



# Groundwater Impacted System Management Plan

Maple Lodge (Misbourne Sub Catchment)

River Misbourne

July 2021



It's everyone's water

# Version control

Version	Date	Amendment	Author	Checked	Reviewed
1-d1	16/06/2021	Draft for EA	AJ	SE	DJ
1-d2	26/06/2021	Final Draft for EA	AJ	SE	DJ
1-V1	28/07/2021	Version 1	AJ	SE/KD	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

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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 being significant and likely to lead the sewerage system, on occasions, becoming overwhelmed.

All sewerage systems combined and separate will experience some groundwater infiltration<sup>1</sup> 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 centred 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<sup>2</sup>. 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 & fix' approach to date lacks a degree of certainty of resolution and for this reason Thames Water has in 2020 undertook a different approach for the medium to long-term management of groundwater, which is covered within this

<sup>1</sup> Sewers for Adoption makes an allowance for 10% of peak wastewater flow to allow for unaccounted flows such as groundwater infiltration.

<sup>2</sup> 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. 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 works' 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 until our plan is fully implemented and when we will publish future updates on progress against this plan.

# Brief description of Maple Lodge catchment

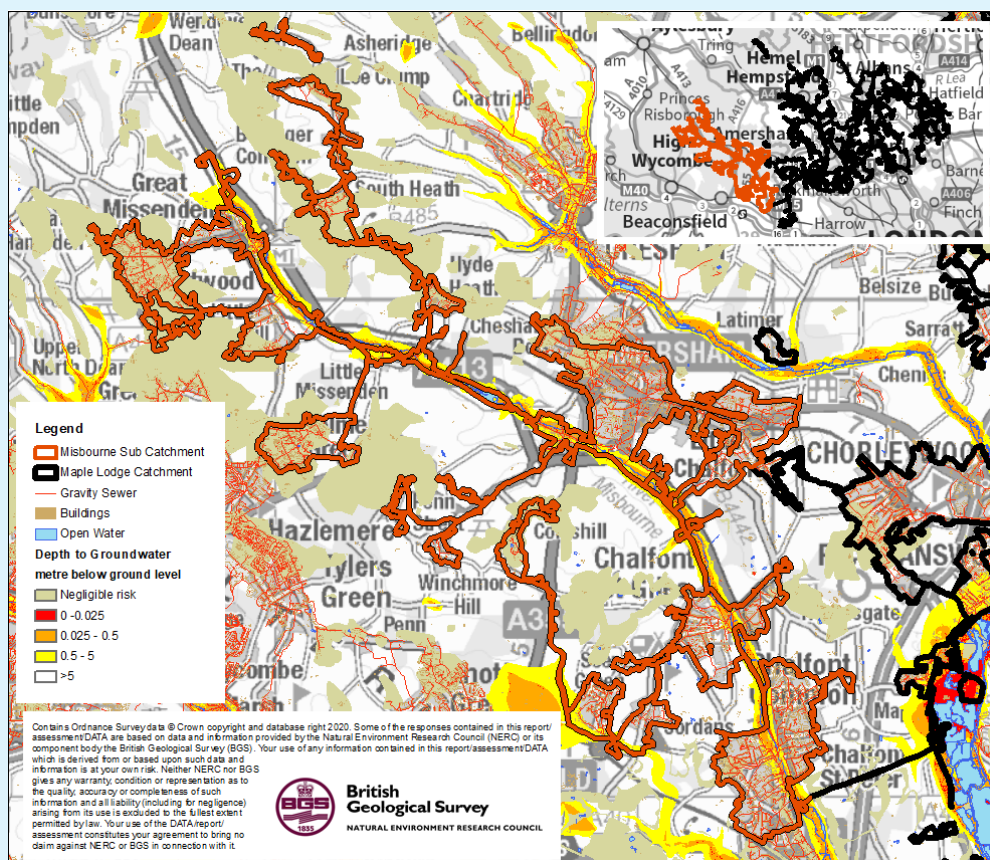


Figure 1.0 – Maple Lodge catchment and Misbourne Sub Catchment

Maple Lodge is located in the Colne Valley, Hertfordshire, England, south of Rickmansworth. The Maple Lodge system serves a population equivalent<sup>3</sup> of 574,420 with a predominantly separate sewerage network totaling some 5160 km in length excluding private drains and sewers. The focus of this groundwater plan is on the Misbourne Sub-Catchment, which lies entirely within Buckinghamshire, and encompasses several towns including Chalfont St Peter, Chalfont St Giles, Amersham and Great Missenden. The extent of the Misbourne sub catchment and the whole Maple Lodge catchment is shown in Figure 1.0 above.

## Problem characterisation

Groundwater has the potential to enter our sewers when levels are high and a positive head above the soffit of the sewer is created. Significant unwanted flow can impact sewer

<sup>3</sup> 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 produced by one person in the same time.

capacity and increased risk of flooding. From available data, there is evidence of a relationship between rising river levels and rising groundwater levels, particularly adjacent to the River Misbourne (chalk stream), and the drainage issues some of our customers have experienced, including sewer flooding and restricted use of their toilets and bathrooms. The impacts of surface runoff from agricultural and built-up land has also contributed to these drainage issues.

Additionally, prolonged and heavy rainfall and raised groundwater levels have overwhelmed the sewer system causing operational problems at the local pumping station.

The sewerage system is identified on the public sewer records as being a partially separate foul system, rather than a combined system. 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 historically have detected that there is some evidence of unwanted flow into 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. Surface 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 sewerage systems include 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 although the use of storm sewage overflows is accepted by our regulators, subject to conditions.

This plan focuses on the Misbourne Sub Catchment. The whole area is underlain by chalk. This principal aquifer has a relatively large fluctuation in groundwater levels, which combined with its high permeability increases the sewer networks vulnerability to groundwater infiltration. Previous surveys have identified issues with infiltration along the Broadway, in old Amersham. Past surveys have also identified neighbourhoods where rainwater from roofs is directed in the sewer network, and there is a change to work with the local authorities to redirect this water away from the sewer system.

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 Buckinghamshire Council as Lead Local Flood Authority, Council and Planning Authority, and 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 sewage escapes in the network as a result of surcharging man-holes causing pollution and flooding.

We anticipate that this situation may continue until such time we are able to implement a long-term solution.

The strategy to mitigate the risk of infrequent sewage escapes to local rivers from the impact of groundwater involves the deployment of an ATAC Biofilter at the affected location. In 2023/24 three ATAC units were deployed in the catchment alongside a Mega Unit Infiltration System which has greater treatment capacities than the standard ATAC units. All of these systems discharge to a singular point in the River Misbourne, adjacent to Amersham Household Waste and Recycling Centre (see below for more detail). These systems will ensure the majority of the groundwater remains within the sewage system. Tanker support would still be used to manage flows in the other sections of the network, if required.



# Anticipated unavoidable discharges

Location

The Amersham ATAC will be deployed adjacent to the Amersham Household Waste and Recycling Centre and will discharge treated water into the River Misbourne at the point of interest marked below. There are a total of three units here with a singular discharge discharge point, additionally a mega unit is able to be deployed in the catchment with a higher treatment capacity than the ATAC units.



Discharges

10 l/s

- Mitigation
- In order to ensure the current system is working to maximum capability the following actions will be carried out:
- Regular sewer investigations (and resultant sewer cleaning) to remove any blockages.
  - Ongoing investigations and remediation of priority infiltration sources as outlined in this document.
  - Identifying and taking actions to minimise where surface water ponding may be inundating manholes
  - Tankering where appropriate in other areas of the system.

## Anticipated unavoidable discharges

	In order to minimise the impact on the watercourse the discharges will be treated via an ATAC Biofilter which removes solids and biological loading from wastewater influents, whilst also adding dissolved oxygen into the effluent flow.
Mitigation	Should flows stay within the sewer, and not reach the volume to discharge from the sewer, no discharge to the river will take place.
Monitoring	<p>During periods of discharge daily samples of water quality will be taken upstream and downstream to assess impact on the river amenity, use and quality.</p> <p>The following parameters at a minimum will be tested:</p> <ul style="list-style-type: none"> <li>• Biological Oxygen Demand</li> <li>• ammonia</li> <li>• solids</li> <li>• phosphorus</li> <li>• and bacterial quality including E. Coli</li> </ul>
Contact	<p>If discharges occur the Environment Agency will be informed (by logging through the Agency's National Incident Communication Service). For any other reporting please use the Environment Agency pollution reporting number 0800 807060. In addition, local community representatives will be informed.</p> <p>If the ATACs are deployed signage will be placed in the locality and local letter drops carried out to inform residents. An example of the type of signage and information displayed is shown in the appendix of this document.</p>

# General outline plan & timescale

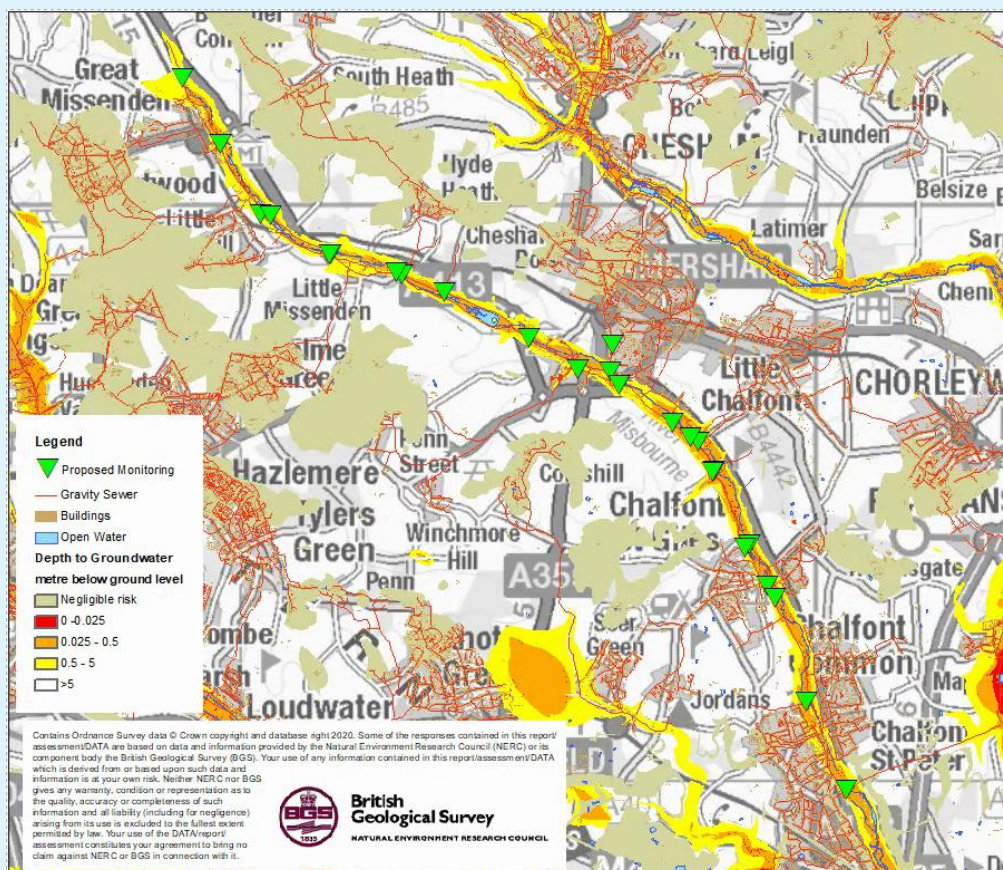


Figure 2.0 – Maple Lodge – Misbourne Sub Catchment monitoring plan area and infiltration zones

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.

Complimenting 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 Maple Lodge 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<sup>4</sup> 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 Maple Lodge.

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

Activity	When	Description
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	2021-23	Monitors are being developed to help calibrate and validate the zones. Each year completeness / coverage monitors will be reviewed and added to / or modified as necessary.
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 compliment 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.

<sup>4</sup> Decisions regarding the 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	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 to 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.

# Maple Lodge Infiltration Management Plan

As detailed above the impact of infiltration is experienced in the network in the subcatchment of the Misbourne and effects are also seen at the STW.

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

## High level approach statement

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

1. We will investigate the network with a view to identifying sources of ingress of infiltration that are cost effective<sup>5</sup> 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 aide 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 future investment cycles.

<sup>5</sup> 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 Maple Lodge 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 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	35.05	13
Medium	Predicted groundwater extreme 0-1m above pipe invert	5.56	2
Low	Predicted groundwater extreme 0-1m below pipe invert	11.57	4
Very Low	Predicted groundwater extreme >1m below pipe invert	226.73	81
Total		278.92	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	906	11
Medium	Inundation risk in 1% AEP fluvial or pluvial event	481	6
Low	Inundation risk in 0.1% AEP fluvial or pluvial event	1172	15
Very Low	All other manholes	5492	68
Total		8051	100



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

Lift and Look and CCTV surveys have not yet commenced in the Misbourne-sub catchment. A summary of findings will be provided in the next update of this report.

Future Works

These are subject to feasibility and contractor review.

	Priority 2021/2022	Known follow On Work
Survey	Plans to be reviewed in Winter 2021	
Sewer Lining	Any gushing locations identified	
Manhole Sealing – Infiltration Ingress	Any gushing locations identified	
Manhole Sealing – Pluvial and Fluvial Ingress	Area walkovers during the wet winter period highlighted 16 manholes in the flood plain of the River Misbourne that were suffering from very high levels of inundation. For 2020/21 our priority for this system is to re-build these manholes and add sealing plates to minimise river ingress.	Plan to be developed based on at risk manholes identified in JBA analysis
Sewage Treatment Works Upgrade	See main text	

# 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

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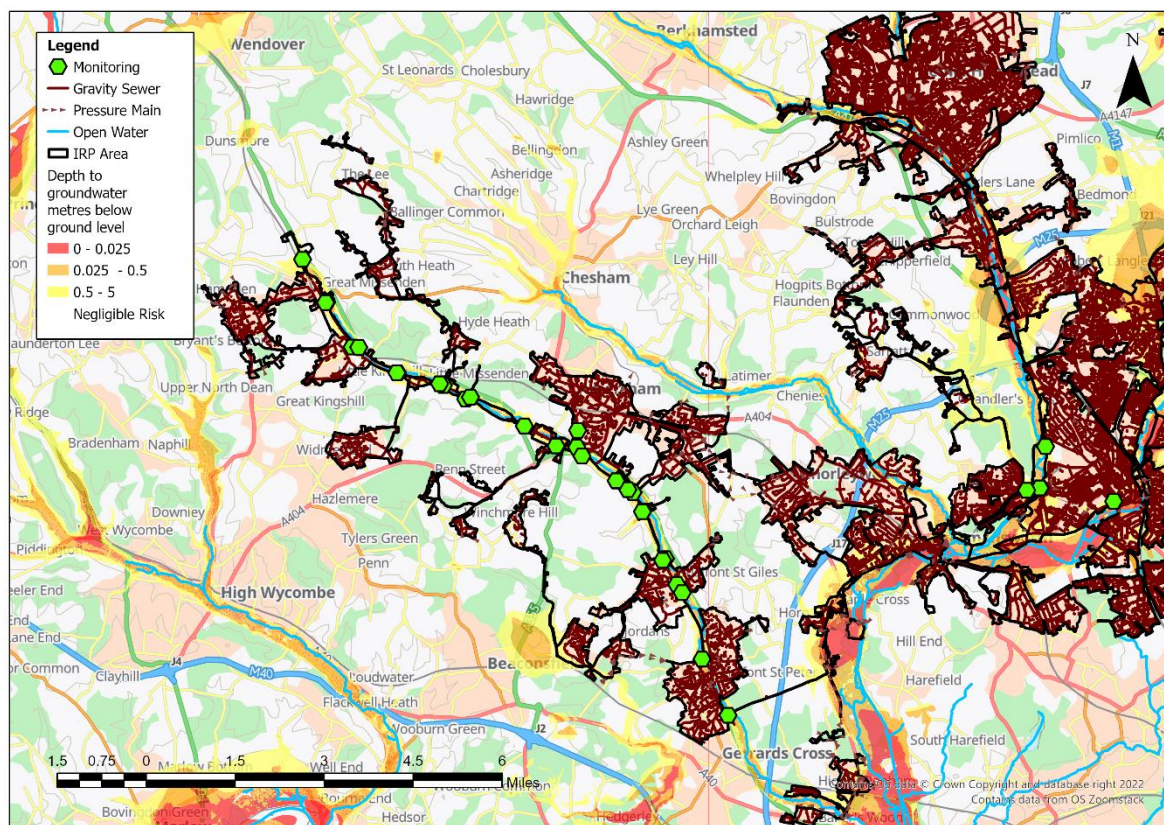
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## Overview

This addendum to the Maple Lodge 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 – Maple Lodge Monitoring Plan





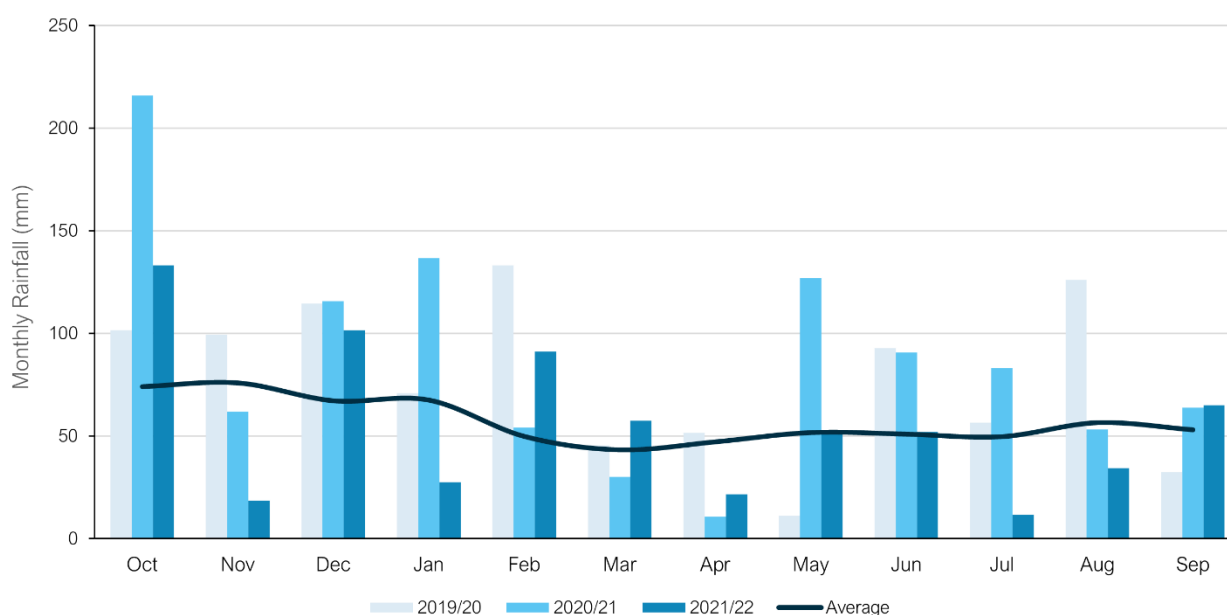
## Hydrological Review – 2021-2022

This section summaries the hydrological conditions within the Maple Lodge 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 1<sup>st</sup> to September 30<sup>th</sup>.

### 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 Northwood based on the period 1991-2020

The total rainfall for the 2021/22 hydrological year is 1.4% 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)
686	935	1043	677

## Groundwater / Local River Level

The Maple Lodge catchment is situated in the Chilterns East - Colne and North London water resources areas. It primarily sits in the Seaford Chalk and Newhaven Chalk Formations of carbonate material, the Lewes Nodular Chalk Formation of Carbonate Material and the London Clay Formation of coarse to fine grained slurries of debris. The chalk formations are designated principal aquifers within the UK.

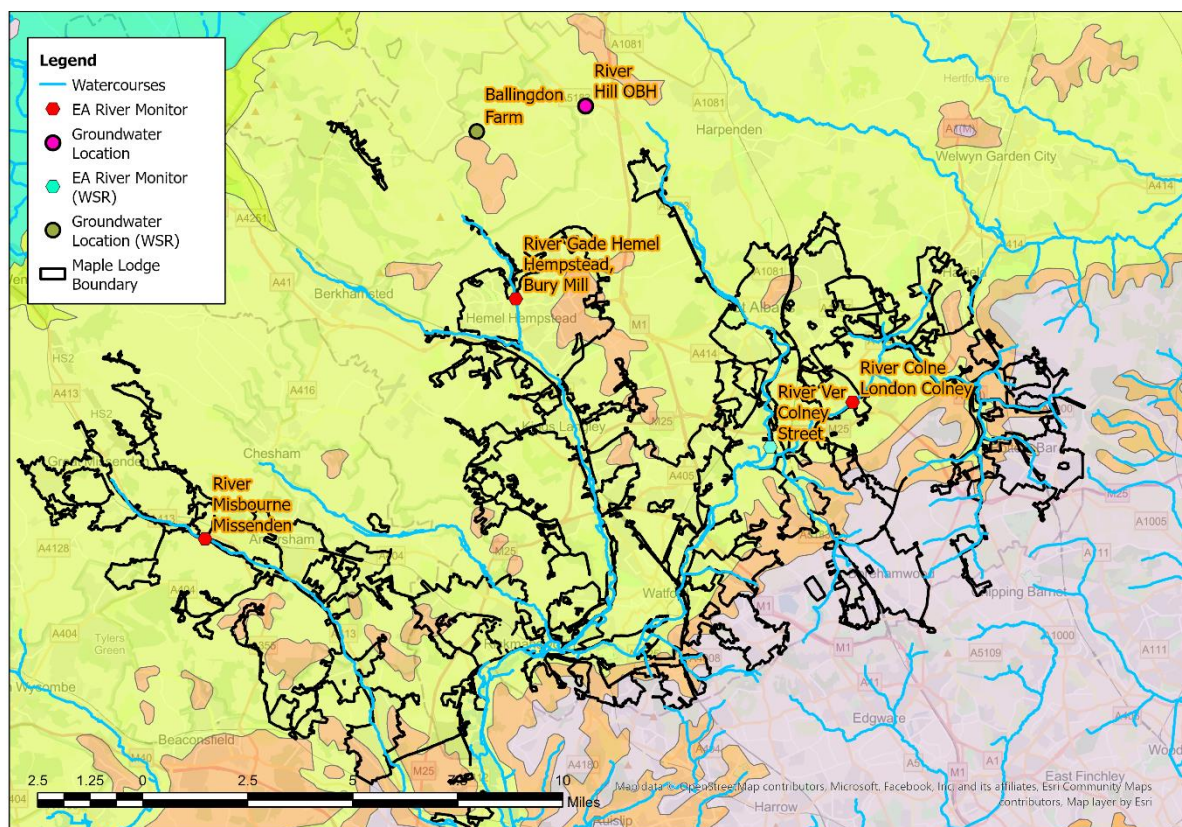
The Environment Agency has gauging stations on local watercourses measuring stage and observation boreholes measuring groundwater levels locally to the catchment which can be used to provide indicative local groundwater performance.

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

- River Colne, London Colney.
- River Gade, Hemel Hempstead, Bury Mill.
- River Misbourne, Missenden.
- River Hill OBH.

These sites are illustrated in the figure 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 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.

Figure 5A – River Colne, London Colney

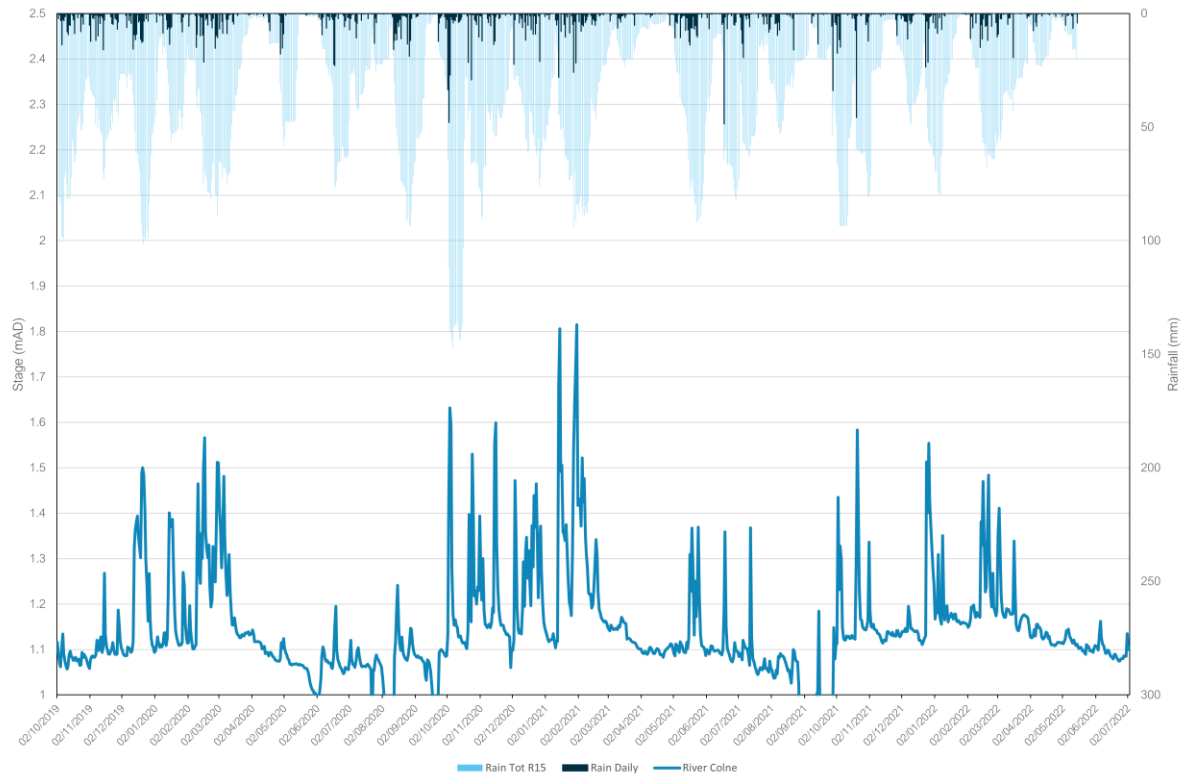


Figure 5B – River Gade, Hemel Hempstead, Bury Mill

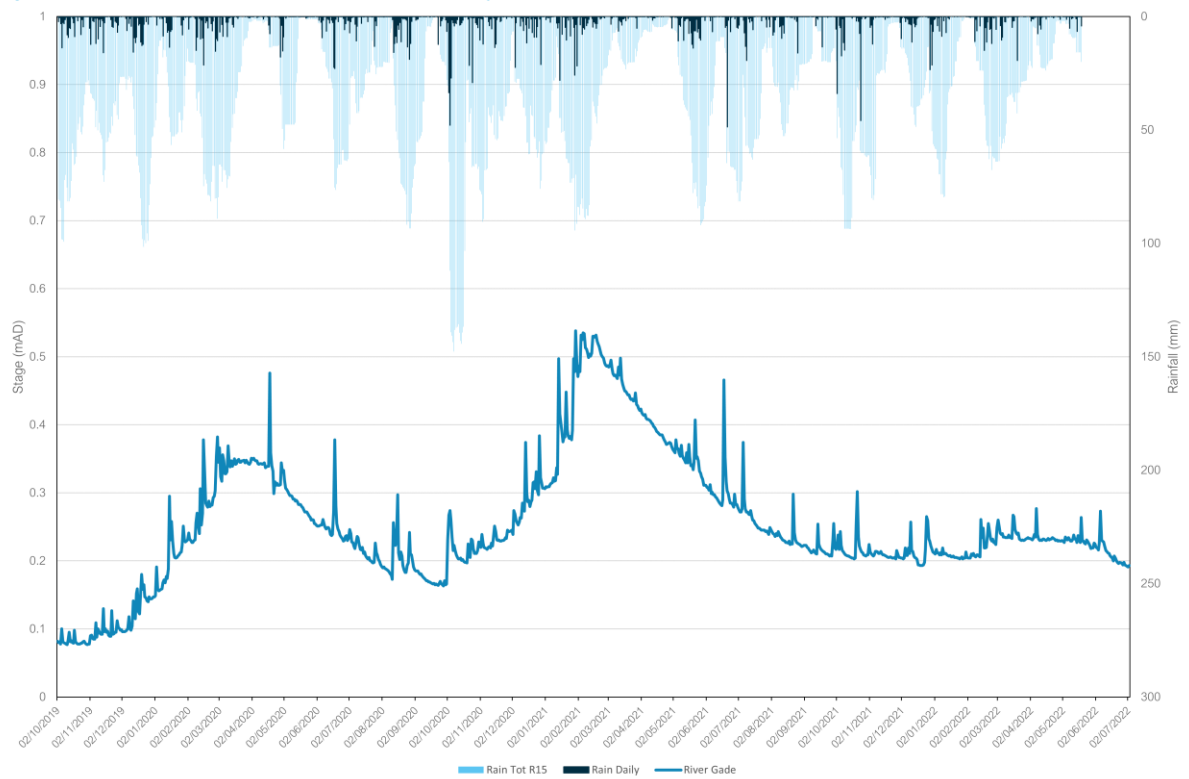


Figure 5C – River Misbourne, Missenden

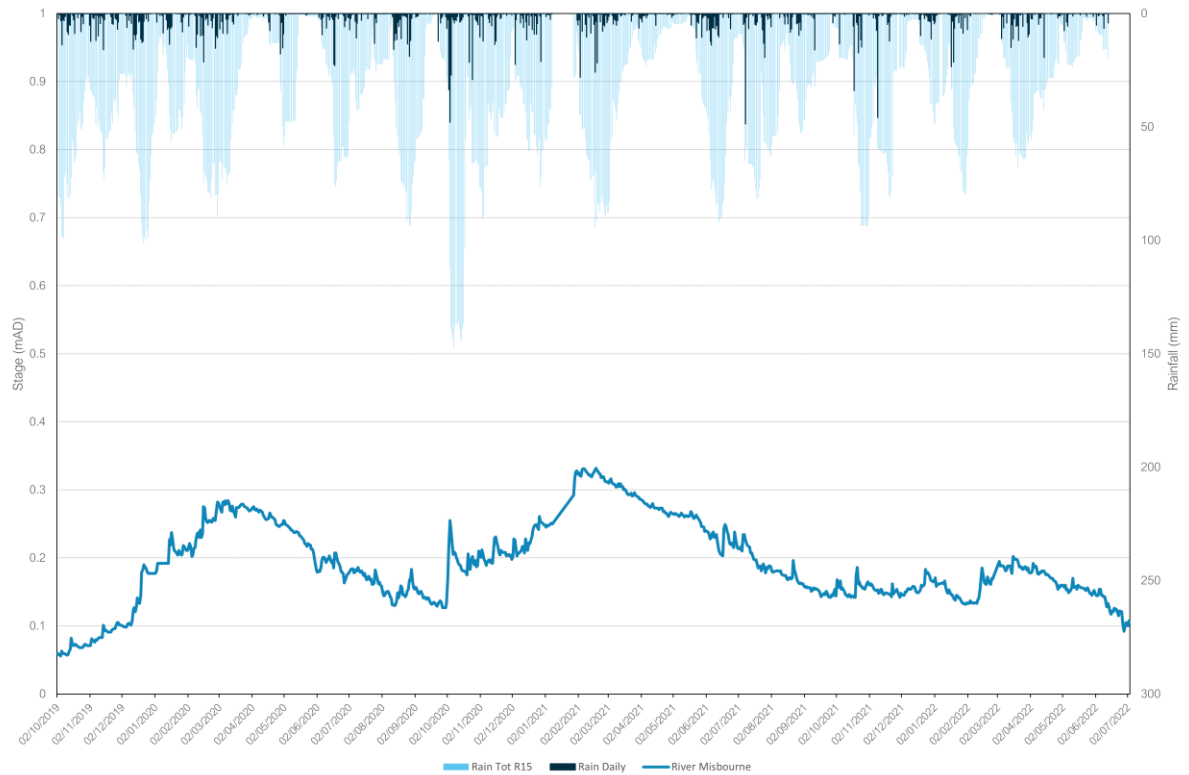
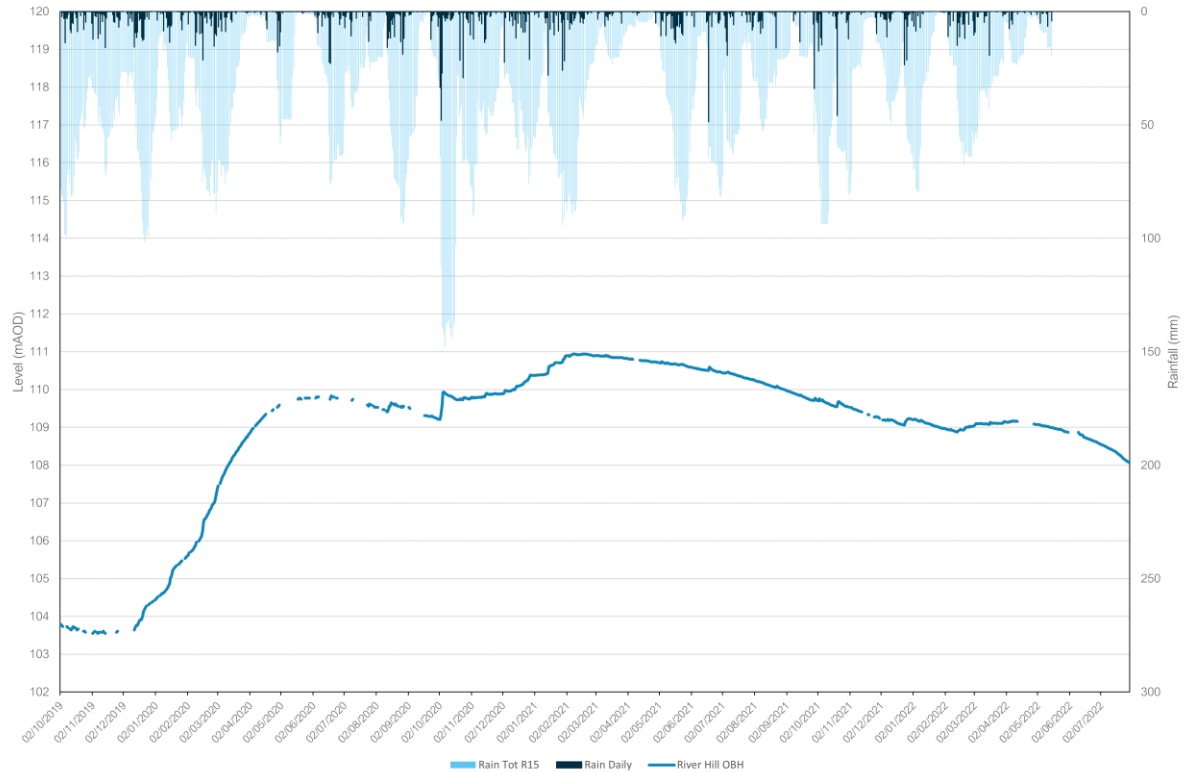


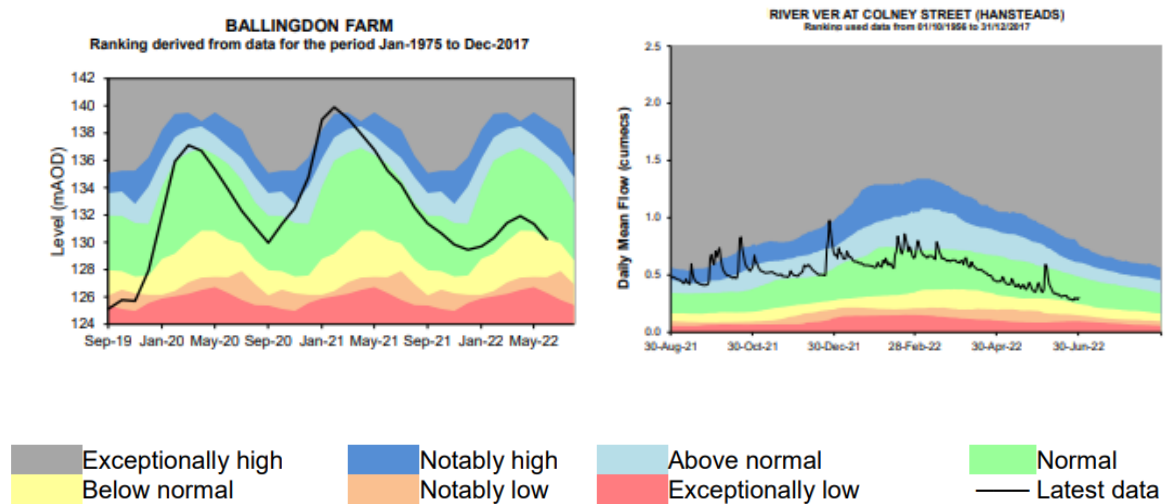
Figure 5D – River Hill OBH





In addition to these specific stations, the wider groundwater context is illustrated in the Water Situation Report for Chilterns East - Colne. The nearest groundwater reference station is Ballingdon 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 Colney Street on the River Ver.

Figure 6 – Water Situation Report



Extract from - [Water Situation Report \(publishing.service.gov.uk\)](https://publishing.service.gov.uk)

## Network Performance

Within the Maple Lodge 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.

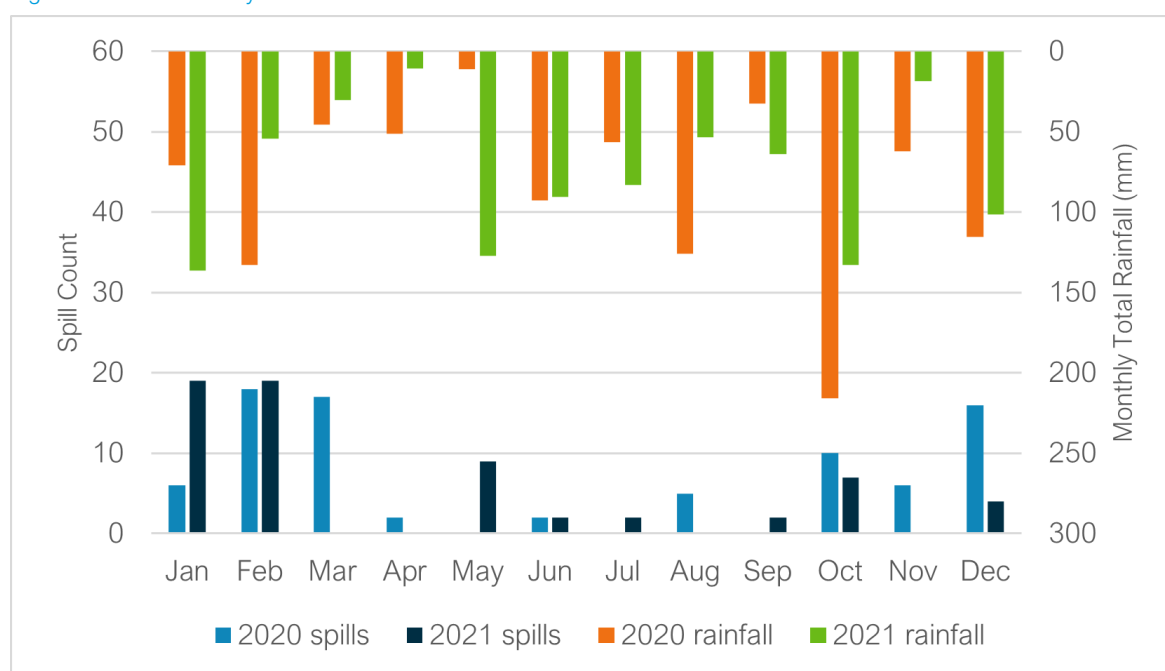
Table 7 – Event Duration Monitoring

Overflow	2020		2021	
	Spills	Duration (hours)	Spills	Duration (hours)
Maple Lodge STW	82	1109.95	64	960.00

Note that a spill count of 82 is stated for 2020, which is lower than the published figure of 83. The spill count data has been revalidated/corrected and the revised figure of 82 will be included in the 2020 re-submission.

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



The trend in spill performance across the two recorded years does show variation in spills, with a focus on spills during the autumn and winter months. The data suggests a wider relationship between rainfall, elevated groundwater levels and spill frequency, particularly evident at the start of the hydrological years (Oct-Dec). Despite broadly similar rainfall amounts, significantly more EDM spills were recorded at Maple Lodge STW in December 2020, compared to December 2021. The indicator sites suggest groundwater levels in the catchment were lower in December 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 14 monitors installed within the Maple Lodge catchment. There are currently 19 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 Maple Lodge 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	90 metres
Patch lining	N/A
Manhole sealing	18 manholes
Manhole sealing plates	N/A
Manhole covers and frames replaced	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 Maple Lodge catchment over the 2021/22 hydrological year has been below average, with groundwater levels in the aquifer beneath Maple Lodge not reaching the levels seen in previous years which triggered groundwater ingress into the sewerage network and elevated flow/depth readings at monitoring sites. This is indicated by the lower number of EDM spills recorded at Maple Lodge STW in December 2021, compared to December 2020, when the indicator sites suggest groundwater levels in the catchment were higher.

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.

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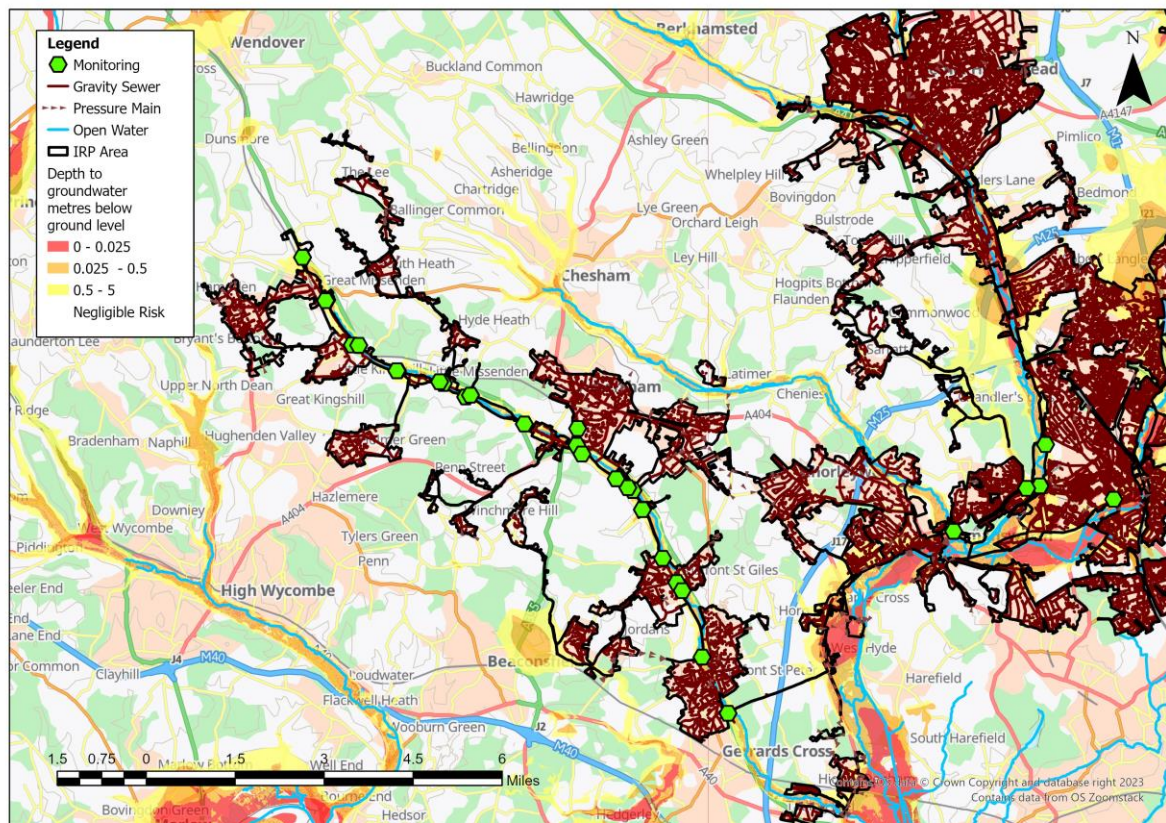


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- Performance of the sewerage system
- Mitigation / remedial measures progressed over the last year and those being planned
- Summary and plan for 2023/24

Figure 1 – Maple Lodge Monitoring Plan



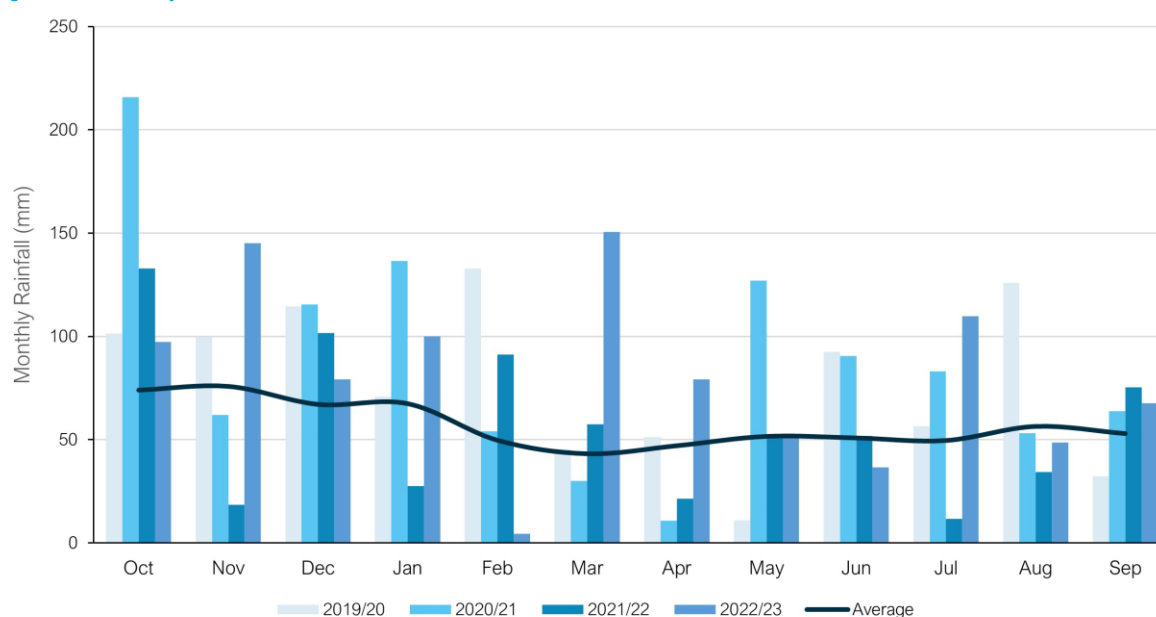
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### Catchment Rainfall

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 four 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 Northwood based on the period 1991-2020

The total rainfall for the 2022/23 hydrological year is 41% 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)
686	935	1043	677	971



## Groundwater / Local River Level

The Maple Lodge catchment is situated in the Chilterns East - Colne and North London water resources areas. It primarily sits in the Seaford Chalk and Newhaven Chalk Formations of carbonate material, the Lewes Nodular Chalk Formation of Carbonate Material and the London Clay Formation of coarse to fine grained slurries of debris. The chalk formations are designated principal aquifers 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 which 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 Colne, London Colney.
- River Gade, Hemel Hempstead, Bury Mill.
- River Misbourne, Missenden.
- River Hill OBH.

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

Figure 4 – Local Monitoring Stations

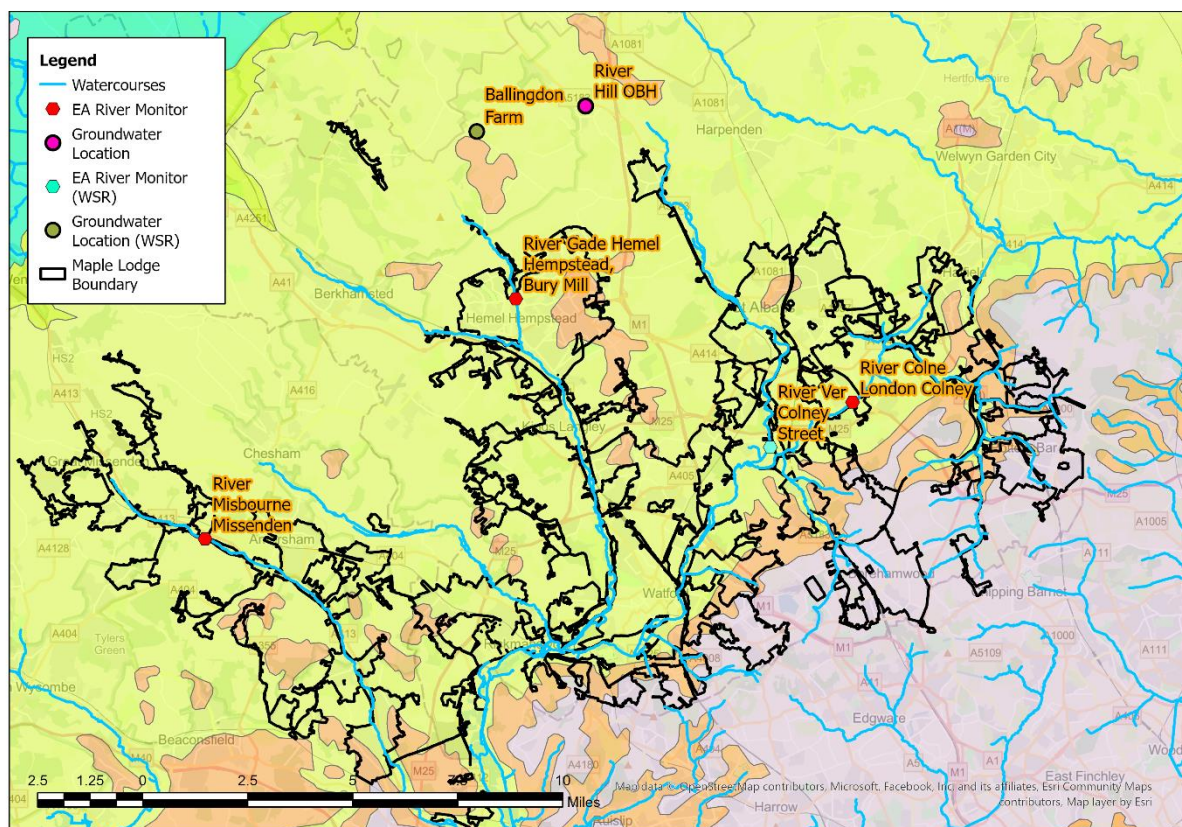


Figure 5A – River Colne, London Colney

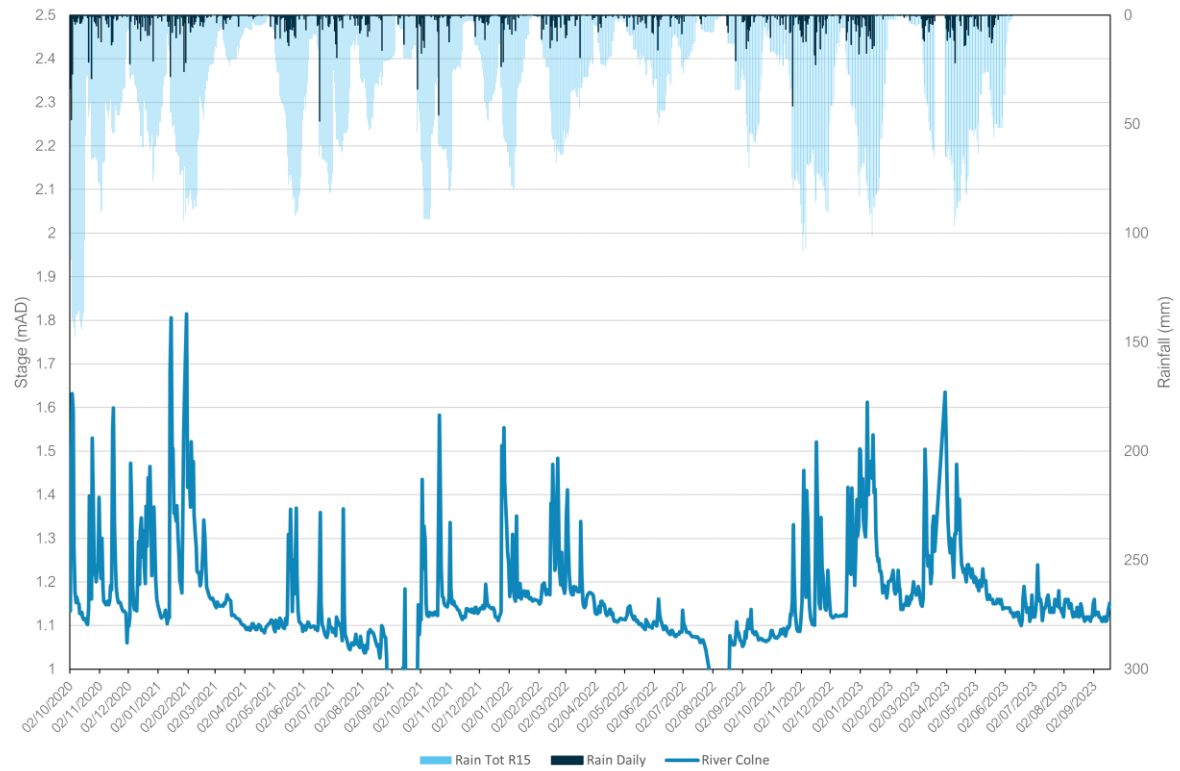


Figure 5B – River Gade, Hemel Hempstead, Bury Mill

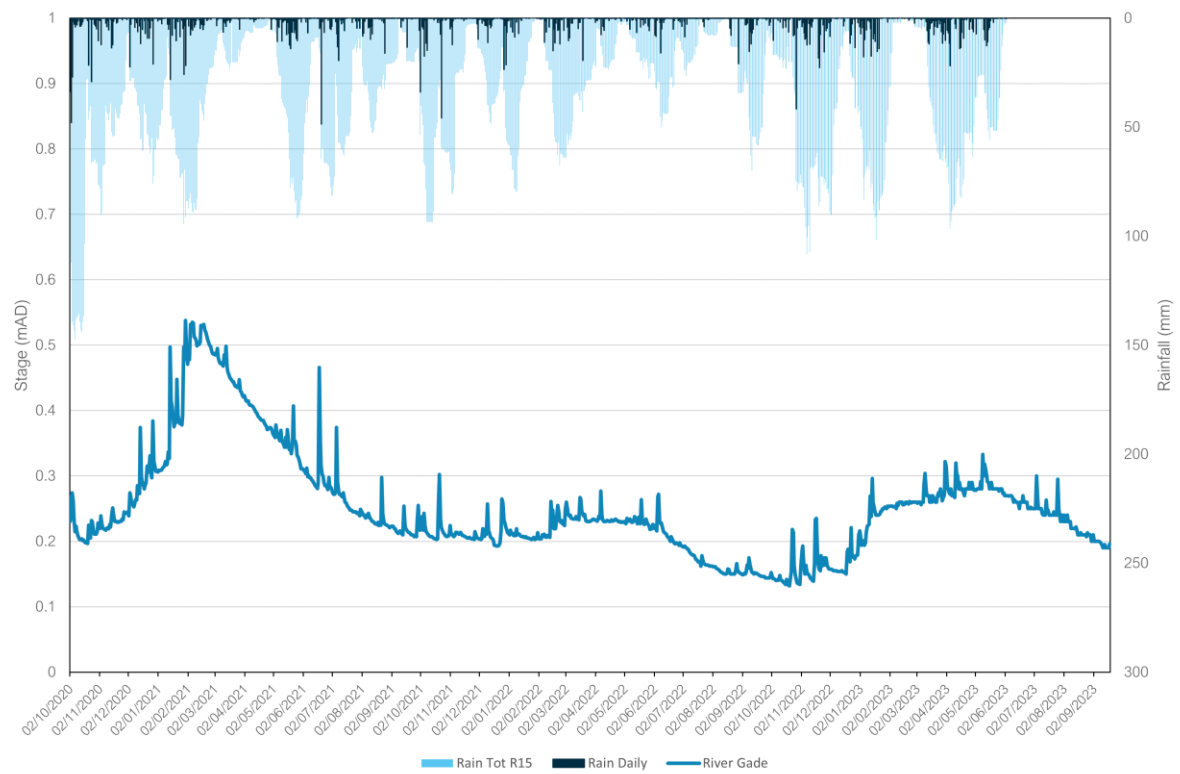


Figure 5C – River Misbourne, Missenden

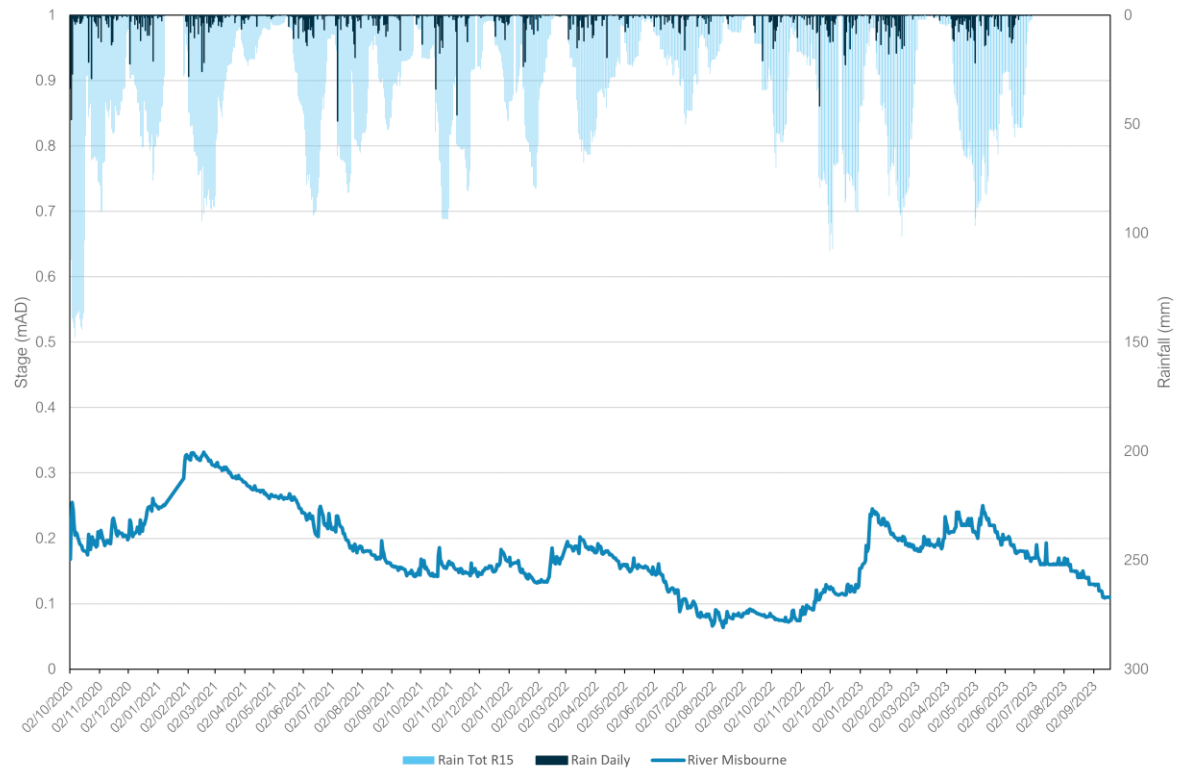
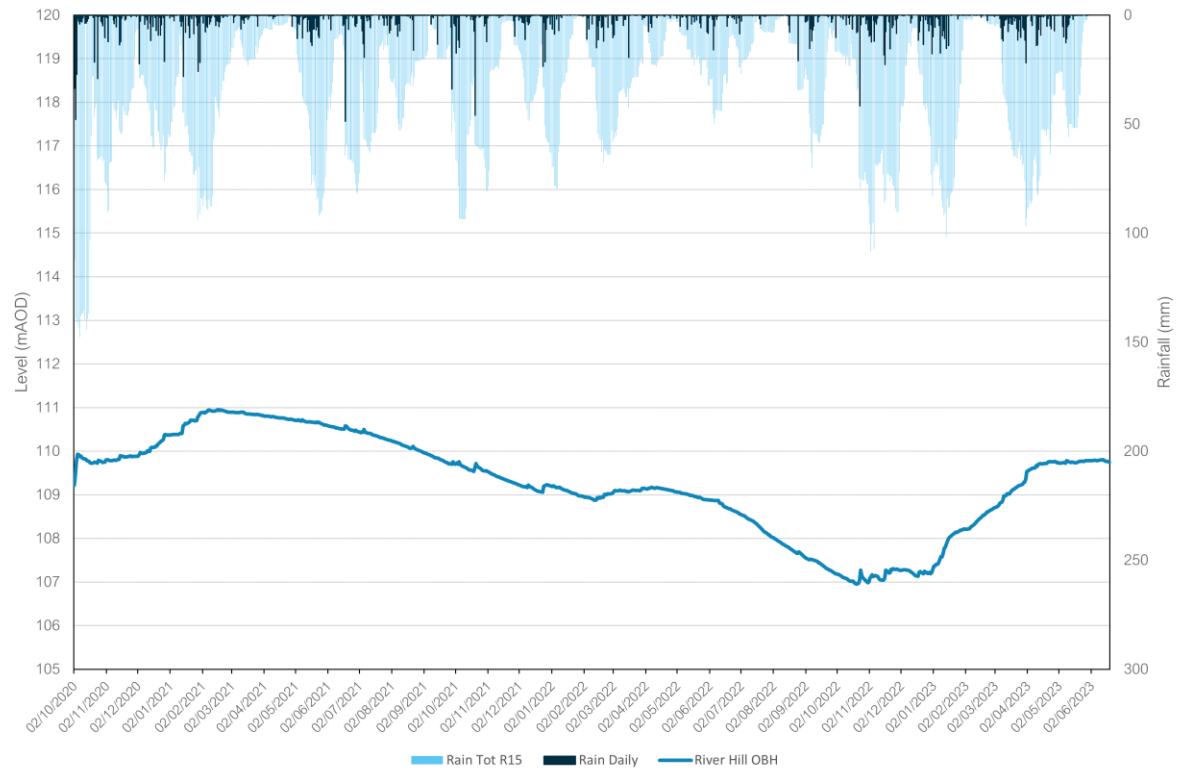


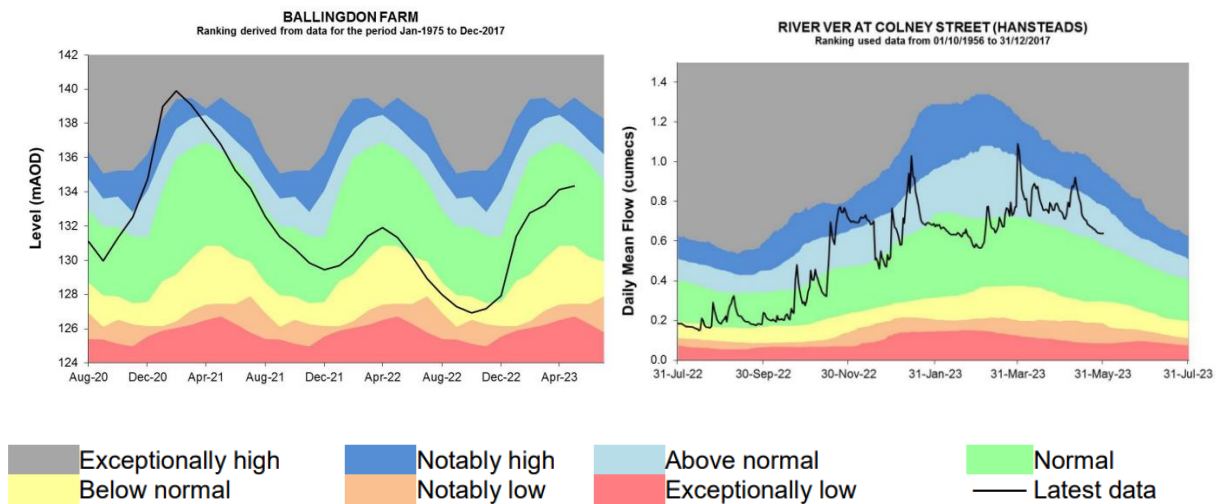
Figure 5D – River Hill OBH





In addition to these specific stations, the wider groundwater context is illustrated in the Water Situation Report for Chilterns East - Colne. The nearest groundwater reference station is Ballingdon Farm. This site shows groundwater levels at normal or below normal levels in 2022. Groundwater levels are observed to rise towards the end of the year and have been observed at normal levels in 2023, and at higher levels than equivalent periods in 2022. This can be seen in the figure below alongside the river indicator location at Colney Street on the River Ver.

Figure 6 – Water Situation Report



Extract from - [Water Situation Report \(publishing.service.gov.uk\)](https://publishing.service.gov.uk)

## Network Performance

Within the Maple Lodge catchment there are two sites detailed within the Environment Agency Consents Database which have an Event Duration Monitor (EDM) fitted. As part of the ongoing process of matching GISMP catchments to EDM sites, an additional EDM site which was not included in last year's addendum report has been identified in the Maple Lodge catchment. The overflow – '15 Coldharbour Lane, Bushey' – did not have any EDM spills recorded in 2021/22.

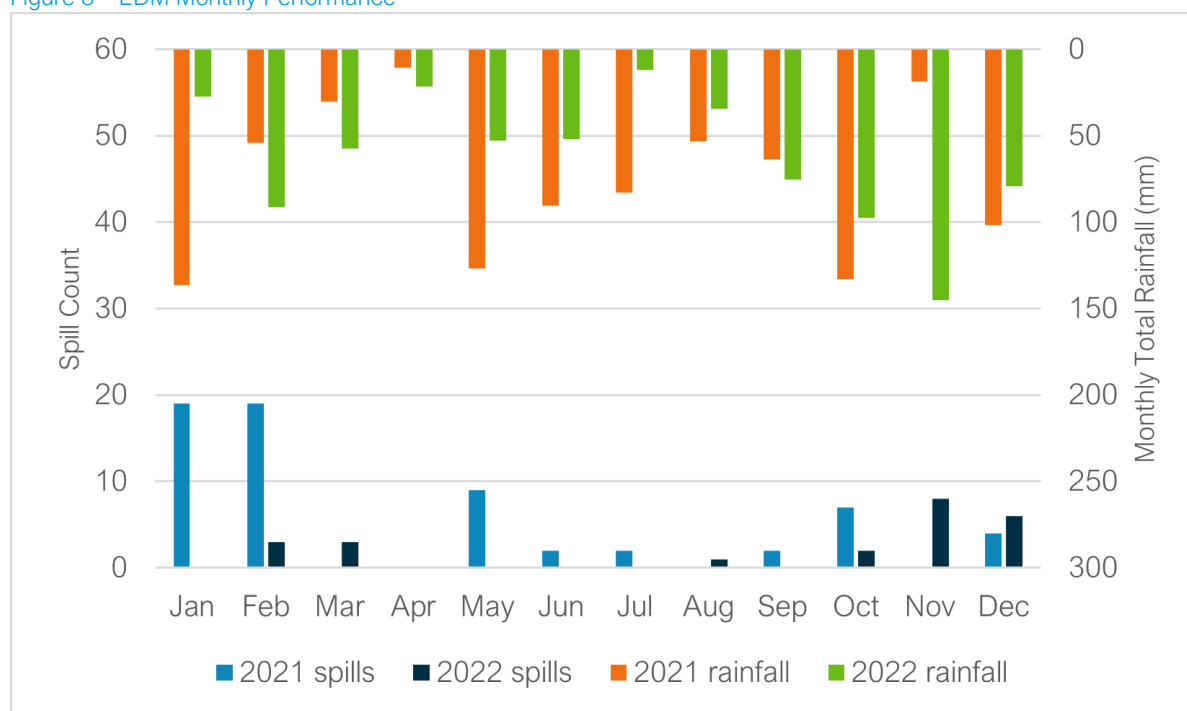
Table 7 below details the last 2 years performance of overflow 'Maple Lodge STW'.

Table 7 – Event Duration Monitoring

Overflow	2021		2022	
	Spills	Duration (hours)	Spills	Duration (hours)
Maple Lodge STW	64	960.00	23	204.12

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



The trend in spill performance across the two recorded years does show variation in spills, with a focus on spills during the autumn and winter months. The data suggests a wider relationship between rainfall, elevated groundwater levels and spill frequency. Significantly more EDM spills were recorded at Maple Lodge STW in January and February 2021, compared to the same period in 2022. The indicator site data shown in Figure 5, suggests groundwater levels in the catchment were significantly higher in January and February 2021, with Figure 6 suggesting they were notably/ exceptionally high over the period, compared to the normal levels observed January – February 2022.

## Investigations & Interventions

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

### Monitor Installations

The sewer depth monitor (SDM) programme supports long term groundwater understanding within GISMP catchments. Currently, there are a total of 29 monitors installed within the Maple Lodge catchment. There are currently 2 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 Maple Lodge 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	2 surveys
Sewer lining	90 metres	N/A
Patch lining	N/A	N/A
Manhole sealing	18 manholes	N/A
Manhole sealing plates	N/A	N/A
Manhole covers and frames replaced	N/A	N/A

In the next hydrological year, it is planned that 16 manholes in the floodplain will be raised. At the time of writing, funding decisions are being awaited to decide whether the work will be progressed.

Maple Lodge STW is also being upgraded to ensure a higher quality of treated effluent going to the river, and to increase the capacity of the storm tanks. This will reduce the need for untreated sewage discharges during storm conditions. A completion date for the schemes is yet to be confirmed.

## Summary

Indicator site data for the Maple Lodge catchment, suggest groundwater levels in the catchment were generally lower in 2022 than in 2021, with EDM data indicative of the role of groundwater infiltration on spills in the catchment. This hydrological year (October 2022 – September 2023), indicator site data suggests groundwater levels have reached higher levels than the previous hydrological year, and EDM data for 2023 will be analysed once available to continue to examine the relationship between groundwater infiltration and overflow spills in the catchment.

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 2024

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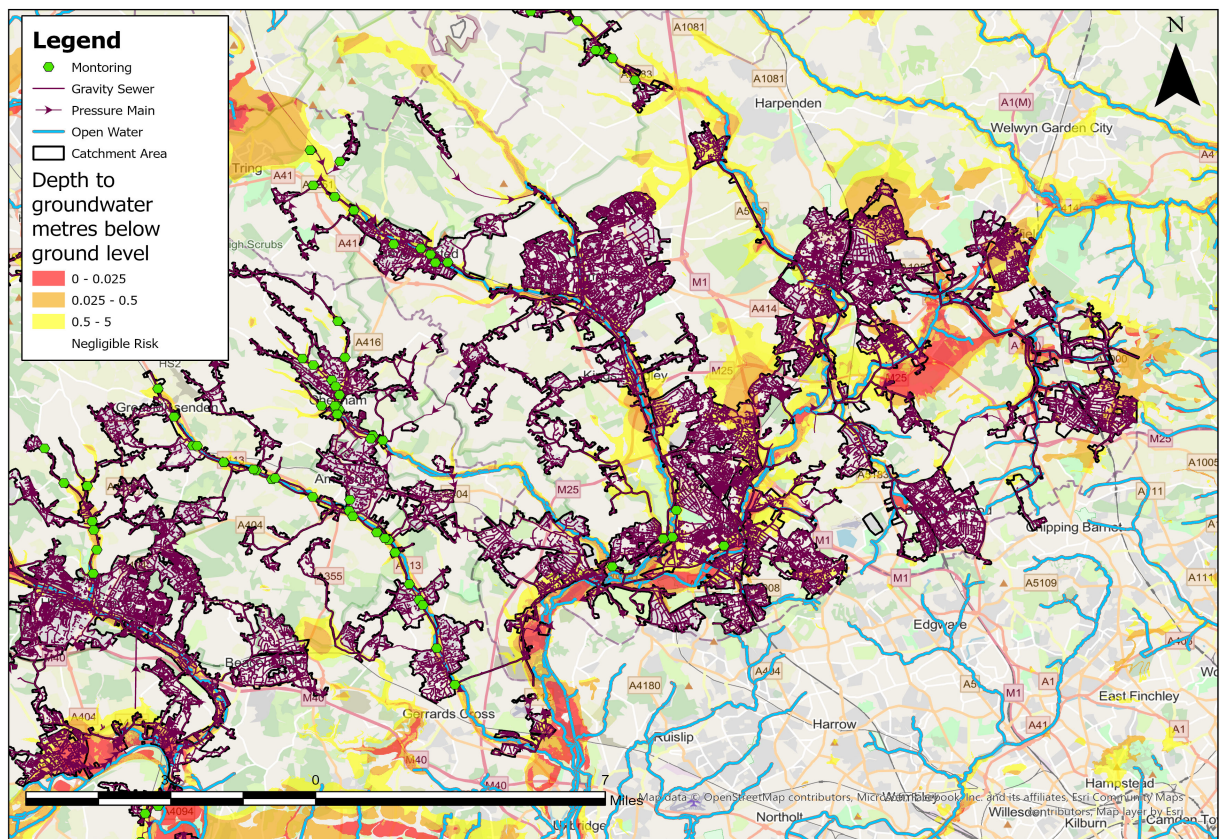


## Overview

This addendum to the Maple Lodge 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 – Maple Lodge Monitoring Plan



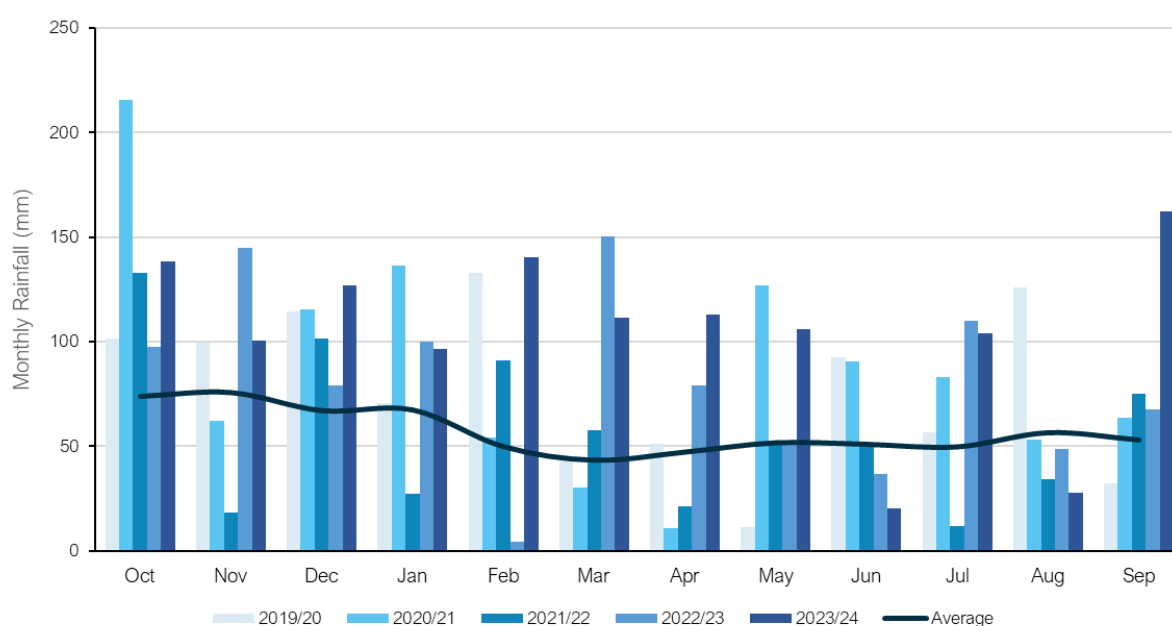
## Hydrological Review – 2023-2024

This section summarises the hydrological conditions across the Maple Lodge 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 1<sup>st</sup> to September 30<sup>th</sup>.

### 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 Northwood based on the period 1991-2020

The total rainfall for the 2023/24 hydrological year is 82% 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)
686	935	1043	677	971	1249

The Maple Lodge catchment is situated in the Chilterns East - Colne and North London water resources areas. It primarily sits in the Seaford Chalk and Newhaven Chalk Formations of carbonate material, the Lewes Nodular Chalk Formation of Carbonate Material and the London Clay Formation of coarse to fine grained slurries of debris. The chalk formations are designated principal aquifers within the UK.

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

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

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Figure 5A – River Colne, London Colney

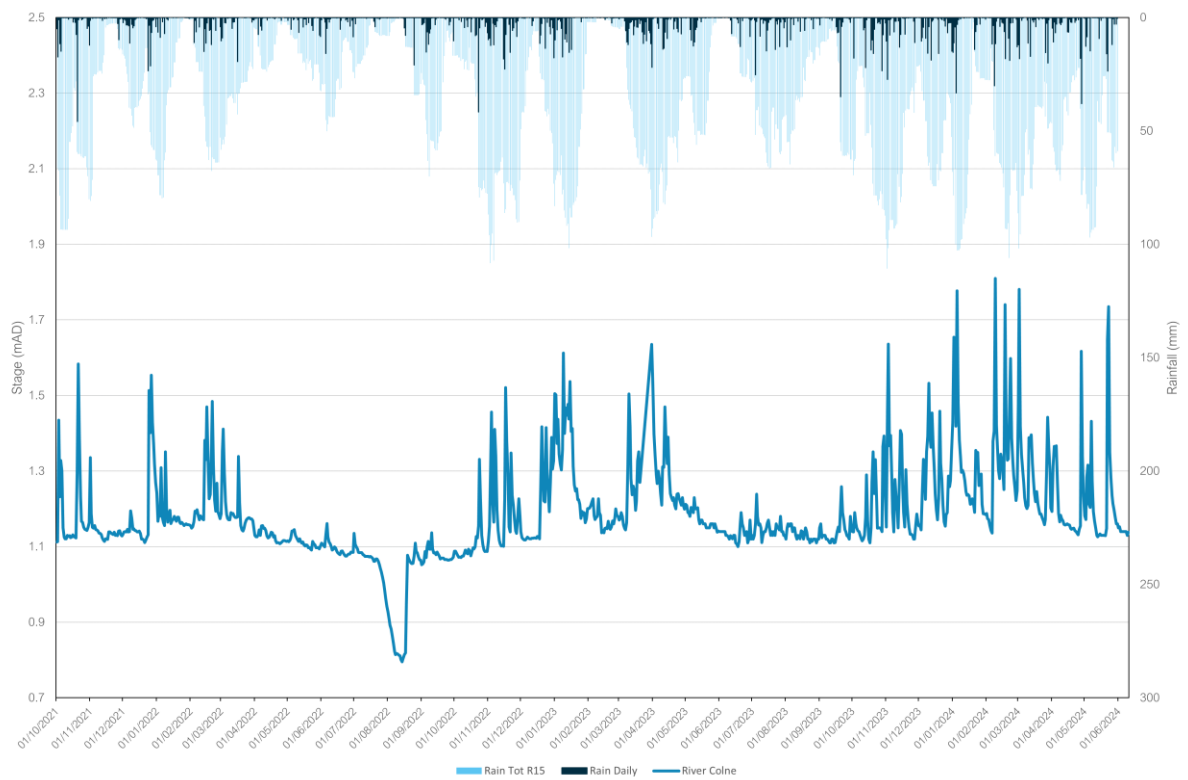


Figure 5B – River Gade, Hemel Hempstead, Bury Mill

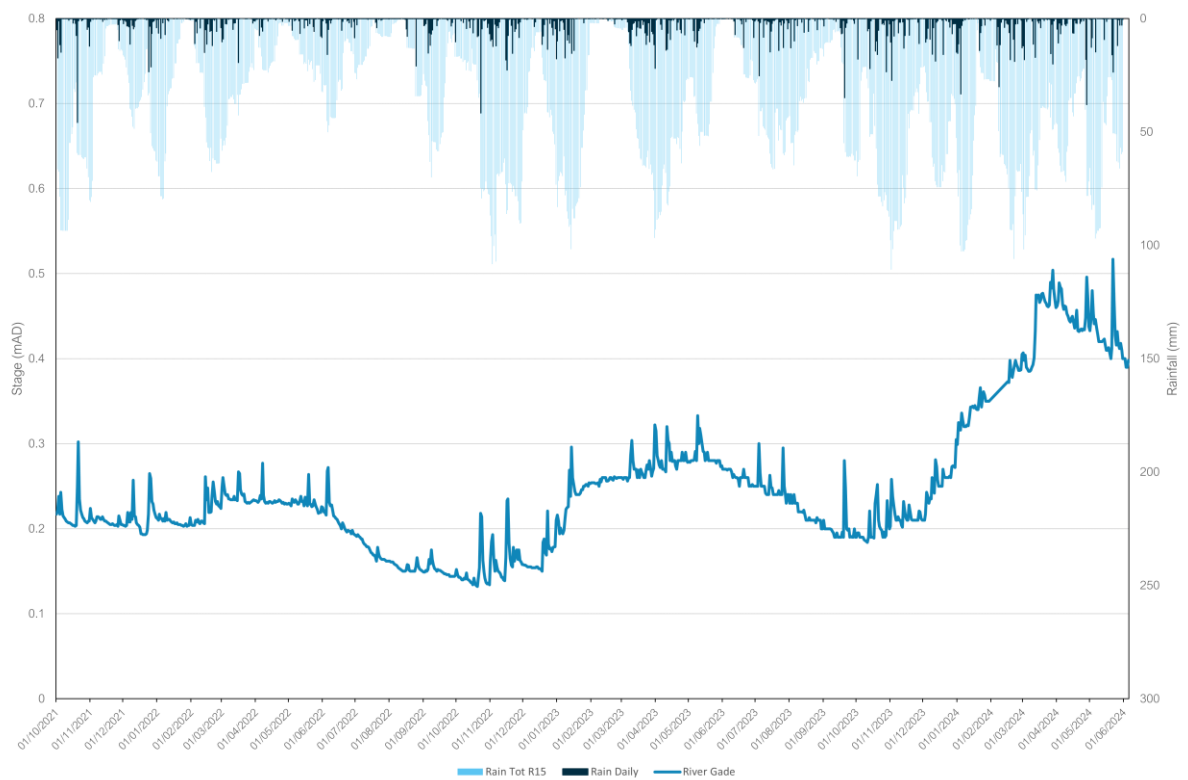


Figure 5C – River Misbourne, Missenden

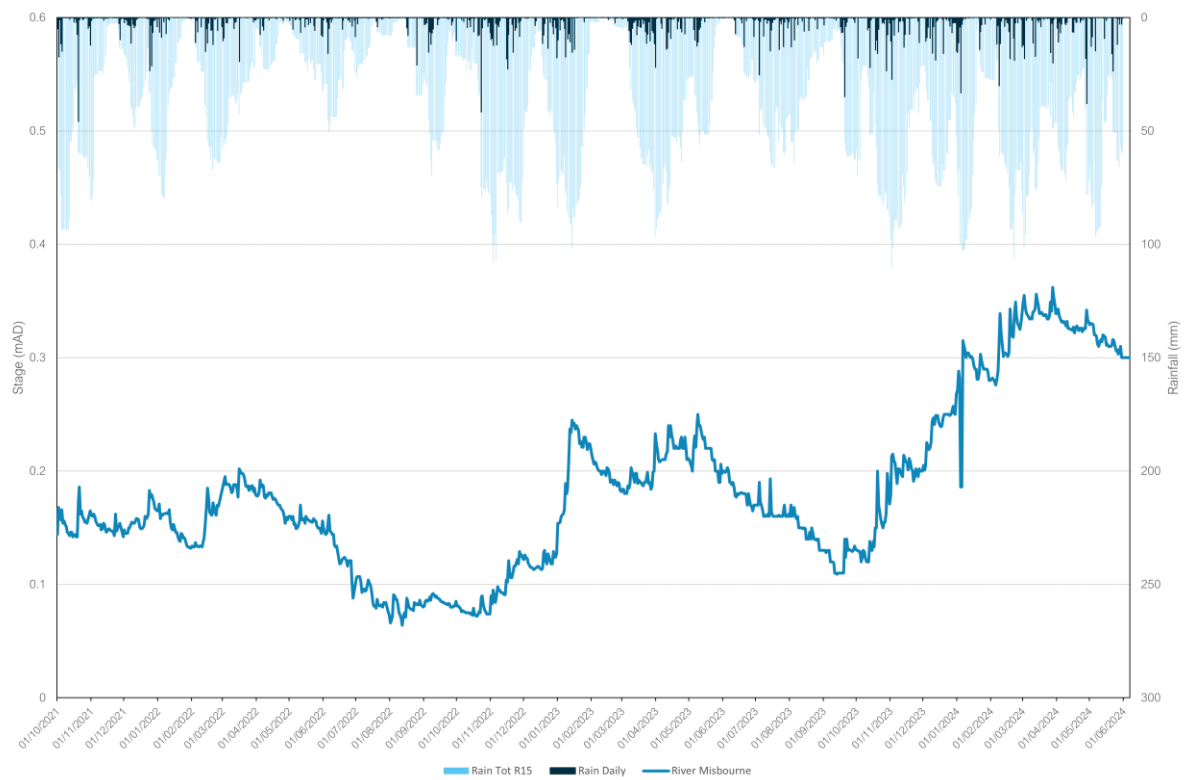
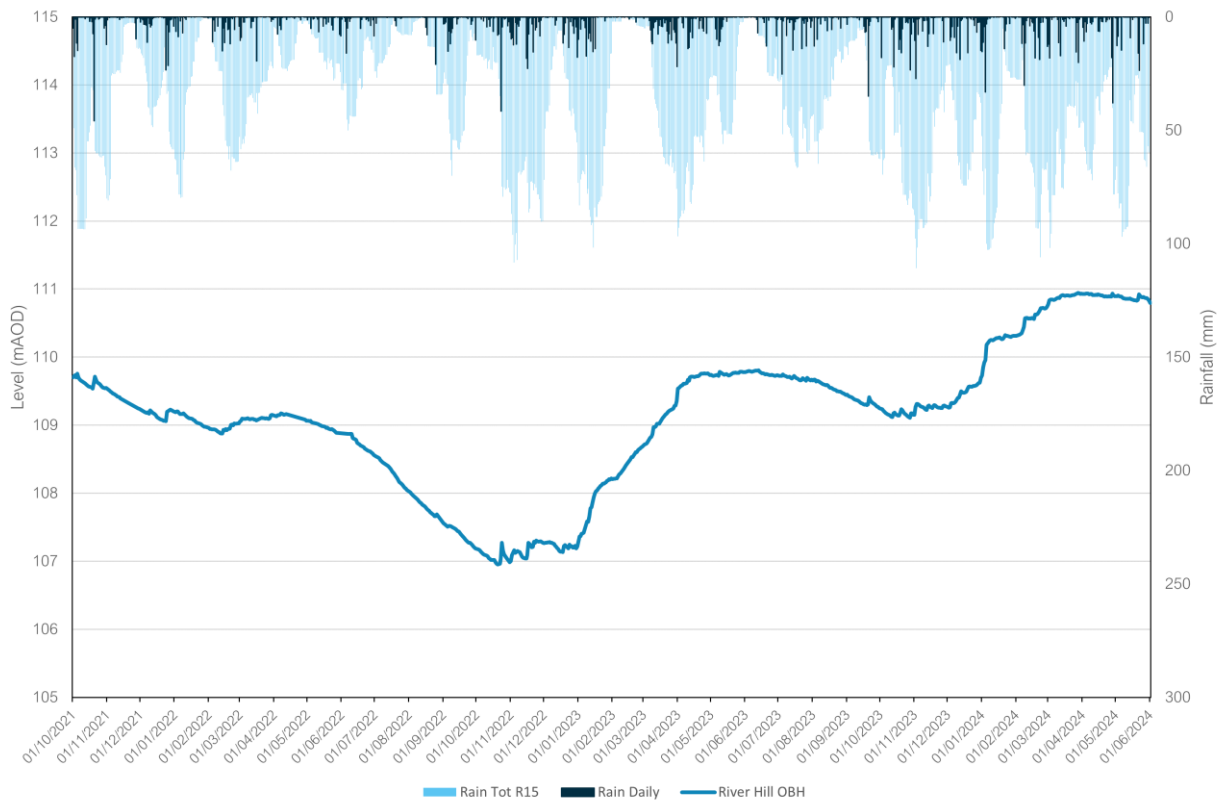
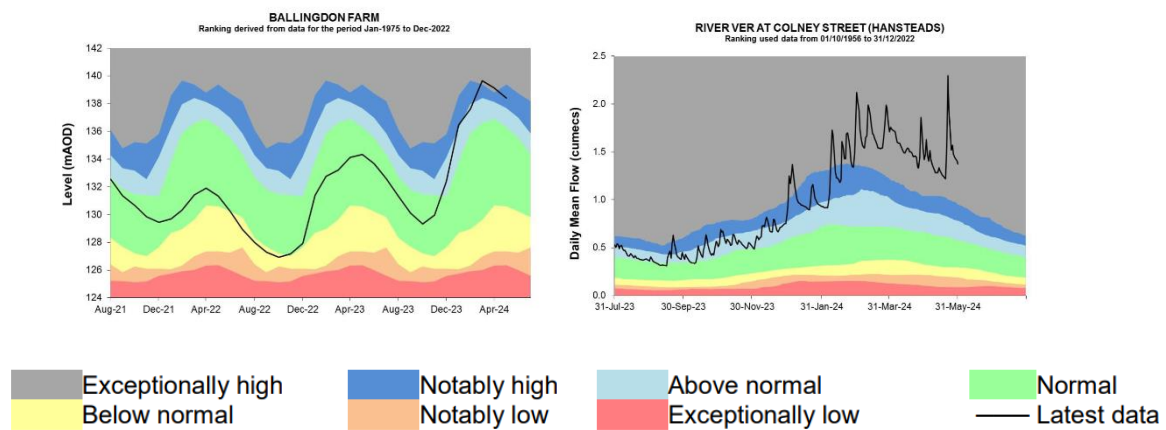


Figure 5D – River Hill OBH



In addition to these specific stations, the wider groundwater context is illustrated in the Water Situation Report for Chilterns East - Colne. The nearest groundwater reference station is Ballingdon Farm. This site shows groundwater levels at normal levels throughout 2023. Groundwater levels are observed to rise towards the end of the year and have been observed at above normal, notably high and exceptionally high levels in 2024. This can be seen in Figure 6 alongside the river indicator location at Colney Street on the River Ver.

Figure 6 – Water Situation Report



Extract from - [Water Situation Report \(publishing.service.gov.uk\)](https://publishing.service.gov.uk)



## Network Performance

Within the Maple Lodge catchment there are two sites detailed within the Environment Agency Consents Database which have an Event Duration Monitor (EDM) fitted. The overflow – ‘15 Coldharbour Lane, Bushey’ – did not have any EDM spills recorded in 2022 and 2023.

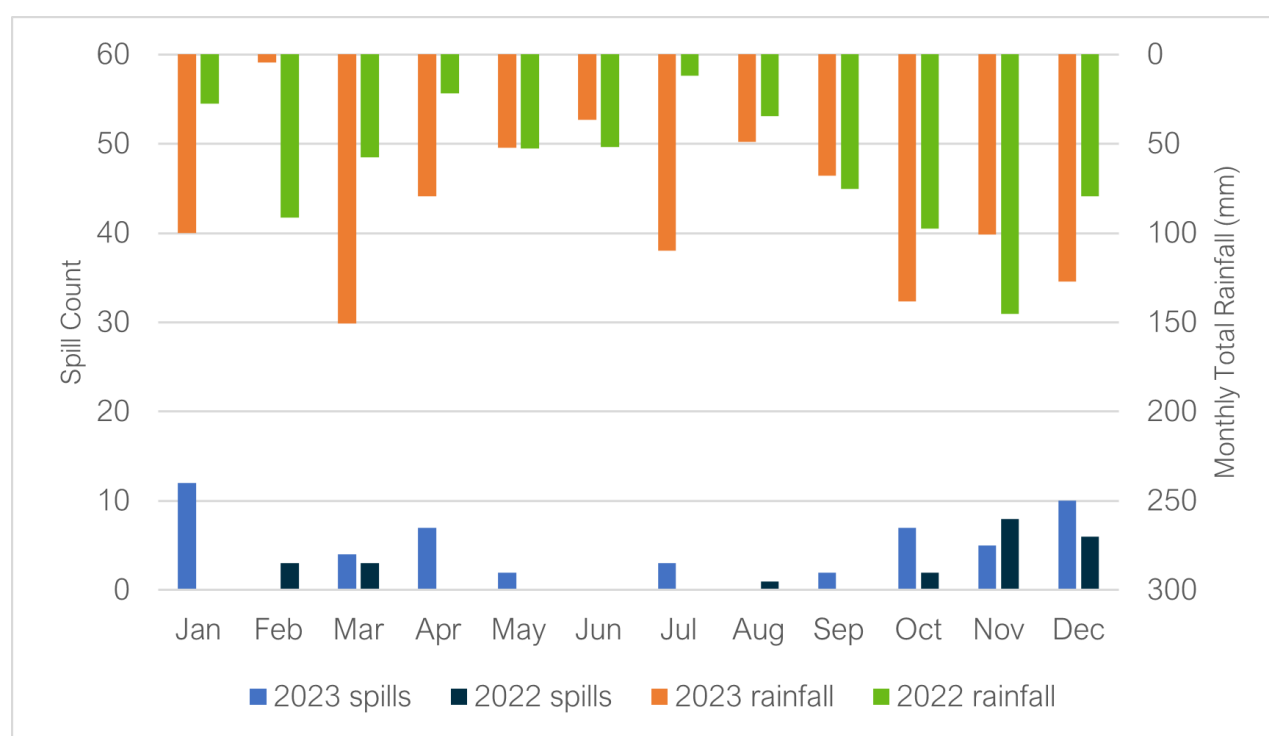
Table 7 below details the last 2 years performance of overflow ‘Maple Lodge STW’.

Table 7 – Event Duration Monitoring

Overflow	2022		2023	
	Spills	Duration (hours)	Spills	Duration (hours)
Maple Lodge STW	23	204.12	52	650.50

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 ‘Maple Lodge STW’



The trend in spill performance across the two recorded years does show variation in spills, with a focus on spills during the autumn and winter months. The data suggests a wider relationship between rainfall, elevated groundwater levels and spill frequency. For example, despite a significantly higher rainfall total in March 2023 compared to March 2022, a similar number of spills were recorded. The indicator site data shown in Figure 5, suggests that groundwater levels in the catchment were similar in March 2022 and March 2023. The occurrence of spills in the summer months, is also indicative of spills occurring in the catchment during prolonged or intense rainfall events, outside of periods of significantly elevated groundwater levels.

## Investigations & Interventions

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

### Monitor Installations

The sewer depth monitor (SDM) programme supports long term groundwater understanding within GISMP catchments. Currently, there are a total of 31 monitors installed within the Maple Lodge 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 Maple Lodge catchment in the 2023/24 Hydrological Year, as well as works undertaken in the previous two hydrological years.

Table 9 – Works Undertaken in the 2023/24, 2022/23 & 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	408m
Look and lift survey	N/A	2 surveys	N/A
Sewer lining	90 metres	N/A	N/A
Patch lining	N/A	N/A	N/A
Manhole sealing	18 manholes	N/A	N/A
Manhole sealing plates	N/A	N/A	N/A
Manhole covers and frames replaced	N/A	N/A	N/A

The ATAC (temporary bio-filter units) in the Maple Lodge catchment at Amersham Storm Tanks were deployed in the 2023/24 Hydrological Year. Two of the three units were set up on 03/01/2024 and the final one on 19/01/2024. In addition to the ATAC units, a mega unit filtration system was operational in the catchment from 14/03/2024, this has a higher capacity than the ATAC units. Sampling was carried out every other day, readings showed a mass drop in dissolved oxygen at the point of interest. High ammonia (NH<sub>3</sub>) recordings were also seen (0.03 – 0.05 mg/l) and ammonium cation (NH<sub>4</sub>) spiked, resulting in a CAT 1 pollution event. In July 2024, the ATAC units were still operational and being turned off and on as required during heavy rainfall events. The mega unit was decommissioned 08/07/2024.

Maple Lodge STW is being upgraded to ensure a higher quality of treated effluent going to the river, and to increase the capacity of the storm tanks. This will reduce the need for untreated sewage discharges to the environment. A completion date for the schemes is yet to be confirmed.

It is expected that Maple Lodge STW will meet all government targets for storm overflows by 2035 – 2040 and that 15 Coldharbour Lane, Bushey CSO will meet all government targets for storm overflows by 2040 – 2045.

## Proposed Flow Management Interventions

### Proposed Filtration and Over Pump Arrangements at Amersham Tanks

Proposals are being developed to alter the existing Amersham storage tanks, adjacent to the Amersham Household Waste and Recycling Centre to accommodate the temporary set ups required in the event of excessive flows to minimise the impact of unavoidable sewage escapes to the River Misbourne.

The current proposal is for the installation of a temporary 3mm filtration unit to be fed by two overpumps from the storm tanks. From this filtration unit, flow will then gravitate to micro filtration units before outfalling to the River Misbourne via a new designated outfall. This setup will allow the minimise the debris and biological loading from wastewater to be discharged to the River Misbourne. This setup will only be utilised in the cases of excessive flows within the network to mitigate against property flooding.

### Proposed new tankering set up adjacent to High Street, Chalfont St Peter

To mitigate against the flooding on Chalfont St Peter high street a dedicated tankering point is proposed to be constructed on the A413 off the junction with High Street. This will allow tankers to draw off excessive flows from the main sewer located on High Street. Temporary pumps will be deployed during high flows to pump the flow to tankers stationed on the A413 adjacent to the High Street to mitigate against the previously observed flooding in this area and help minimise disruption.

## Summary

Indicator site data for the Maple Lodge catchment, suggests groundwater levels in the catchment were generally higher in 2023 than in 2022, with EDM data indicative of the role of groundwater infiltration on spills in the catchment. This hydrological year (October 2023 – September 2024), indicator site data suggests groundwater levels have reached higher levels than the previous hydrological year, and EDM data for 2024 will be analysed once available to continue to examine the relationship between groundwater infiltration and overflow spills in the catchment.

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.



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