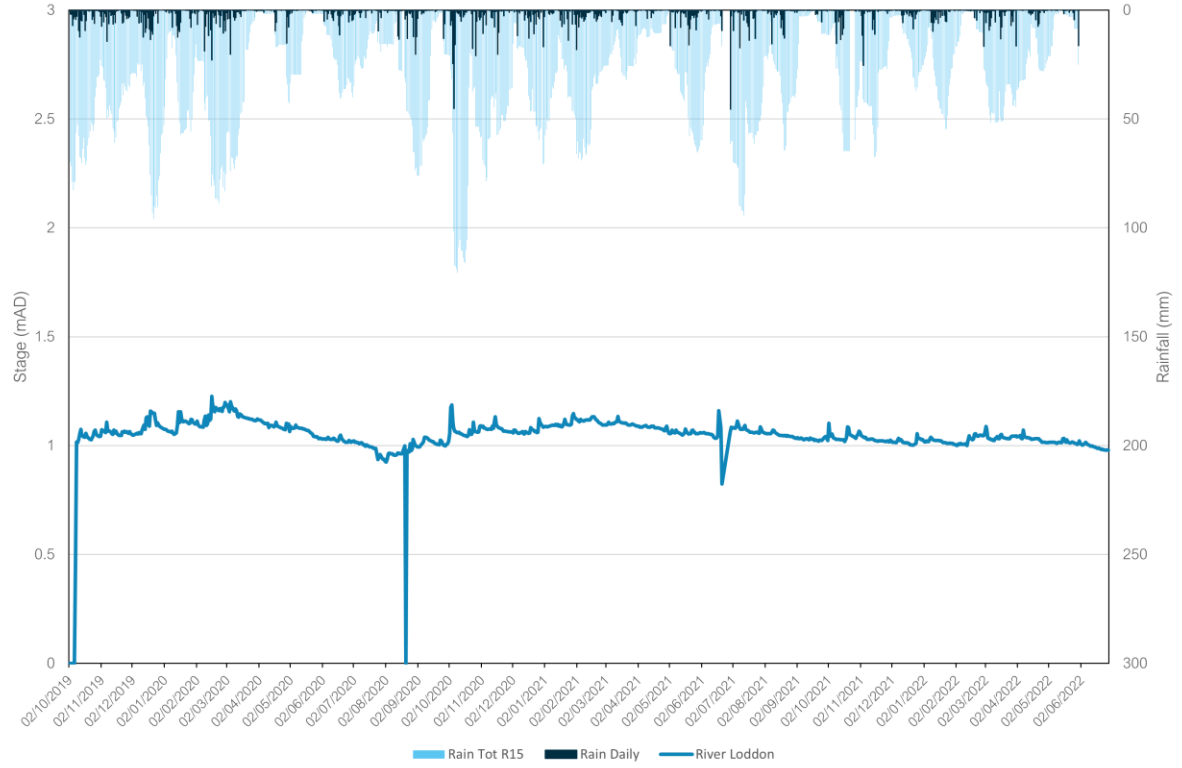
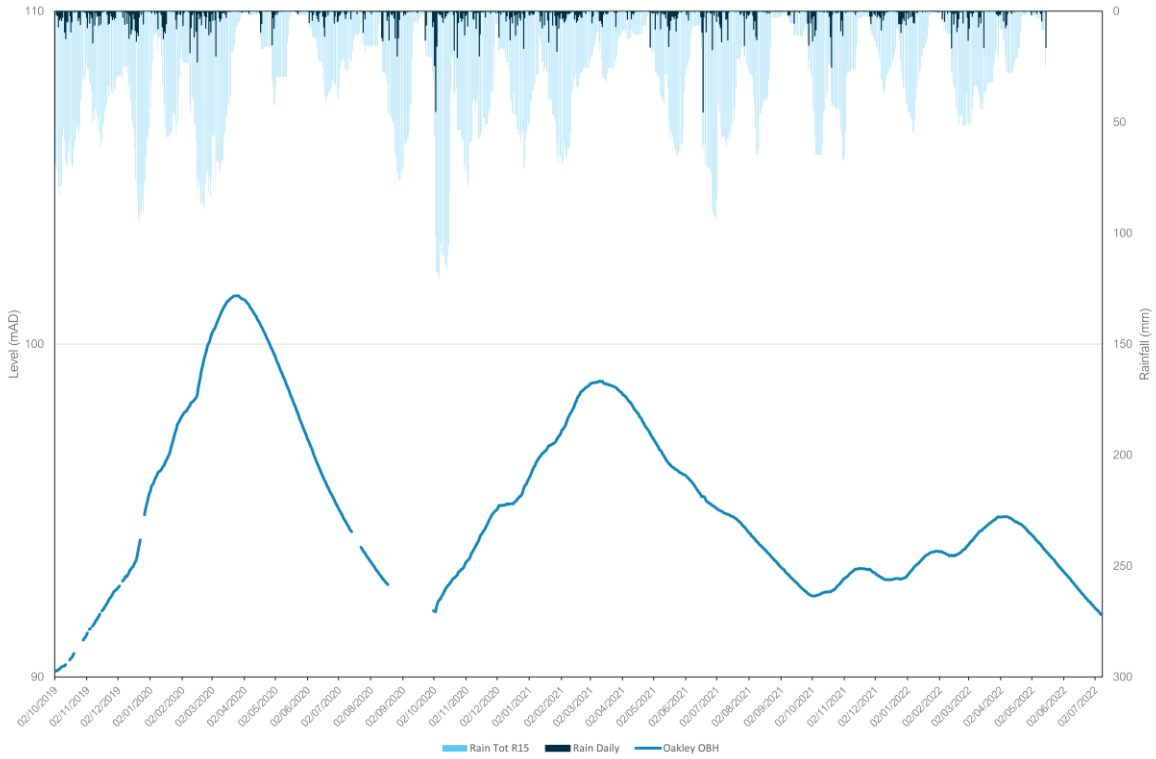
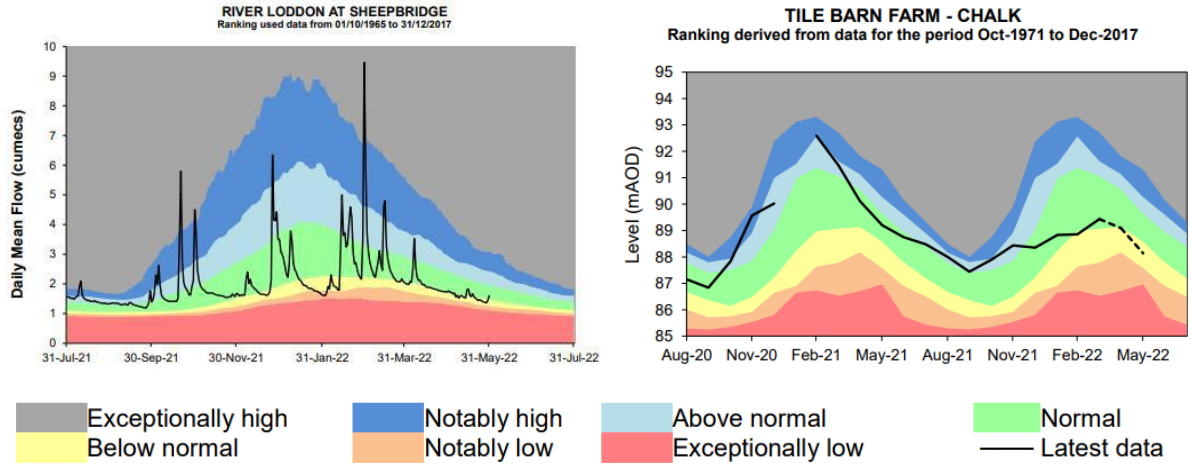


Figure 5B – Oakley OBH



In addition to these specific stations, the wider groundwater context is illustrated in the Water Situation Report for the North Downs - Hampshire water resources area. The closest groundwater reference station is Tile Barn Farm. This site shows significantly lower overall groundwater than the previous year. This can be seen in the figure below alongside the river indicator location at Sheepbridge on the River Loddon. Note recent groundwater levels at Tile Barn Farm have been estimated based on nearby boreholes due to site issues.

Figure 6 – Water Situation Report



Extract from - [Water Situation Report (publishing.service.gov.uk)]

Network Performance

Within the Basingstoke catchment there is one site detailed within the Environment Agency Consents Database which has an Event Duration Monitor (EDM) fitted.

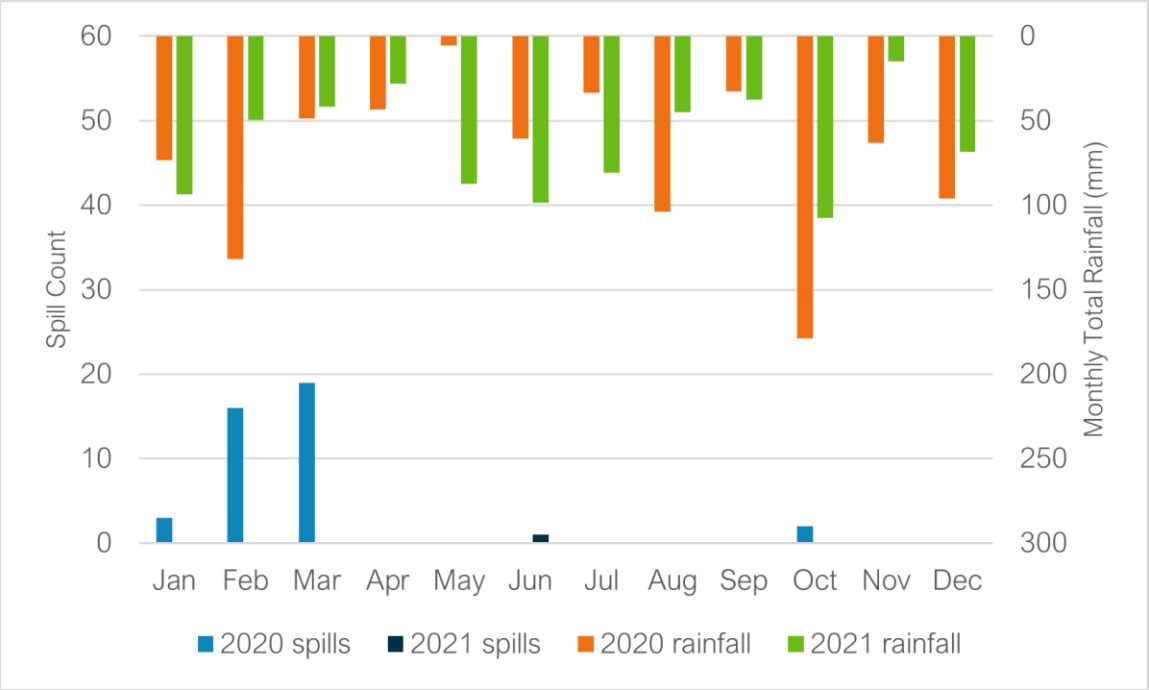
Table 7 below details the last 2 years performance of overflows within the catchment.

Table 7 – Event Duration Monitoring

Overflow	2020		2021	
	Spills	Duration (hours)	Spills	Duration (hours)
Basingstoke STW	40	410.85	1	8.15

A critical part of the assessment of EDM performance and its relation to groundwater inundation is to review the month-on-month spill performance, against previous years and the monthly total rainfall values to give context to the performance. Figure 8 below presents the EDM performance trend and rainfall for recent years.

Figure 8 – EDM Monthly Performance



Only one spill was recorded at Basingstoke STW in 2021. As the majority of the 2020 spills were recorded February – March 2020, coinciding with a period of elevated groundwater levels in comparison to those recorded in 2021, this is indicative of a wider relationship between increased winter rainfall, elevated groundwater levels, and increased spill frequency. Note however, there were also significant operational issues at Basingstoke STW in 2020 (failure of storm return pumps), which may have also led to more spills compared to in 2021.

Investigations & Interventions

This section details the activities that have been undertaken within the catchment within the Hydrological Year 2021-22.

Monitor Installations

The Sewer Depth Monitor (SDM) programme supports long-term groundwater understanding within GISMP catchments. Currently, there are a total of 16 monitors installed within the Basingstoke catchment. There are a further 8 monitor installs planned.

The data from these will be cross-referenced with other long-term records (where available) within the catchment.

Remediation Works Undertaken this Hydrological Year

Table 9 below provides a summary of the investigations and remediation works undertaken or planned within the Basingstoke catchment in the 2021-22 Hydrological Year.

Table 9 – Works Undertaken in the 2021/22 Hydrological Year

Investigation/ remediation type	Number/ length undertaken
CCTV survey	N/A
Look and lift survey	N/A
Sewer lining	N/A
Patch lining	N/A
Manhole sealing	N/A

With the seasonal trends in groundwater being low in comparison with previous years and the SDM installations ongoing, the larger scale survey, identification and remediation of the sewerage network has not been possible within the 2021/22 hydrological year.

Summary

Rainfall in the Basingstoke catchment over the 2021/22 hydrological year has been below average, with winter levels in the aquifer beneath Basingstoke not reaching the levels seen in previous years which triggered groundwater ingress into the sewerage network.

Our operational teams have worked with local stakeholders to improve overland drainage in the area which may be contributing to inundation into the foul system through manholes.

Lift and look and CCTV surveys will continue throughout the remaining wet winter periods with the aim of finding further priority locations for remediation and investigating/justifying the need for future larger scale lining as part of our Price Review (PR) process if required.

Addendum - Annual Update 2023

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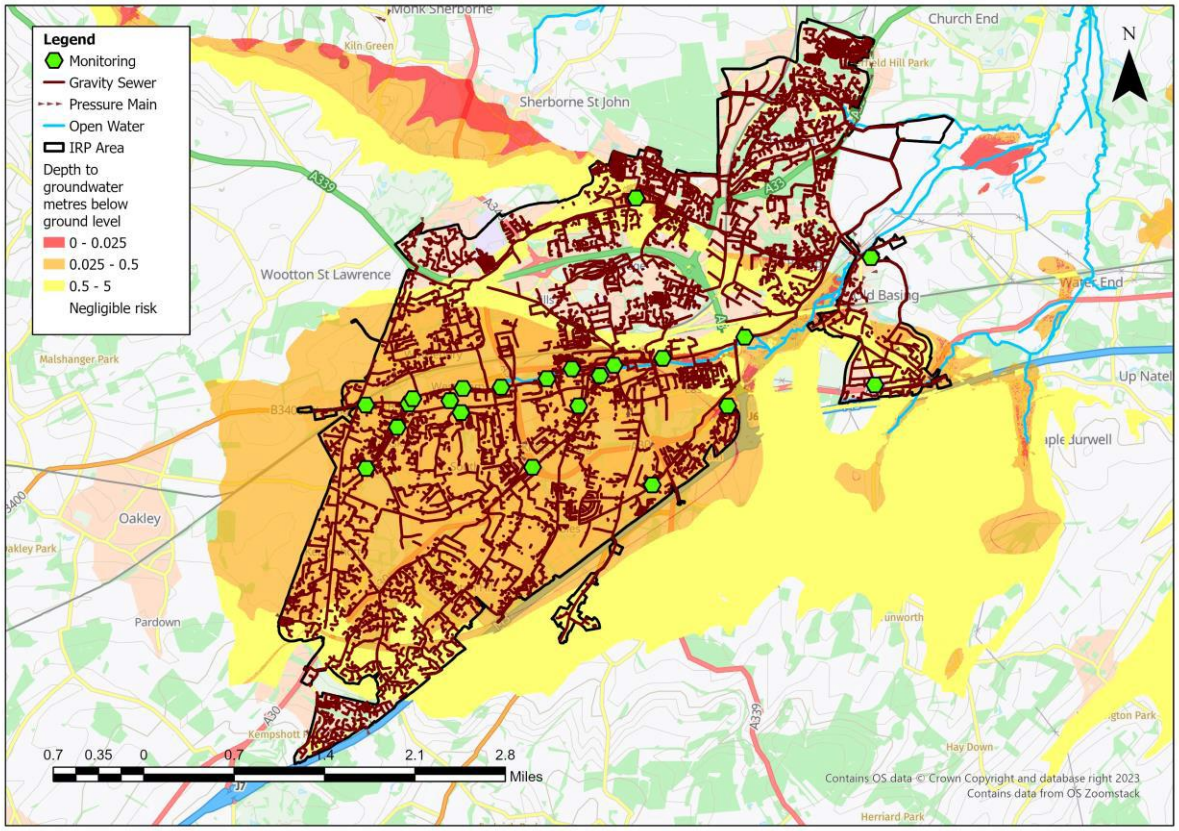

Hydrological Review – 2022-2023

This section summaries the hydrological conditions across the Basingstoke catchment within the period under investigation and provides comparison against previous year's performance to put the annual performance into context. The hydrological review has been undertaken based on the Hydrological Year, which runs October 1st to September 30th.

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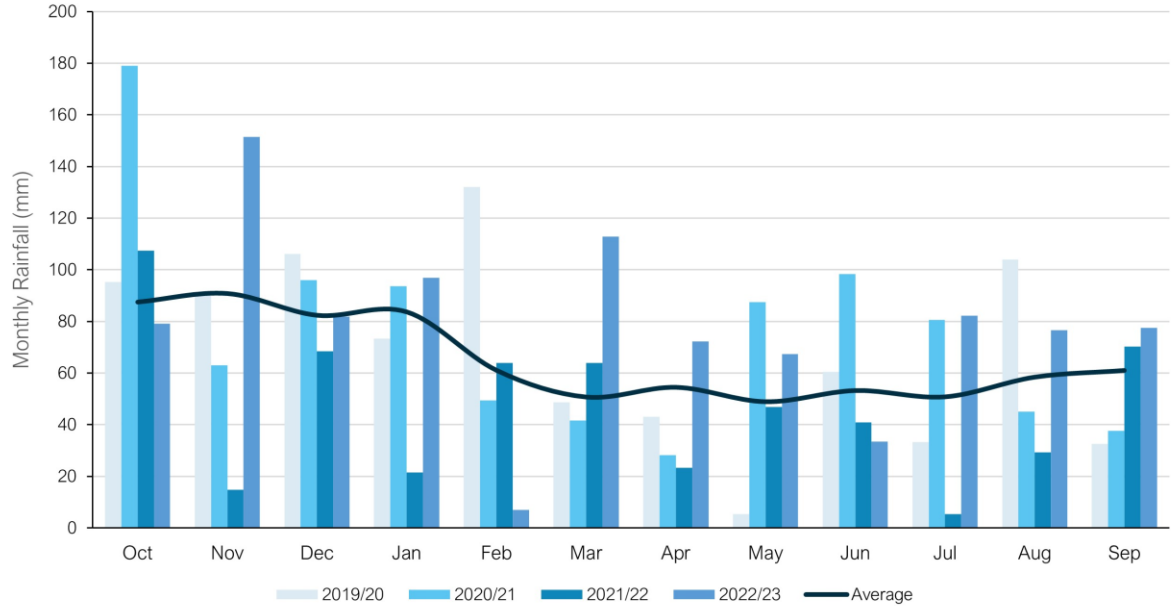

Average Values taken from Met Office Weather Station at Odiham based on the period 1991-2020

The total rainfall for the 2022/23 hydrological year is 20% above the annual average total. Total rainfall values are presented in Table 3 below.

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From previous investigations, we have identified the following sites as good indicators of groundwater levels within the catchment.

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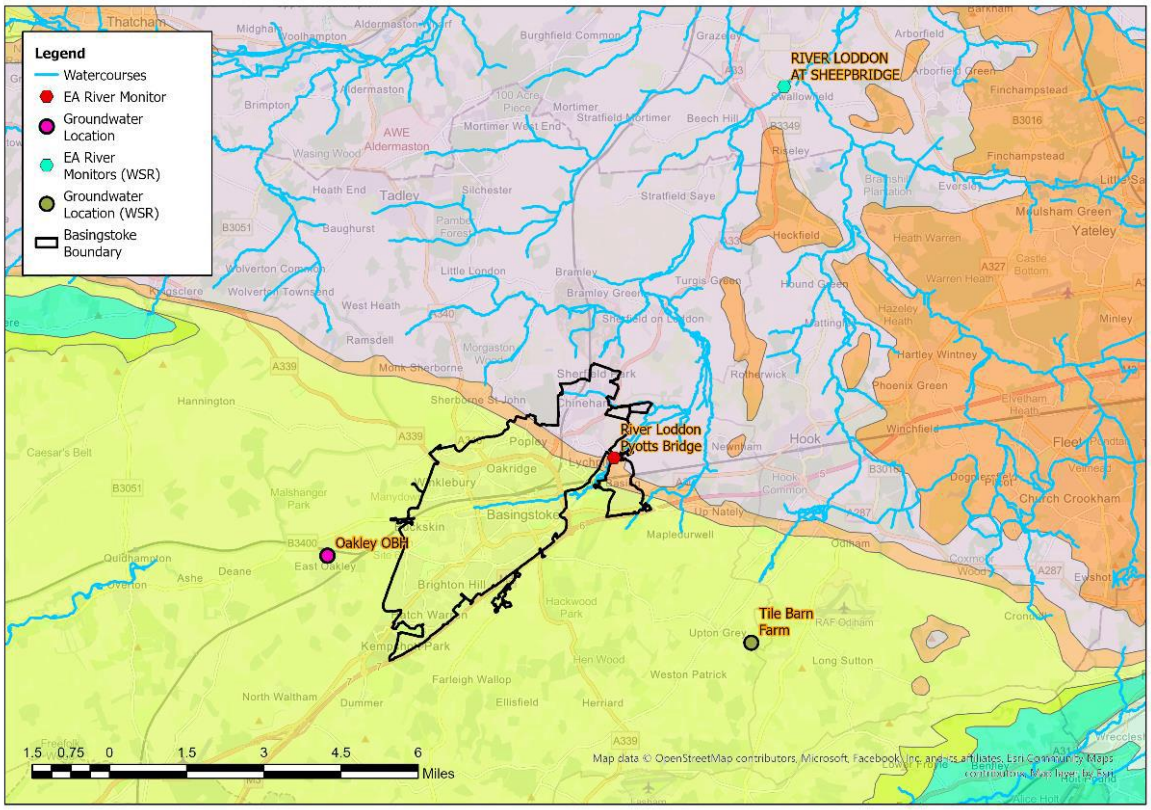

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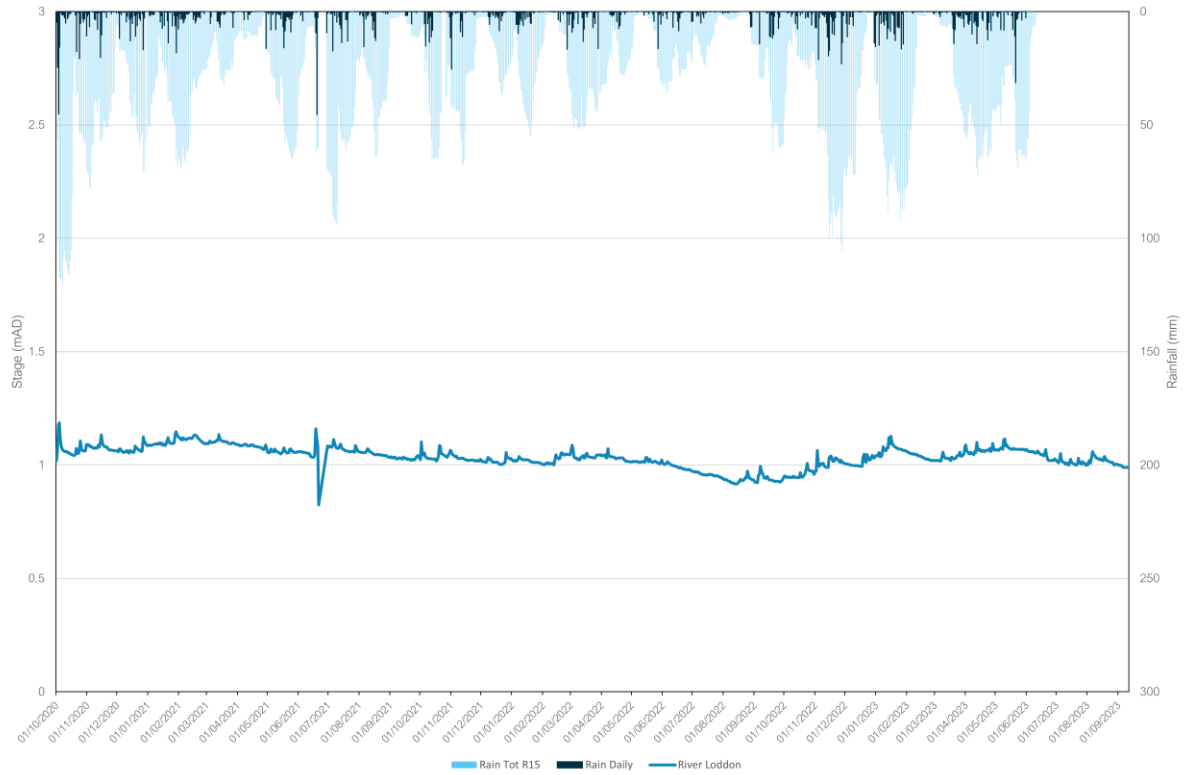
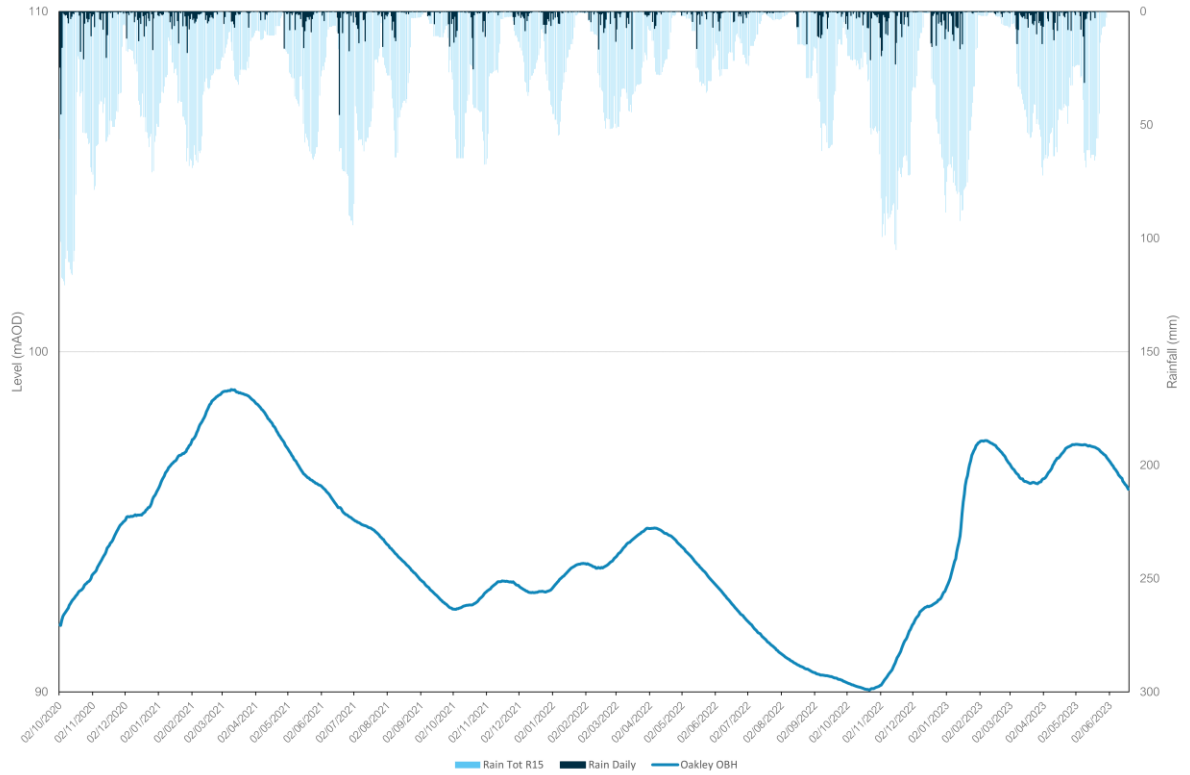
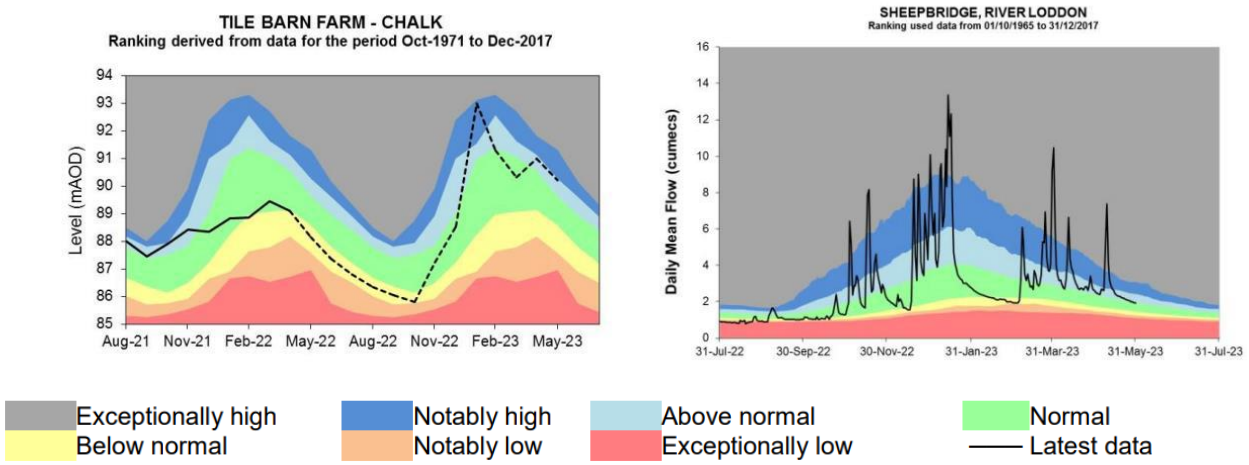


Figure 5B – Oakley OBH



In addition to these specific stations, the wider groundwater context is illustrated in the Water Situation Report for the North Downs - Hampshire water resources area. The closest groundwater reference station is Tile Barn Farm. This site shows groundwater levels to be at normal or below normal levels for the majority of 2022, before rising towards the end of the year, to reach above normal and notably high levels in 2023. This can be seen in the figure below alongside the river indicator location at Sheepbridge on the River Loddon. Note recent groundwater levels at Tile Barn Farm have been estimated based on nearby boreholes due to
site issues.

Figure 6 – Water Situation Report



Extract from - [Water Situation Report (publishing.service.gov.uk)]

Network Performance

Within the Basingstoke catchment there is one site detailed within the Environment Agency Consents Database which has an Event Duration Monitor (EDM) fitted.

Table 7 below details the last 2 years performance of overflows within the catchment.

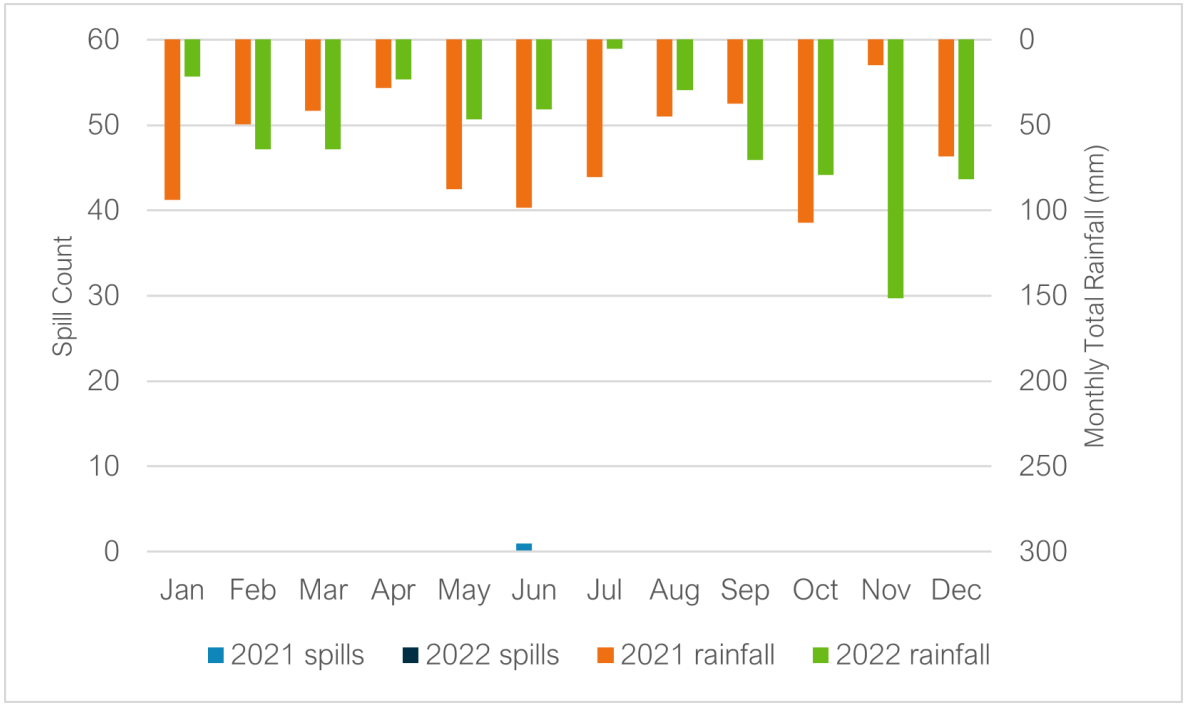
Table 7 – Event Duration Monitoring

Overflow	2021		2022	
	Spills	Duration (hours)	Spills	Duration (hours)
Basingstoke STW	1	8.15	0	0

A critical part of the assessment of EDM performance and its relation to groundwater infiltration, is to review the month-on-month spill performance against previous years and the monthly total rainfall values to give context to the performance.

Figure 8 below presents the EDM performance trend and rainfall for recent years.

Figure 8 – EDM Monthly Performance



A trend in spill performance at Basingstoke STW cannot be established based on the above data, as only one spill was recorded at the site in 2021, and no spills were recorded in 2022. Please refer to the Groundwater Impacted System Management Plan for 2021/22, included in this PDF document, for discussion regarding trends evident in the EDM data for 2020, indicative of the role of groundwater infiltration on spills in the catchment.

Investigations & Interventions

This section details the activities that have been undertaken across the catchment within the Hydrological Year 2022-23.

Monitor Installations

The Sewer Depth Monitor (SDM) program supports long term groundwater understanding within GISMP catchments. Currently, there are a total of 22 monitors installed within the Basingstoke catchment. There are currently no further monitor installs planned.

The data from these will be cross-referenced with other long-term records (where available) within the catchment.

Remediation Works Undertaken this Hydrological Year

Table 9 below provides a summary of the investigations and remediation works undertaken or planned within the Basingstoke catchment in the 2022-23 Hydrological Year, as well as works undertaken in the 2021-22 Hydrological Year.

Table 9 – Works Undertaken in the 2022/23 Hydrological Year & in the 2021/22 Hydrological Year

Investigation/ remediation type	Number/ length undertaken 21/22	Number/ length undertaken 22/23
CCTV survey	N/A	N/A
Look and lift survey	N/A	N/A
Sewer lining	N/A	N/A
Patch lining	N/A	N/A
Manhole sealing	N/A	N/A

No interventions/ investigations were carried out in the catchment in the 2022/23 Hydrological Year. A level of 102.50 mAOD at the Oakley OBH indicator site, has been assigned as the 'Amber' threshold level for groundwater infiltration into the network, indicating that limited infiltration occurred in the network over the winter 2022/23 period, as levels remained below this threshold. The system will continue to be monitored, and investigations/ interventions carried out as appropriate and when conditions allow.

An upgrade is planned for Basingstoke STW. This will improve its ability to treat the volumes of incoming sewage, reducing the need for untreated discharges to the environment. The scheme, currently in design, is due to be completed in 2028.

Summary

For this hydrological year (October 2022 – September 2023), indicator site data suggests groundwater levels in the Basingstoke catchment have generally been higher than the previous hydrological year, and EDM data for 2023 will be analysed once available to continue to examine and understand the relationship between groundwater levels and overflow spills in the catchment.

Our operational teams have worked with local stakeholders to improve overland drainage in the area which may be contributing to infiltration into the foul system through manholes.

Lift and look and CCTV surveys will be undertaken in remaining wet winter periods if conditions are allowed. The aim of this is to find further priority locations for remediation and investigating/ justifying the need for future larger scale lining as part of our Price Review (PR) process if required.

Addendum - Annual Update 2024

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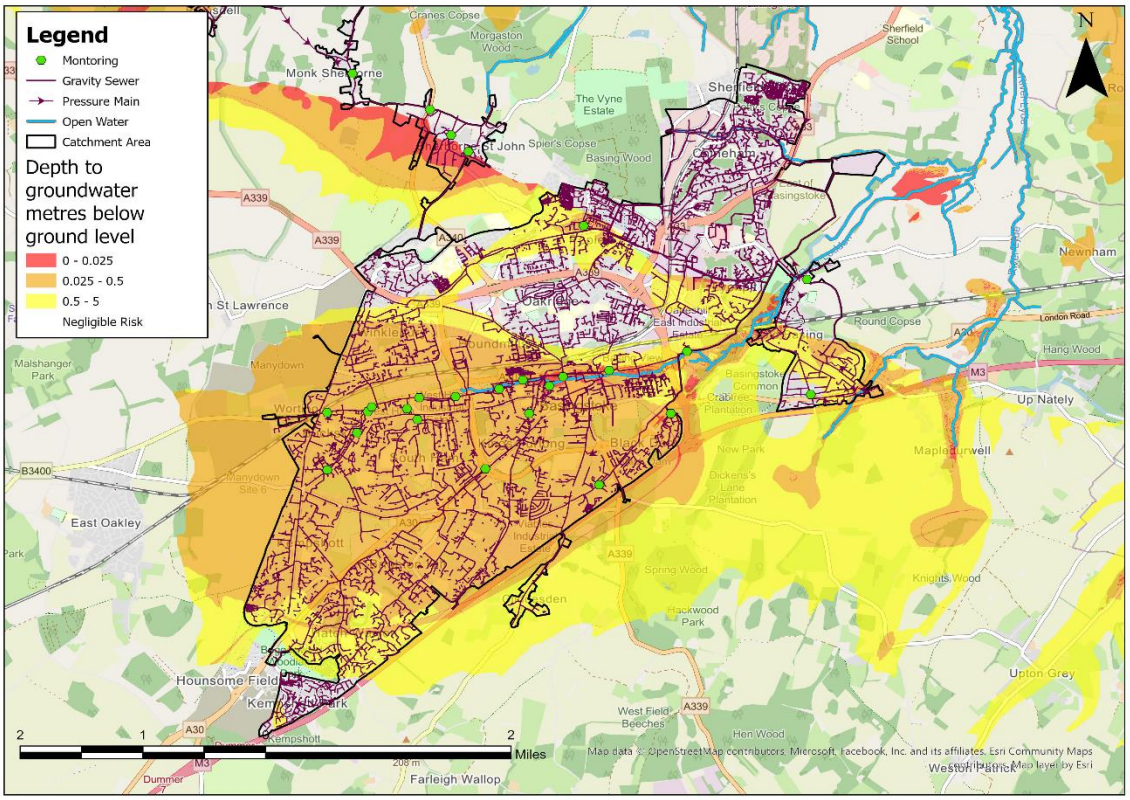
Overview

This addendum to the Basingstoke Groundwater Impacted System Management Plan 2021 (GISMP) provides an update on work undertaken in the Hydrological Year October 2023 to September 2024. The key points covered include:

- Hydrological conditions
- Performance of the sewerage system
- Mitigation / remedial measures progressed over the last year and those being planned
- Summary and plan for 2024/25

Figure 1 – Basingstoke monitoring plan



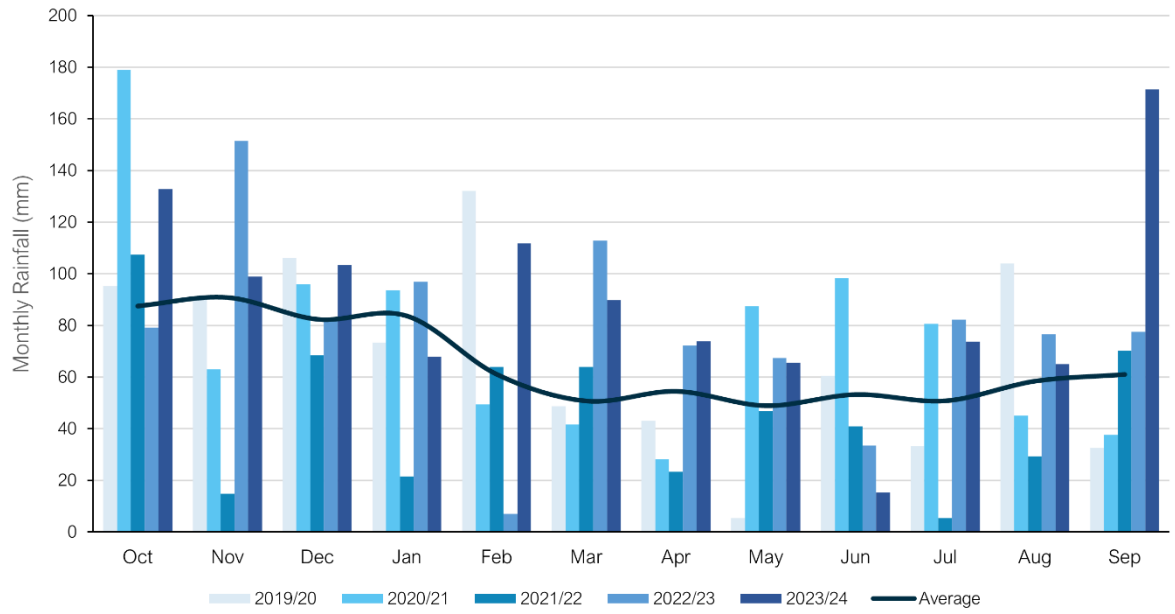
Hydrological Review – 2023-2024

This section summaries the hydrological conditions across the Basingstoke catchment within the period under investigation and provides comparison against previous year's performance to put the annual performance into context. The hydrological review has been undertaken based on the Hydrological Year which runs October 1st to September 30th.

Catchment Rainfall

Representative Radar rainfall has been used to generate monthly data at catchment level for comparison with average data generated by local Met Office Weather Station Records. Figure 2 presents the comparison of this data for the last five hydrological years to support longer term trends within the local system.

Figure 2 – Monthly Rainfall Data



Average Values taken from Met Office Weather Station at Odiham based on the period 1991-2020

The total rainfall for the 2023/24 hydrological year is 37% above the annual average total. Total rainfall values are presented in Table 3 below.

Table 3 –Total Rainfall Based on Hydrological Year

Average (mm)	2019/20 (mm)	2020/21 (mm)	2021/22 (mm)	2022/23 (mm)	2023/24 (mm)
783	825	900	556	939	1069

Groundwater / Local River Level

The Basingstoke catchment is situated in the North Downs - Hampshire water resources area as well as in the Loddon water resources area. It primarily sits in the Seaford Chalk Formation, generally comprising carbonate material forming distinctive beds of chalk. A smaller part of the catchment sits in the London Clay Formation, comprising course to fine grained slurries of debris. The Seaford Chalk formation is a designated principal aquifer within the UK.

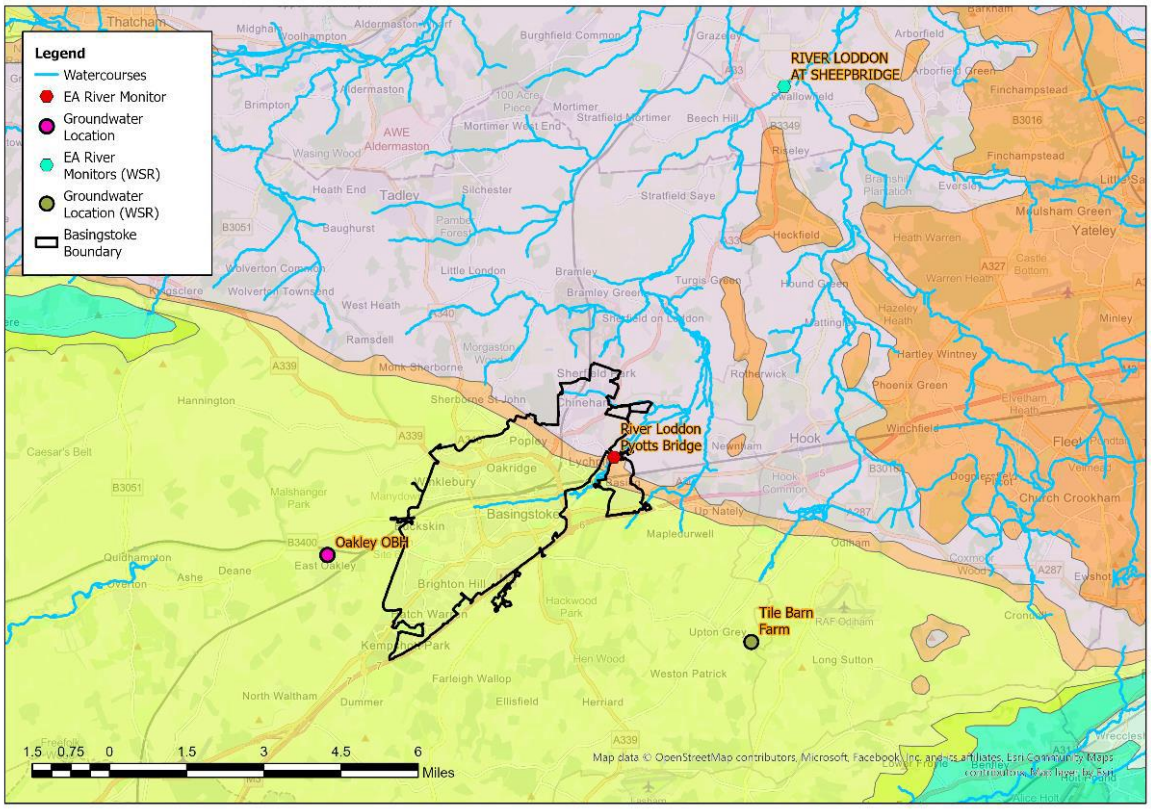
The Environment Agency has gauging stations on local watercourses measuring stage, and observation boreholes (OBH) measuring groundwater levels locally to the catchment. These can be used to provide indicative local groundwater performance.

From previous investigations, we have identified the following sites as good indicators of groundwater levels within the catchment.

- River Loddon, Pyotts Bridge
- Oakley OBH

These sites are illustrated in Figure 4, alongside the closest groundwater reference station and closest gauging station from the Water Situation Report.

Figure 4 – Local Monitoring Stations



Figures 5A – 5B represent the last three hydrological years of level information at the indicator sites to build a picture of the relative conditions prevalent in the current year. It is presented against both the daily total rainfall values for the catchment and a rolling 15-day total rainfall. Note that level data for Oakley OBH is not available post February 2024.

Figure 5A – River Loddon at Pyotts Bridge

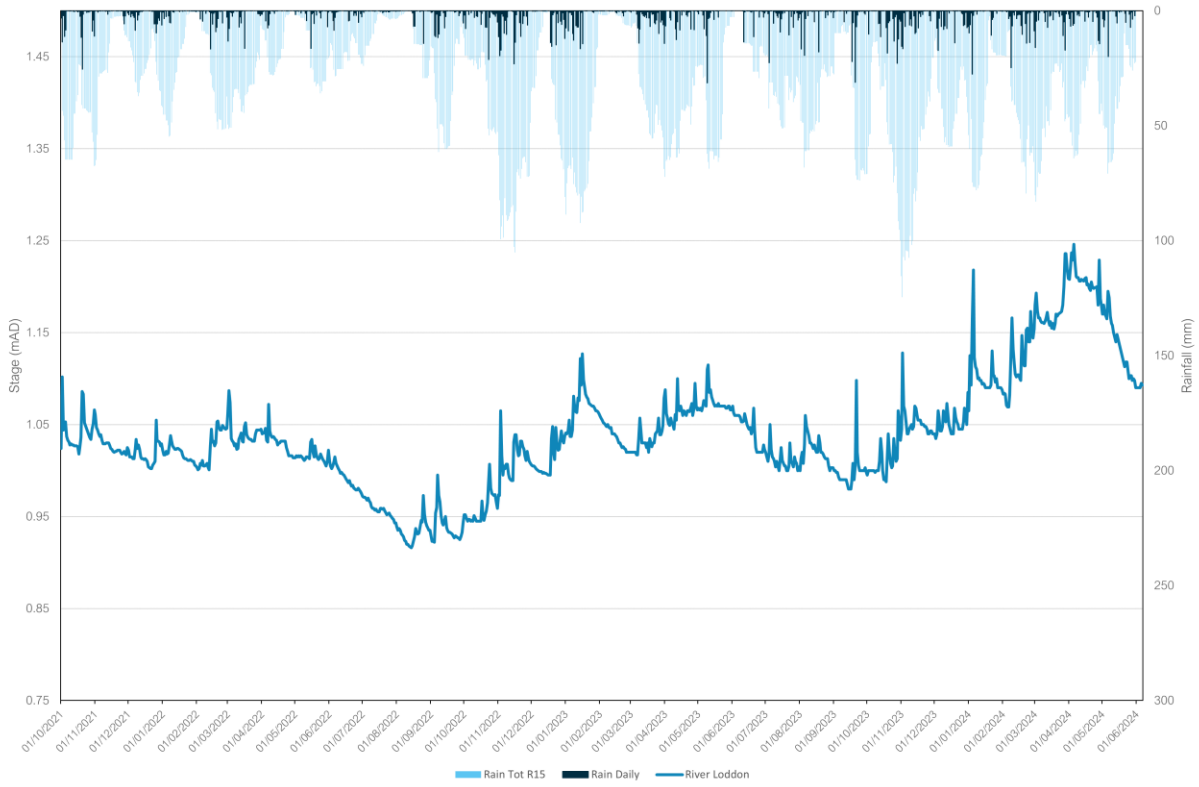
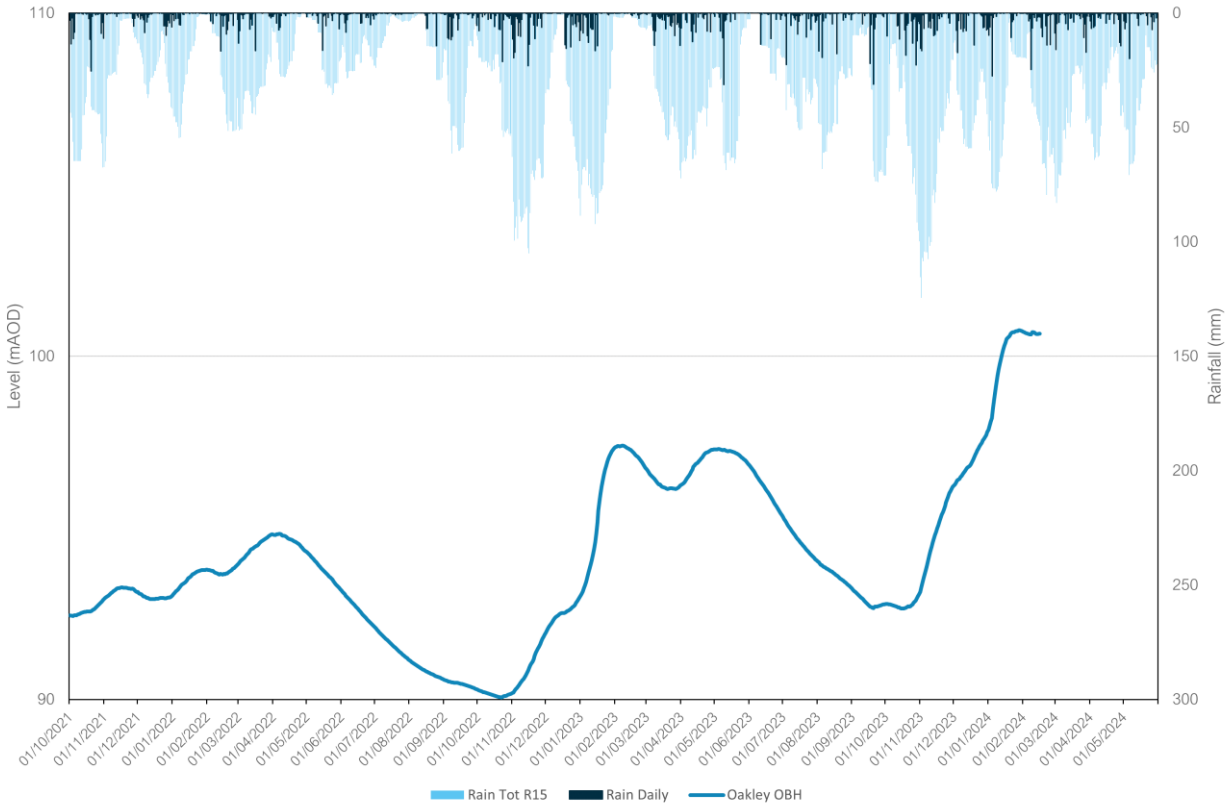
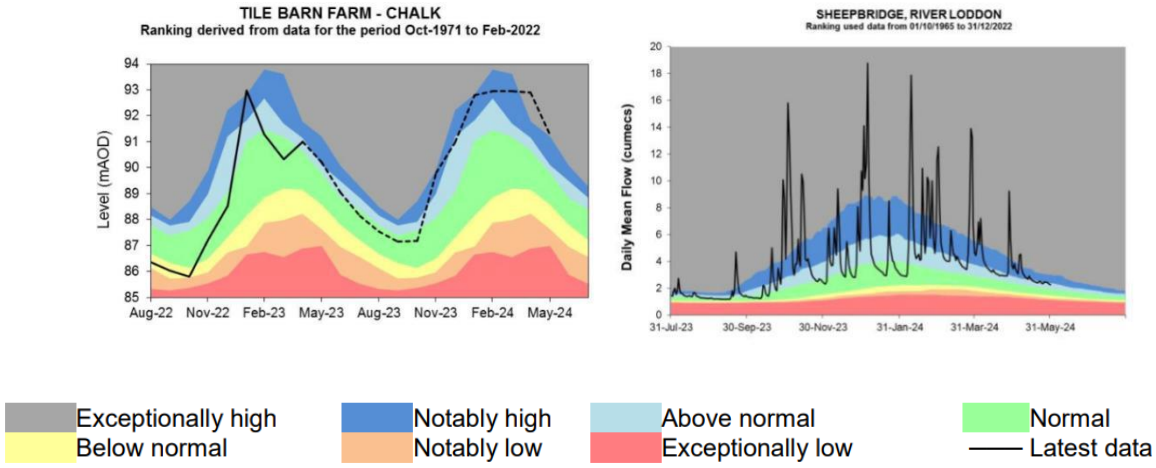


Figure 5B – Oakley OBH



In addition to these specific stations, the wider groundwater context is illustrated in the Water Situation Report for the North Downs - Hampshire water resources area. The closest groundwater reference station is Tile Barn Farm. This site shows groundwater levels in 2024 were at notably high levels for a more prolonged period than in 2023. This can be seen in Figure 6 alongside the river indicator location at Sheepbridge on the River Loddon. Note that recent groundwater levels at Tile Barn Farm have been estimated based on nearby boreholes due to site issues.

Figure 6 – Water Situation Report



Extract from - [Water Situation Report (publishing.service.gov.uk)]

Network Performance

Within the Basingstoke catchment there is one site detailed within the Environment Agency Consents Database which has an Event Duration Monitor (EDM) fitted.

Table 7 below details the last 2 years performance of overflows within the catchment.

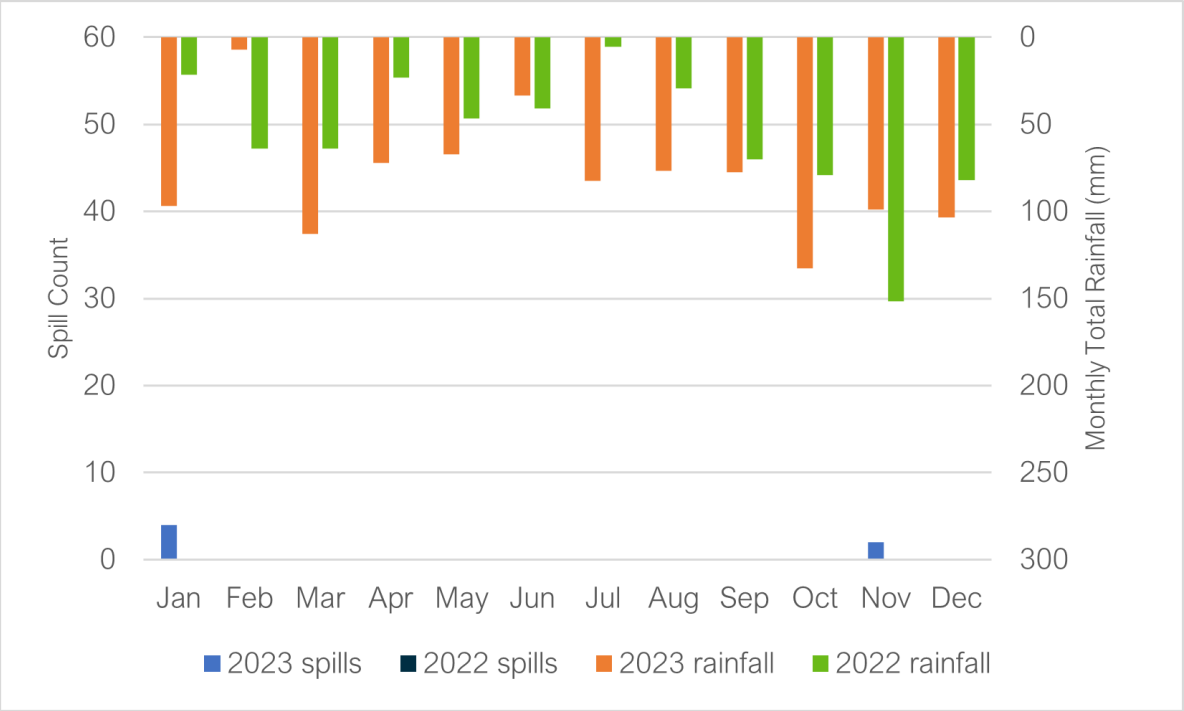
Table 7 – Event Duration Monitoring

Overflow	2022		2023	
	Spills	Duration (hours)	Spills	Duration (hours)
Basingstoke STW	0	0	6	46

A critical part of the assessment of EDM performance and its relation to groundwater infiltration, is to review the month-on-month spill performance against previous years and the monthly total rainfall values to give context to the performance.

Figure 8 below presents the EDM performance trend and rainfall for recent years.

Figure 8 – EDM Monthly Performance



No spills were recorded at Basingstoke STW in 2022 and only six spills were recorded in 2023. However, four of the six spills occurred in January 2023, when the indicator site data shown in Figures 5 and 6 suggests that groundwater levels peaked in the catchment. The data is Therefore, indicative of a wider relationship between rainfall, elevated groundwater levels and spill frequency in the catchment. To further understand the impact of groundwater infiltration on spills at Basingstoke STW, 2024 EDM data will be analysed once available.

Please refer to the Groundwater Impacted System Management Plan for 2021/22, included in this PDF document, for discussion regarding trends evident in the EDM data for 2020, indicative of the role of groundwater infiltration on spills in the catchment.

Investigations & Interventions

This section details the activities that have been undertaken across the catchment within the Hydrological Year 2023-24.

Monitor Installations

The Sewer Depth Monitor (SDM) program supports long term groundwater understanding within GISMP catchments. Currently, there are a total of 22 monitors installed within the Basingstoke catchment. There are currently no further monitor installs planned.

The data from these will be cross-referenced with other long-term records (where available) within the catchment.

Remediation Works Undertaken this Hydrological Year

Table 9 below provides a summary of the investigations and remediation works undertaken or planned within the Basingstoke catchment in the 2023-24 Hydrological Year, as well as works undertaken in the previous two hydrological years.

Table 9 – Works Undertaken in the 2023/2024 Hydrological Year, 2022/23 Hydrological Year & in the 2021/22 Hydrological Year

Investigation/ remediation type	Number/ length undertaken 21/22	Number/ length undertaken 22/23	Number/ length undertaken 23/24
CCTV survey	N/A	N/A	N/A
Look and lift survey	N/A	N/A	N/A
Sewer lining	N/A	N/A	N/A
Patch lining	N/A	N/A	N/A
Manhole sealing	N/A	N/A	N/A

No interventions/ investigations were carried out in the catchment in the 23/24 Hydrological Year. However, the system will continue to be monitored, and future investigations/ interventions carried out as appropriate and when conditions allow.

An upgrade is planned for Basingstoke STW. This will improve its ability to treat the volumes of incoming sewage, reducing the need for untreated discharges to the environment. The scheme, currently in design, is due to be completed in 2027. Delivery dates are being managed at a programme level, delivery dates stated are based upon current views and are subject to change

The catchment is expected to meet all government targets for storm overflows by 2040 - 2045.

Summary

Indicator site data suggests groundwater levels in the Basingstoke catchment have generally been higher in the 2023/24 Hydrological Year than in the previous hydrological year. Only six spills were recorded at Basingstoke STW in 2023. However, the majority of spills occurred in a period of elevated groundwater levels, indicating a wider relationship between rainfall, elevated groundwater levels and spill frequency in the catchment. The 2024 EDM data will be analysed once available to continue to examine and understand the relationship between groundwater levels and overflow spills in the catchment.

Our operational teams have worked with local stakeholders to improve overland drainage in the area which may be contributing to infiltration into the foul system through manholes. Lift and look and CCTV surveys will be undertaken in remaining wet winter periods if conditions allow and subject to funding and available capacity. The aim of this is to find further priority locations for remediation and investigating/justifying the need for future larger scale lining as part of our Price Review (PR) process if required.

Addendum - Annual Update 2025

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Loddon and Trib river basin summary

The Thames Water region covers the length of the River Thames from its source down to Tilbury including all its tributaries. The sewer network has overflows that discharge along the River Thames and its associated tributaries. The role of storm overflows in the network is to protect against property flooding from the sewerage system. Storm overflows, which may be augmented with settlement tanks, are employed to optimise the split between wastewater treatment and the management of rainfall. Storm separation is typically designed in accordance with regulatory guidance.

Aligned with our Drainage and Wastewater Management Plan (DWMP) approach, the Thames Water region has been split into River Basins, each contains a varying number of localised sewer networks. Taking this approach allows alignment to the different drivers in each river basin and provides and efficient way to investigate, tackle performance and protect the environment. This report covers the performance of the sewer networks within the Loddon and Trib River Basin which are heavily influenced by groundwater infiltration into the network.

The Loddon and Trib River Basin covers the upper reaches of the River Thames including its associated tributaries and streams. The river basin contains three heavily groundwater impacted Thames Water localised sewer systems that interact with various rivers and streams forming the tributaries to the River Thames. Each localised sewer system contains one or more storm overflows located at sewage treatment works (STW) and/or in the network. Figure 1 shows the relationship between the sewer systems and the associated rivers and streams. Figure 2 shows the location of each localised sewer system within the Loddon and Trib River Basin with an insert showing the location of the Loddon and Trib River Basin in relation to the Thames Water Region.

Sewer System	Associated River / Stream	Relationship to the River Thames
Basingstoke STW	River Loddon	Direct tributary of the River Thames
Crondall STW	River Hart	Indirect tributary of the River Thames via Rover Loddon
Sherborne St John STW	Wey Brook	Indirect tributary of the River Thames via Rover Loddon

Figure 1: Relationship of the Sewer Systems to Associated Rivers

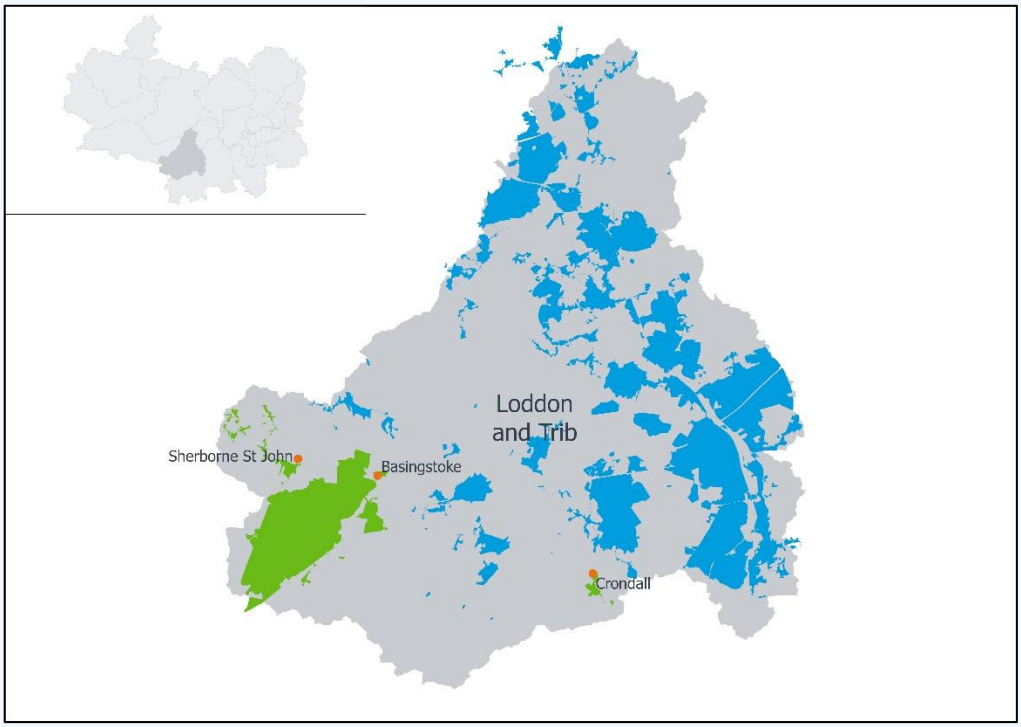


Figure 2: Location of Sewer Systems Within the Loddon and Trib River Basin

Basingstoke

Basingstoke is located in Hampshire, approximately 14 miles south-west of Reading at the source of the River Loddon.

This addendum provides an update on work undertaken in the hydrological year October 2024 to September 2025 for the Basingstoke sewerage system. The key points covered include:

- Hydrological conditions
- Performance of the sewerage system
- Mitigation / remedial measures progressed over the last year

Figures 1 to 5 illustrate the relationship between rainfall and spills at CSOs. As can be seen the decrease in rainfall from 2023/24 into 2024/25, shown in Figure 1; represents a correlation to decreased groundwater and river levels shown in Figure 2, and 3. Additionally, there are fewer and shorter spill events at the CSOs during 2023 compared to 2024, shown in Figure 5.

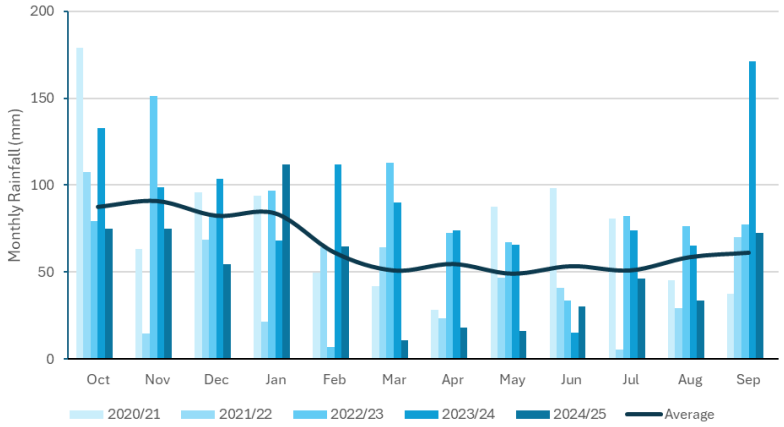


Figure 1: Monthly rainfall data 2020/21 to 2024/25

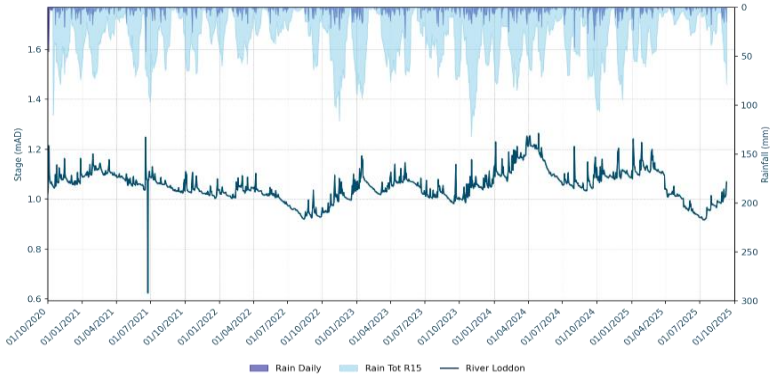


Figure 2: River Level data for River Loddon at Pyotts Bridge

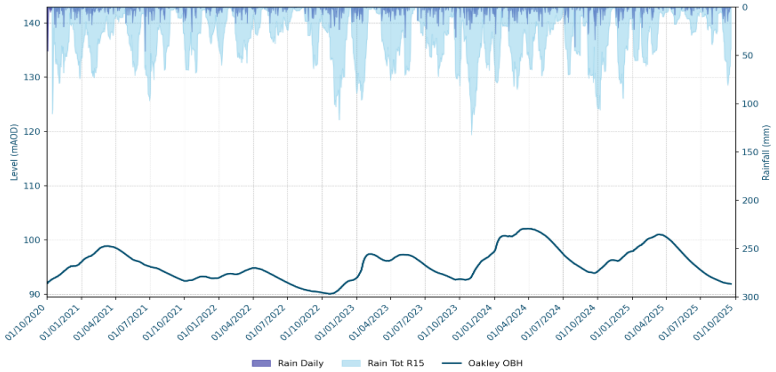
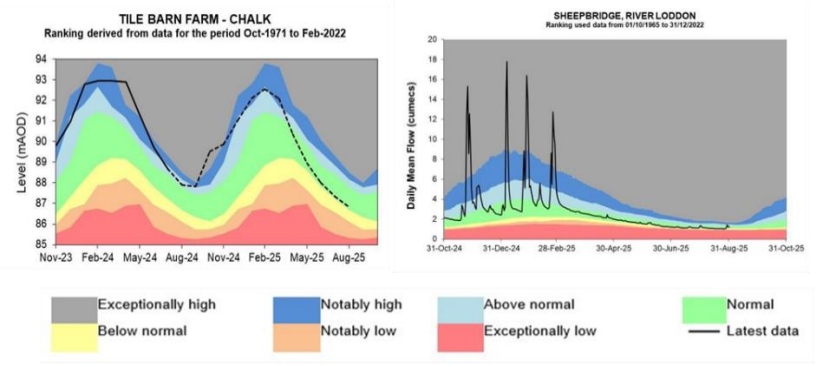


Figure 3: River Level data for Oakley OBH



Extract from - Water Situation Report (publishing.service.gov.uk)

Figure 4: Ground Water situation Report

Table 1 below details the last 2 years performance of overflows in the catchment. To assess EDM performance and its relation to groundwater infiltration, a review of the month-on-month spill performance in 2024 and 2025 against the monthly total rainfall values has been undertaken, as observed in Figure 5.

Event Duration Monitoring	2023		2024	
Overflow	Annual Spills	Duration (hours)	Annual Spills	Duration (hours)
Basingstoke STW	6	46	82	938.15

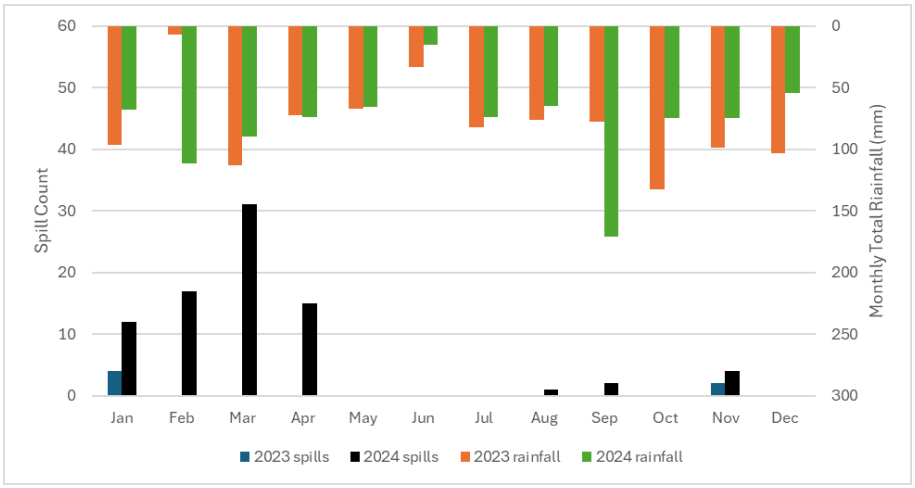


Figure 5: Monthly rainfall data versus monthly spill count for 2023 and 2024 – Basingstoke STW

Table 2 below outlines the remediation works undertaken to address infiltration in the catchment, and enhancements to treatment works and/or pumping stations. Please note that this table only refers to work completed in the previous year

Investigation / remediation type	2020/21	2021/22	2022/23	2023/24	2024/25
CCTV surveys	-	-	-	-	-
Look and lift surveys	-	-	-	-	-
Sewer lining	-	-	-	-	-
Patch lining	-	-	-	-	-
Manhole sealing / plates / covers and frames replaced	-	-	-	-	-
ATAC unit deployment	-	-	-	-	-

Summary

A review of river level data over 2023/24 has increased compared to previous years. The number and duration of spills have increased in 2024 compared to 2023. The higher number of annual spills and river levels could be a result of the increased rainfall in 2024 (seen in Figure 5).

The majority of the sewer spills (see Figure 5) have occurred during the winter periods (January to April), which is usually the wettest months of the year, clearly demonstrating a strong correlation between rainfall and number of spills. Moreover, there is a slight drop in groundwater levels for 2024/2025 compared to the groundwater levels of the previous year, but the effect of this decrease will be analysed when 2025 spill data is published.

Crondall

Crondall is located in the north-east Hampshire, approximately 10 miles south-east of Basingstoke.

This addendum provides an update on work undertaken in the hydrological year October 2024 to September 2025 for the Crondall sewerage system. The key points covered include:

- Hydrological conditions
- Performance of the sewerage system
- Mitigation / remedial measures progressed over the last year

Figures 1 to 4 illustrate the relationship between rainfall and spills at CSOs. The decrease in rainfall from 2023/24 to 2024/25 shown in Figure 1; correlates to a slight decrease in river levels shown in Figure 2. Please note, there is no river Hart level data available before 20/10/2021. Observing Figure 3, there is no clear correlation between rainfall and spills when comparing 2023 to 2024, however the majority of spill events occur during winter months when the water level is more commonly higher.

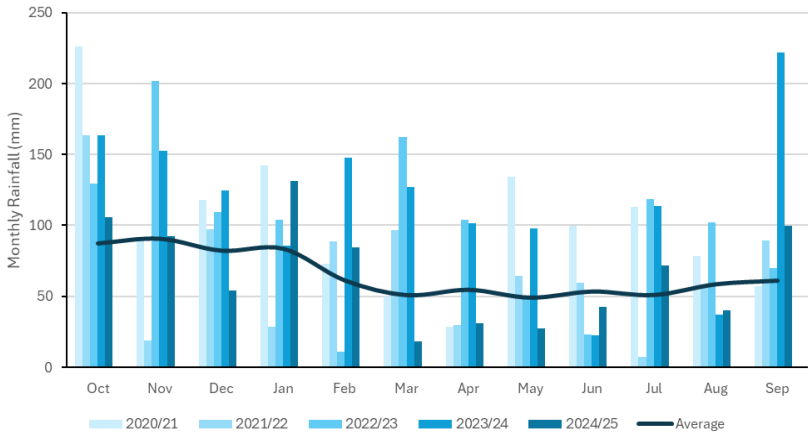


Figure 1: Monthly rainfall data 2020/21 to 2024/25

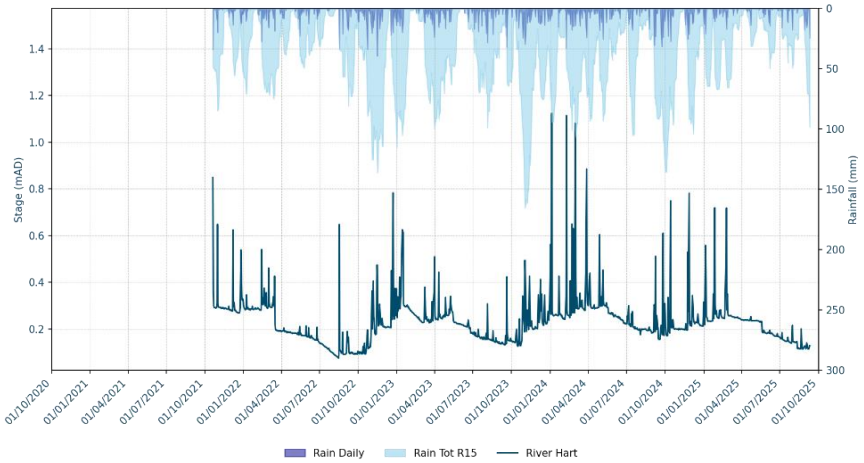
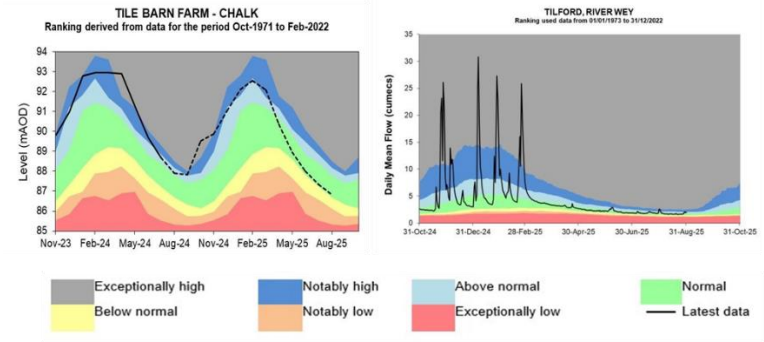


Figure 2: River Level data for River Hart, Crondall Pond



Extract from - Water Situation Report (publishing.service.gov.uk)

Figure 3: Ground Water situation Report

Table 1 below details the last 2 years performance of overflows in the catchment. To assess EDM performance and its relation to groundwater infiltration, a review of the month-on-month spill performance in 2023 and 2024 against the monthly total rainfall values has been undertaken, as observed in Figure 4.

Event Duration Monitoring	2023		2024	
Overflow	Annual Spills	Duration (hours)	Annual Spills	Duration (hours)
Crondall STW	37	762	81	1311.15

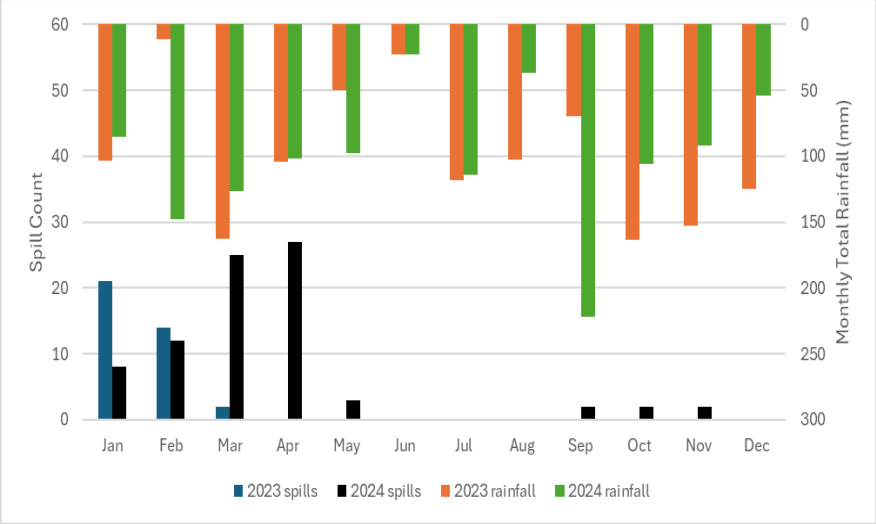


Figure 4: Monthly rainfall data versus monthly spill count for 2023 and 2024 – Crondall STW

Table 2 below outlines the remediation works undertaken to address infiltration in the catchment, and enhancements to treatment works and/or pumping stations. Please note that this table only refers to work completed in the previous year.

Investigation / remediation type	2020/21	2021/22	2022/23	2023/24	2024/25
CCTV surveys	-	-	2,830m	-	-
Look and lift surveys	-	-	-	-	-
Sewer lining	-	1,020m	-	-	-
Patch lining	-	-	-	-	-
Manhole sealing / plates / covers and frames replaced	-	23	-	-	-
ATAC unit deployment	-	-	-	-	-

Summary

A review of river level data over 2023/24 has increased compared to previous years. The number and duration of spills have increased in 2024 compared to 2023. The higher number of annual spills and river levels could be a result of the increased rainfall in 2024 (seen in Figure 4). This suggests that rainfall directly correlates to spill events. However, the wettest month of 2024 was September (seen in Figure 4), but the highest number of spills occurred in the winter months of 2024 (January to April). We can deduce that the continuation of high rainfall between Jan and April led to higher water levels which increased the strain on the sewer infrastructure.

Moreover, there is a slight drop in groundwater levels for 2024/2025 compared to the groundwater levels of the previous year, but the effect of this decrease will be analysed when 2025 spill data is published.

Crondall is listed in the AMP8 WINEP storm overflow programme and infiltration management /GISMP recommendations are likely to be delivered as part of this in AMP8.

Sherborne St John

Sherborne St John is located in Hampshire, approximately 2 miles north of Basingstoke town centre.

This addendum provides an update on work undertaken in the hydrological year October 2024 to September 2025 for the Sherborne St John sewerage system. The key points covered include:

- Hydrological conditions
- Performance of the sewerage system
- Mitigation / remedial measures progressed over the last year

Figures 1 to 5 illustrate the relationship between rainfall and spills at CSOs. As can be seen the decrease in rainfall from 2023/24 into 2024/25, shown in Figure 1; shows a correlation to slightly decreased groundwater and river levels shown in Figure 2, 3 and decreased number and duration of spills at the CSOs shown in Figure 5. Observing several instances of flatlining data in Figure 2, it is likely there is some erroneous data which could impact river level recordings.

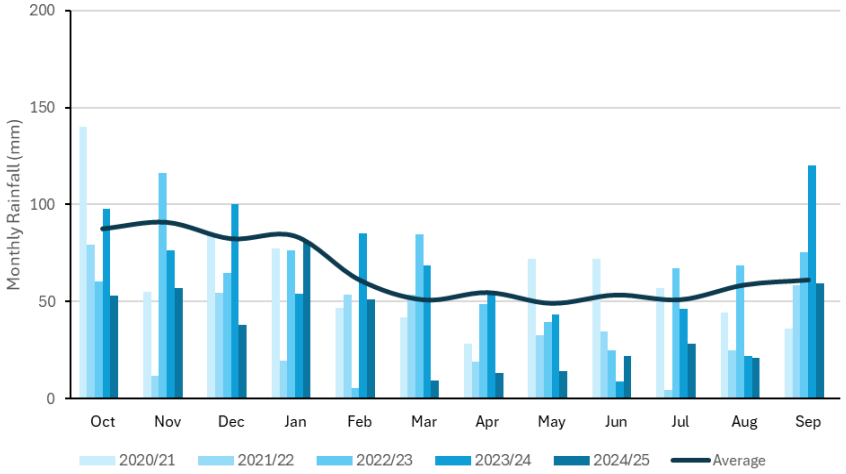


Figure 1: Monthly rainfall data 2019/20 to 2023/24

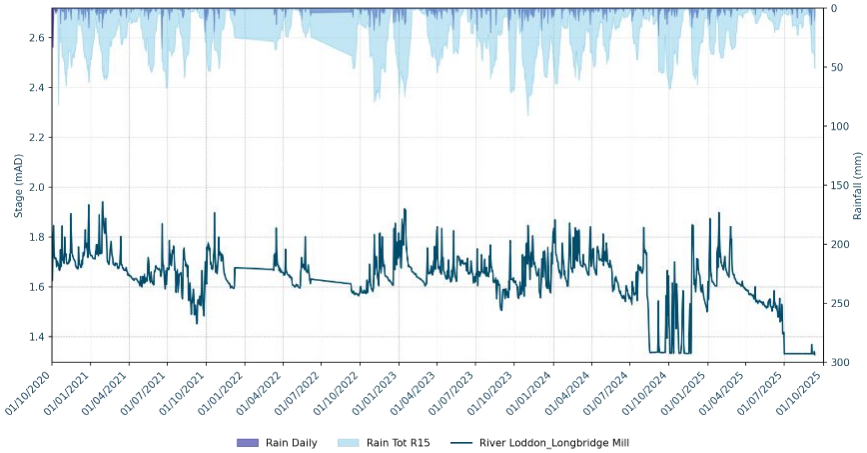


Figure 2: River Level data for River Loddon at Longbridge Mill

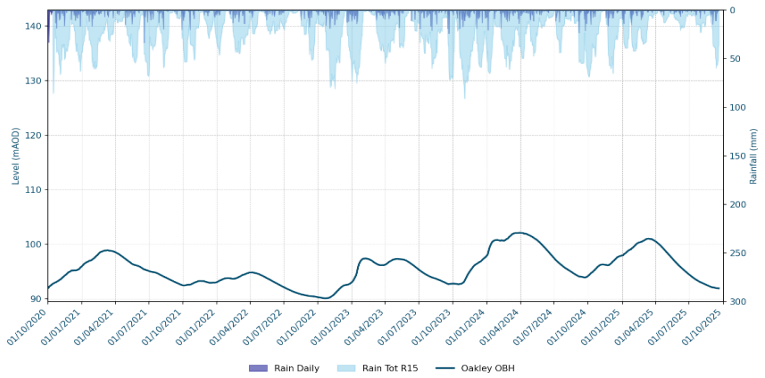


Figure 3: River Level data for Oakley OBH

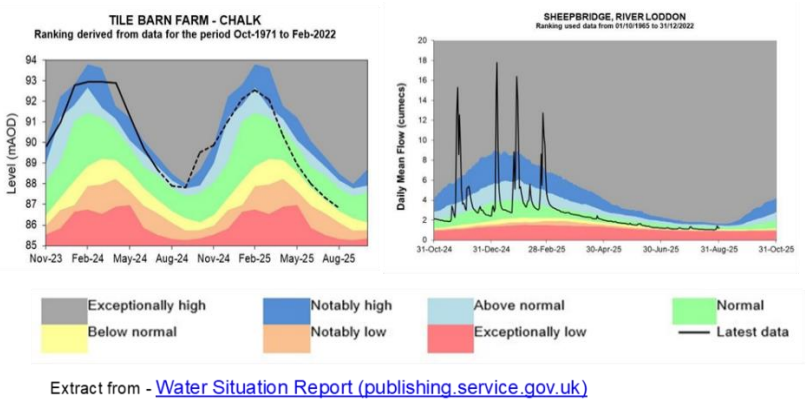


Figure 4: Ground Water situation Report

Table 1 below details the last 2 years performance of overflows in the catchment. To assess EDM performance and its relation to groundwater infiltration, a review of the month-on-month spill performance in 2023 and 2024 against the monthly total rainfall values has been undertaken, as observed in Figure 5.

Event Duration Monitoring	2023		2024	
Overflow	Annual Spills	Duration (hours)	Annual Spills	Duration (hours)
West Heath Ramsdell PS	56	913	99	1801.30

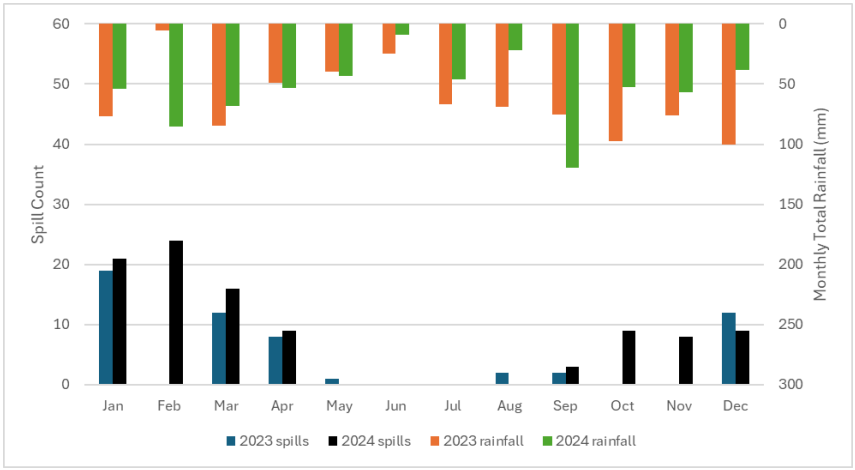


Figure 5: Monthly rainfall data versus monthly spill count for 2023 and 2024 –West Heath Ramsdell PS

Table 2 below outlines the remediation works undertaken to address infiltration in the catchment, and enhancements to treatment works and/or pumping stations. Please note that this table only refers to work completed in the previous year.

Investigation / remediation type	2020/21	2021/22	2022/23	2023/24	2024/25
CCTV surveys	-	-	-	1,355m	-
Look and lift surveys	-	-	-	-	-
Sewer lining	-	-	-	-	-
Patch lining	-	-	-	-	-
Manhole sealing / plates / covers and frames replaced	-	-	-	-	-
ATAC unit deployment	-	-	-	-	-

Summary

A review of river level data over 2023/24 has increased compared to previous years. The number and duration of spills have increased in 2024 compared to 2023. The higher number of annual spills and river levels could be a result of the increased rainfall in 2024 (seen in Figure 5). Moreover, there is a slight drop in groundwater levels for 2024/2025 compared to the groundwater levels of the previous year, but the effect of this decrease will be analysed when 2025 spill data is published. There are strategic plans to mitigate infiltration within the catchment, prioritising the remediation of gushers as quick wins, of which there were none in the survey findings for Sherborne St John. The understanding of runners and seepers allows us to verify our strategic lining plans for the future. Remediating these will be captured as part of future strategic plans.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