



# Groundwater Impacted System Management Plan

Fyfield, River Kennet

April 2021



It's everyone's water

# Version control

Version	Date	Amendment	Author	Checked	Reviewed
1-d1	March 2021	Draft for EA	DJ	SE	APH
1-V1	April 2021	Version 1	DJ	APH	JO
1-V2	July 2021	Update to introductory text and infiltration potential figures	DJ	APH	JO
1-V3	July 2021	Update to infiltration potential figures	DJ	APH	JO
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

# Table of contents

Introduction	4
Brief description of the Fyfield system	6
Problem characterisation	6
Anticipated unavoidable discharges	8
General outline plan & timescale	9
Fyfield Infiltration Management Plan	12
High level approach statement	12
Investigations	12
Monitoring	13
Mitigation and Updates	13
Appendix	14
Investigations & remedial work undertaken since 2019/20 and future plans	14
Addendum - Annual Update 2022	17
Addendum - Annual Update 2023	26
Addendum - Annual Update 2024	35

# 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<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 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<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 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

<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 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 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 the Fyfield system

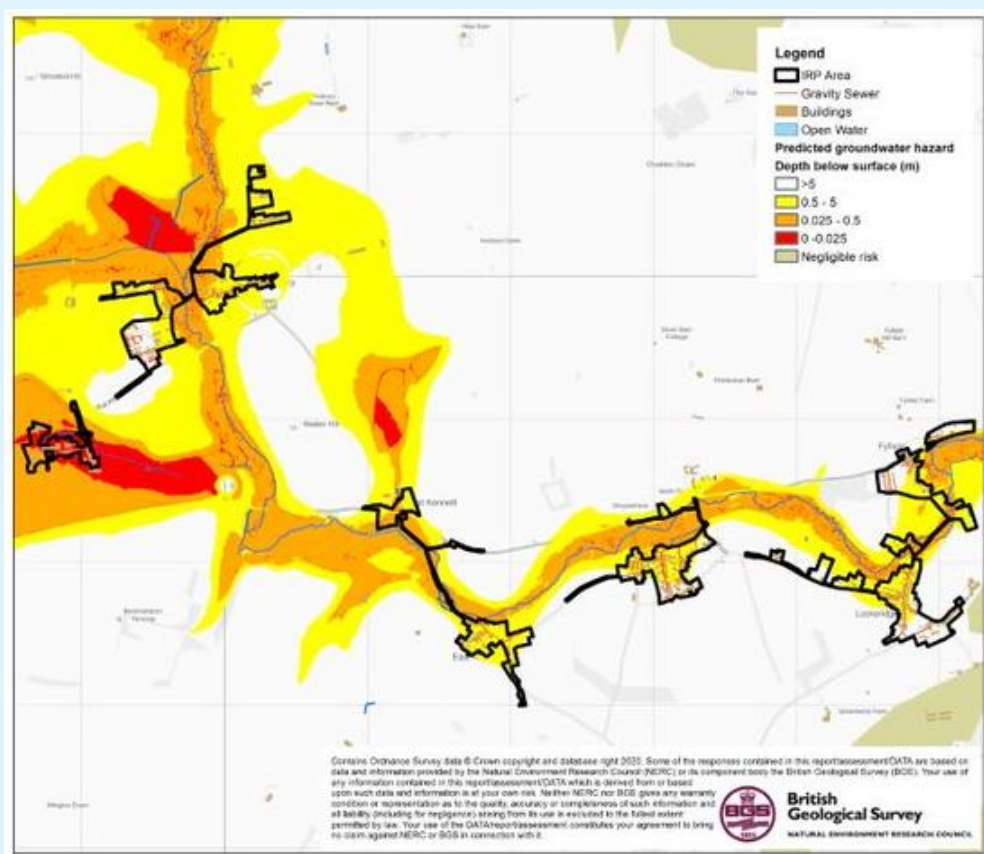


Figure 1.0 – Fyfield catchment

Fyfield lies on the River Kennet in Wiltshire, England, 2km east of Marlborough. Fyfield serves a population equivalent<sup>3</sup> of 1,522 with a predominantly separate sewerage network totaling some 23km in length excluding private drains and sewers. The extent of the catchment is shown in Figure 1.0 above. The system comprises the villages of Fyfield, Lockeridge, West Overton, East Kennet, West Kennet, Avebury and Beckhampton.

## Problem characterisation

Groundwater has potential to enter our sewers when levels are high which reduces their capacity and increases their risk of the network becoming overwhelmed. There's a strong link between the rising river levels that cause rising groundwater levels, particularly adjacent to the River Kennet and its tributaries, and the drainage issues some of our customers have experienced, including sewer flooding and restricted use of their toilets and bathrooms.

<sup>3</sup> Population equivalent or 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.

In recent years the foul sewerage system in the Fyfield catchment has become overwhelmed, following prolonged and heavy rainfall and raised groundwater levels. This has resulted in certain properties suffering from sewer flooding and restricted toilet use, as well as highway flooding. The sewerage system is identified on the public sewer records as being a separate foul system, rather than a combined system. It should therefore, in theory, only be accepting 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 the foul system has surcharged historically because of a combination of groundwater infiltration, surface water run-off from saturated fields and active springs, surface water inundation from highways and public spaces, surface water misconnections and river water overflowing from the River Kennet and other local watercourses.

The Fyfield system suffers from these additional flows in the foul sewer in most winters, not just the 'high groundwater' events across the Thames Valley region and traditionally is one of the systems in the Thames Valley region that reacts to high groundwater earliest within the wet winter periods.

'Lift and Look' and CCTV surveys of the sewer network found a number of locations where unwanted flows are entering our network through cracks and other defects. The CCTV footage that we recorded found groundwater entering our network around the joints in the sewer pipe at several locations in the areas served by the Fyfield system.

The impact of the groundwater infiltration and high flows in Fyfield has overloaded the gravity sewers, sewage pumping stations in the local villages, especially East Kennet and West Overton and at the STW. During most winter periods tankers operate 24 hours a day from East Kennet and West Overton sewage pumping stations to maintain services to customers.

A number of our sewerage systems include for permitted 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 systems.

During the winter months, following prolonged heavy rainfall, we experience increased rates of flow arriving at the STW which on occasions may impact the performance of the STW.

Our permit conditions for Fyfield 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".***

The root causes of sewer surcharges are therefore numerous and resolution of issues complex, requiring all stakeholders responsible for drainage in the catchment to work together to resolve them.

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 Wiltshire County Council as Lead Local Flood Authority, County 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 manholes causing pollution incidents.

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

No mitigation in the form of temporary overflows has been undertaken in this system.



# General outline plan & timescale

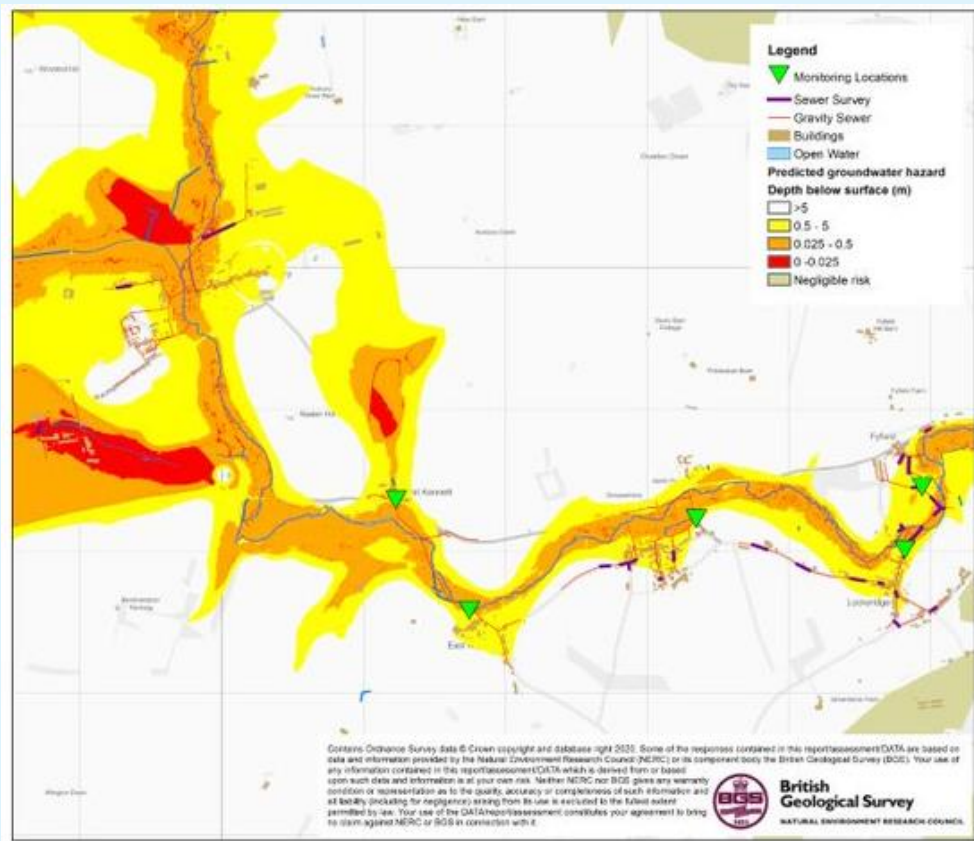


Figure 2.0 – Fyfield monitoring and infiltration zones

Key to bringing the impact of groundwater infiltration under control is an enhanced monitoring regime. We have identified and have installed several telemetered depth monitor locations around the Fyfield system – see Figure 2.0.

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 Fyfield 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 have been 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 Fyfield.

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	JBA have been engaged to undertake modelling activities to identify the areas to be targeted for sealing in the 56 systems in the Thames Water region identified as being impacted by infiltration.
Install monitors	2020-2023	Monitors have been installed in the zones 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 ‘minor works’ 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 would 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 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.

# Fyfield Infiltration Management Plan

As detailed above the impact of infiltration is experienced in the network and at the STW.

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

## High level approach statement

For Fyfield 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);
  - Installed additional monitoring to back up the analysis and to aid focusing of locations for identification of infiltration (2020 to 2023). Each year we will assess the completeness of monitoring and if required add to or modify the current locations.
  - Undertaken 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 (Summer/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 planning cycles.

## Investigations

As mentioned above JBA Consulting have supported 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) have included 'look & lift' surveys, CCTV and where necessary dye tracing to confirm connectivity.

<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.



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

## Monitoring

Sewer Depth Monitors have been installed in the catchment in 2020/2021 (see Figure 2.0). 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.

These units 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 the Fyfield system we will continue to tanker where required but do not envisage needing to undertake further mitigation work within the network at this stage.

## Updates

Work on the Groundwater infiltration management plan will continue, and we will aim to provide updates in October 2022 and annually in October thereafter.

# Appendix

## Groundwater infiltration potential analysis

The table below presents a summary of the JBA groundwater infiltration analysis which identifies the sewers and manholes which are likely to be vulnerable to groundwater infiltration.

Sewer Length by Groundwater Infiltration Risk Zones

Risk category	Description	Length (km)	Percentage
High	Predicted groundwater extreme >1m above pipe invert	5.5	35.2
Medium	Predicted groundwater extreme 0-1m above pipe invert	2.0	12.6
Low	Predicted groundwater extreme 0-1m below pipe invert	2.1	13.2
Very Low	Predicted groundwater extreme >1m below pipe invert	6.2	39.0
Total		15.9 <sup>6</sup>	100.0

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	34	10.0
Medium	Inundation risk in 1% AEP fluvial or pluvial event	37	10.8
Low	Inundation risk in 0.1% AEP fluvial or pluvial event	36	10.5
Very Low	All other manholes	234	68.7
Total		341	100.0

14

<sup>6</sup> 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

At the time of writing we are currently on site undertaking lift and look and CCTV surveys in the Fyfield 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

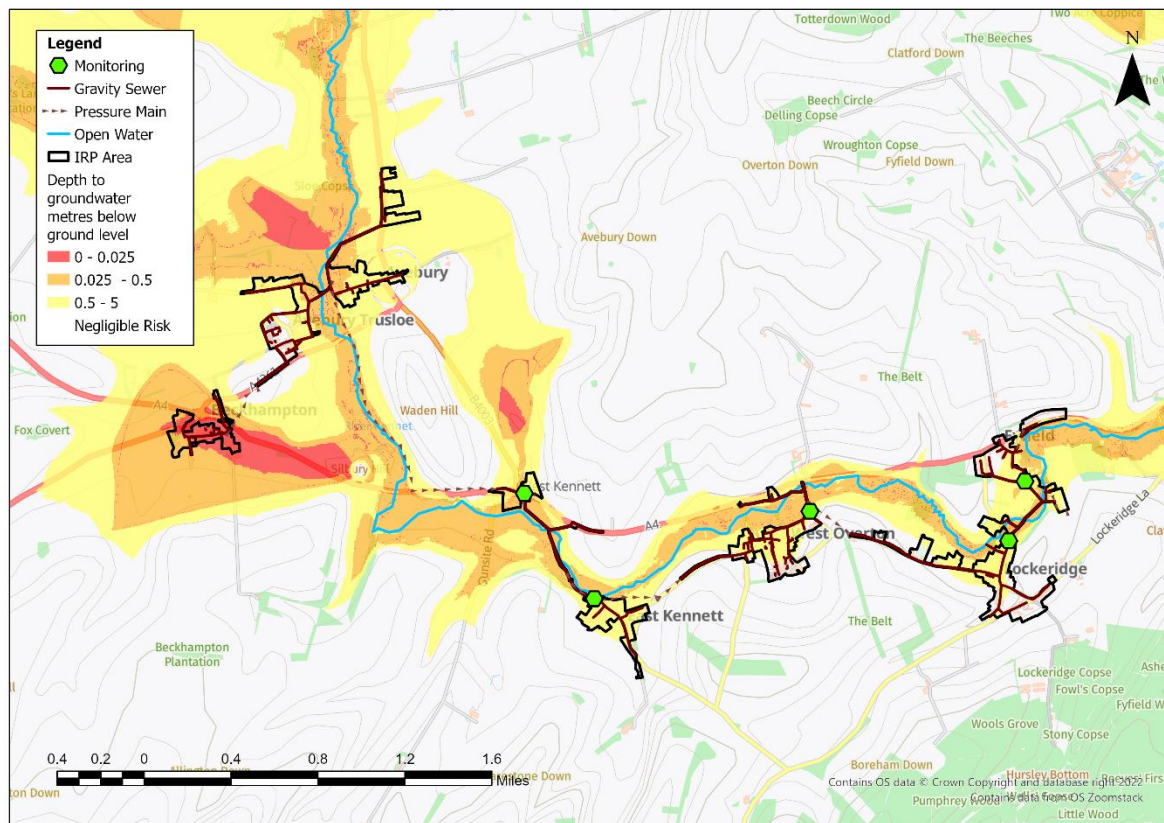
Overview	2
Hydrological Review – 2021-22	3
Network Performance	7
Investigations & Interventions	8
Summary	9

## Overview

This addendum to the Fyfield 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 – Fyfield Monitoring Plan



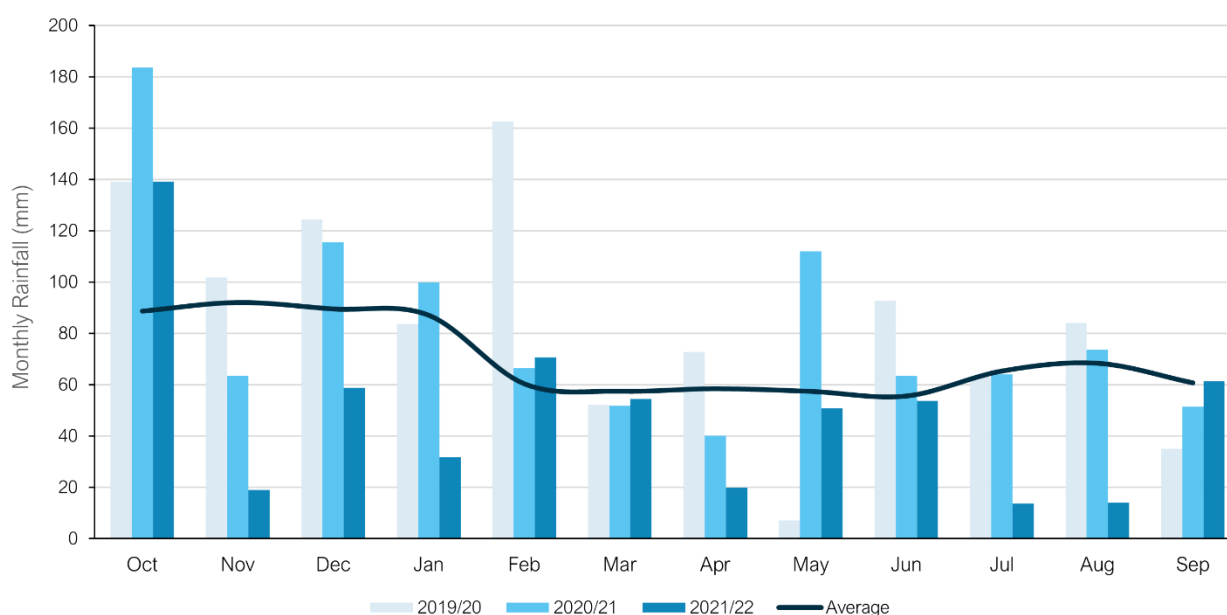
## Hydrological Review – 2021-2022

This section summarises the hydrological conditions within the Fyfield 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 Marlborough 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)
841	1018	985	594

## Groundwater / Local River Level

The Fyfield catchment is situated in the Berkshire Downs water resources area. The extended Fyfield catchment is situated across a number of different rock types within its base geology; however, the predominant rock type is sedimentary bedrock within the Holywell Nodular Chalk formation and New Pit Chalk formation. The Fyfield Catchment and all of its base geology lies within a designated principal aquifer within the UK.

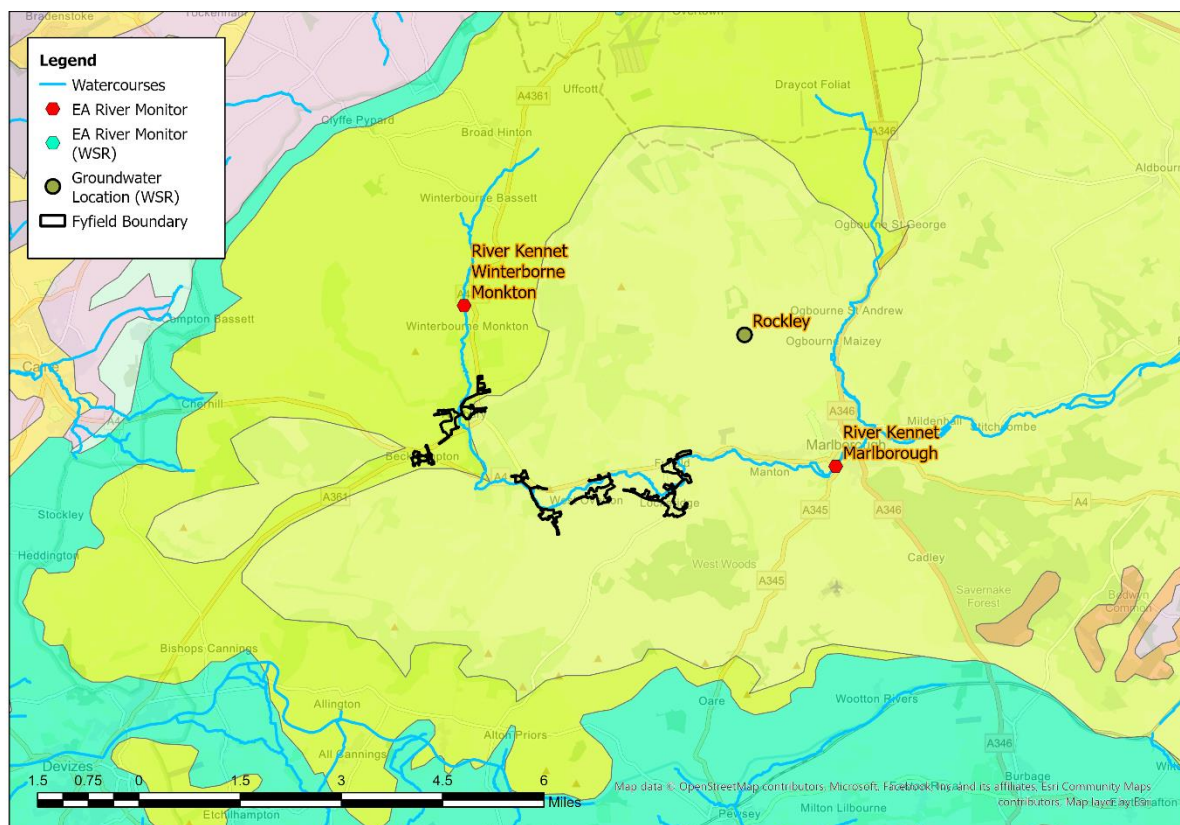
The Environment Agency has gauging stations on local watercourses measuring stage and observation boreholes measuring groundwater levels locally to the catchment which can be used to provide indicative local groundwater performance.

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

- River Kennet, Marlborough.
- River Kennet, Winterborne Monkton.

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 Kennet, Marlborough

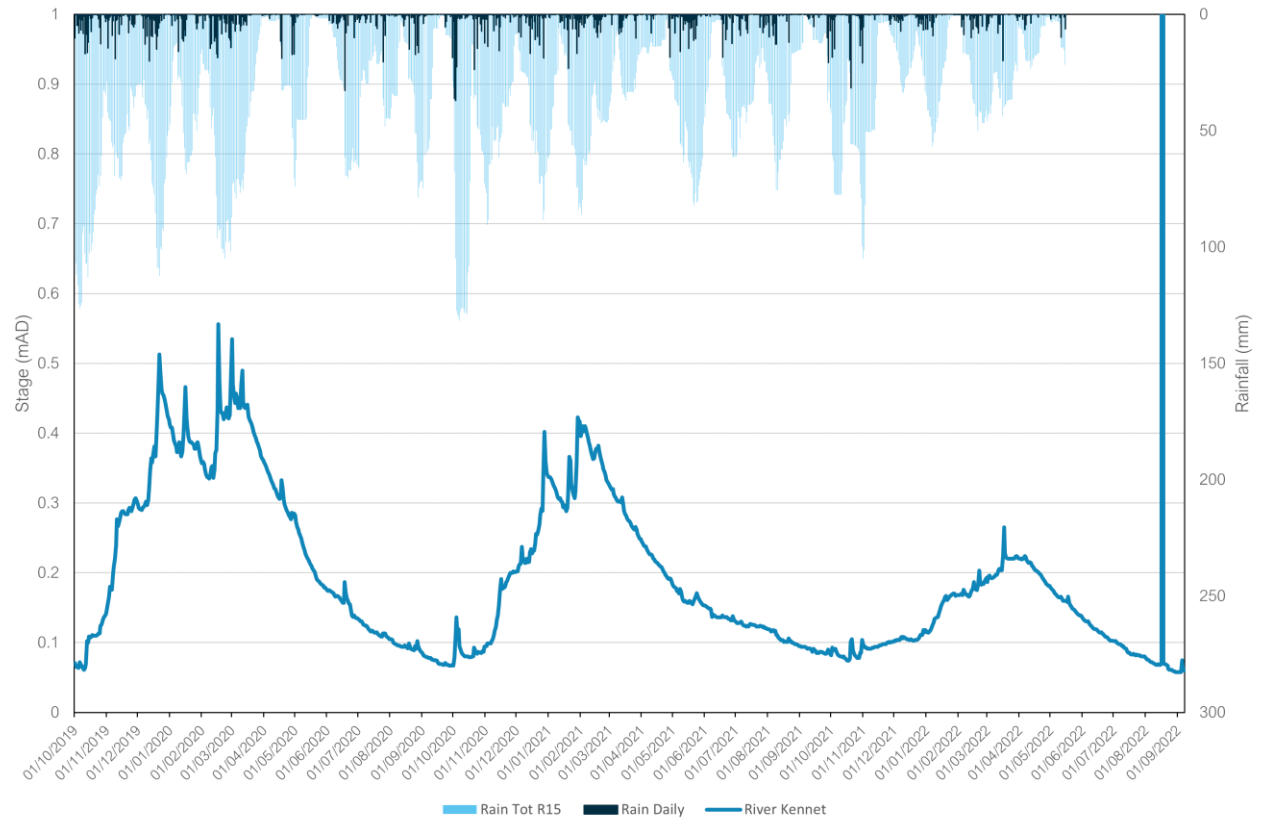
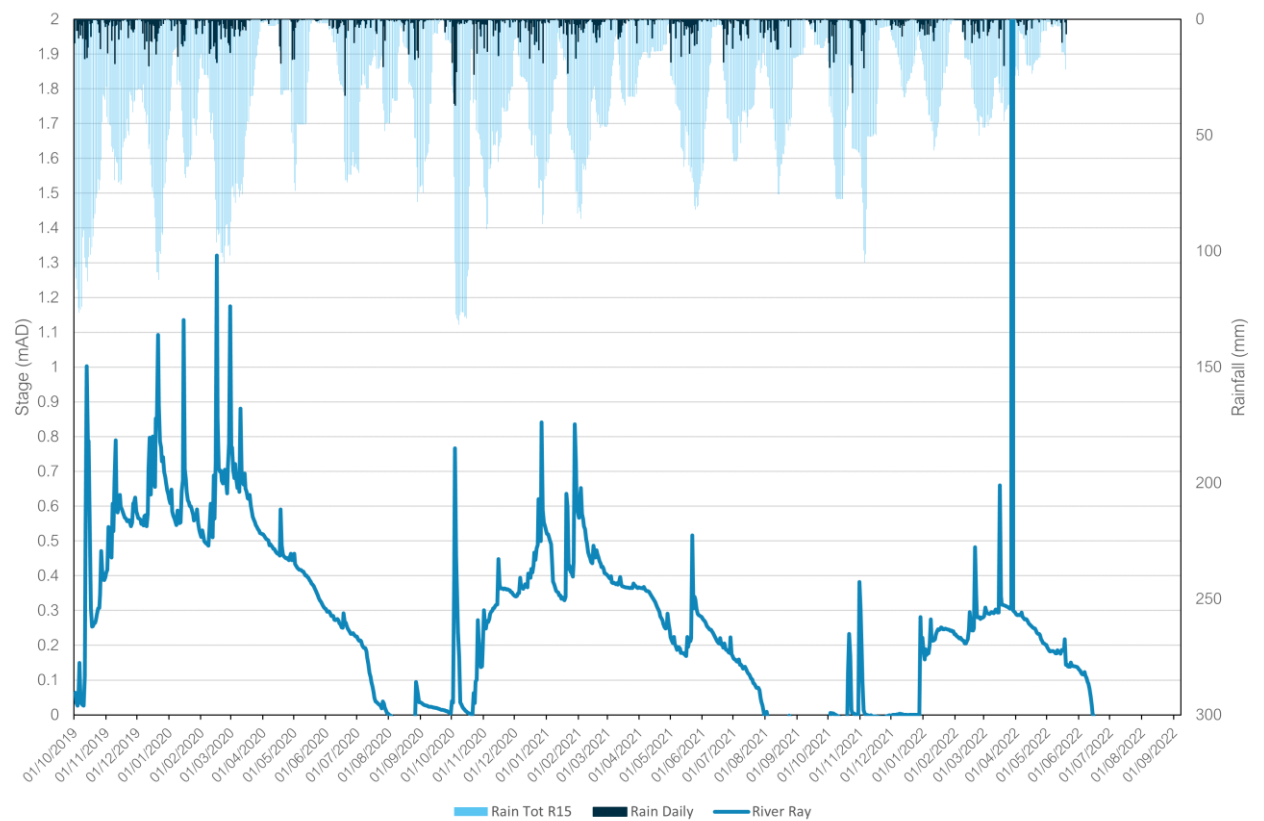
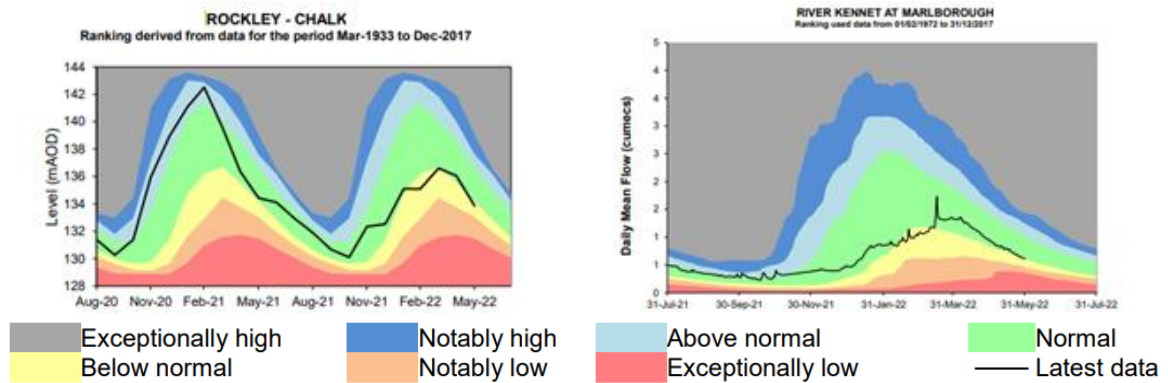


Figure 5B – River Kennet, Winterborne Monkton



In addition to these specific stations, the wider groundwater context is illustrated in the Water Situation Report for Berkshire Downs. The nearest groundwater reference station is Rockley. This site shows significantly lower overall groundwater than the previous year. This can be seen in the figure below alongside the river indicator Marlborough on the River Kennet.

Figure 6 – Water Situation Report



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

## Network Performance

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

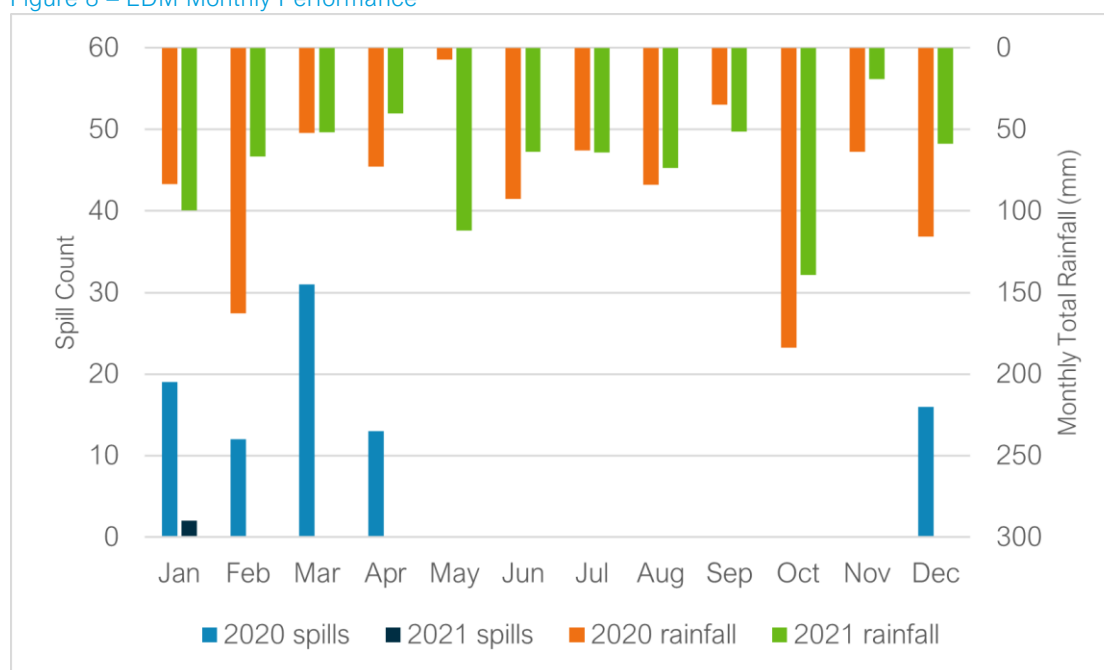
Table 7 below details the last 2 years performance of overflows within the catchment.

Table 7 – Event Duration Monitoring

Overflow	2020		2021	
	Spills	Duration (hours)	Spills	Duration (hours)
Fyfield STW	91	1764.04	2	11.0

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 an overall focus on spills during the winter and early spring months, when groundwater levels are higher, suggesting a wider relationship between rainfall, elevated groundwater levels and spill frequency. However, the root cause of the much higher spill frequency in 2020 compared to 2021, has been identified as an operational issue at Fyfield STW. Therefore, EDM spill data for future years will be compared against rainfall and groundwater levels, in order to allow a more definitive relationship between rainfall, elevated groundwater levels and spill frequency to be established.

## 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 5 monitors installed within the Fyfield 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 Fyfield 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
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, the larger scale survey, identification and remediation of the sewerage network has not been possible within the 2021/2022 hydrological year.

## Summary

Rainfall in the Fyfield catchment over the 2021/22 hydrological year has been below average, with groundwater levels in the aquifer beneath Fyfield 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 fact that no EDM spills were recorded at Fyfield STW at the start of this hydrological year (October – December 2021).

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

## Table of contents

Overview	2
Hydrological Review – 2022-23	3
Network Performance	7
Investigations & Interventions	8
Summary	9

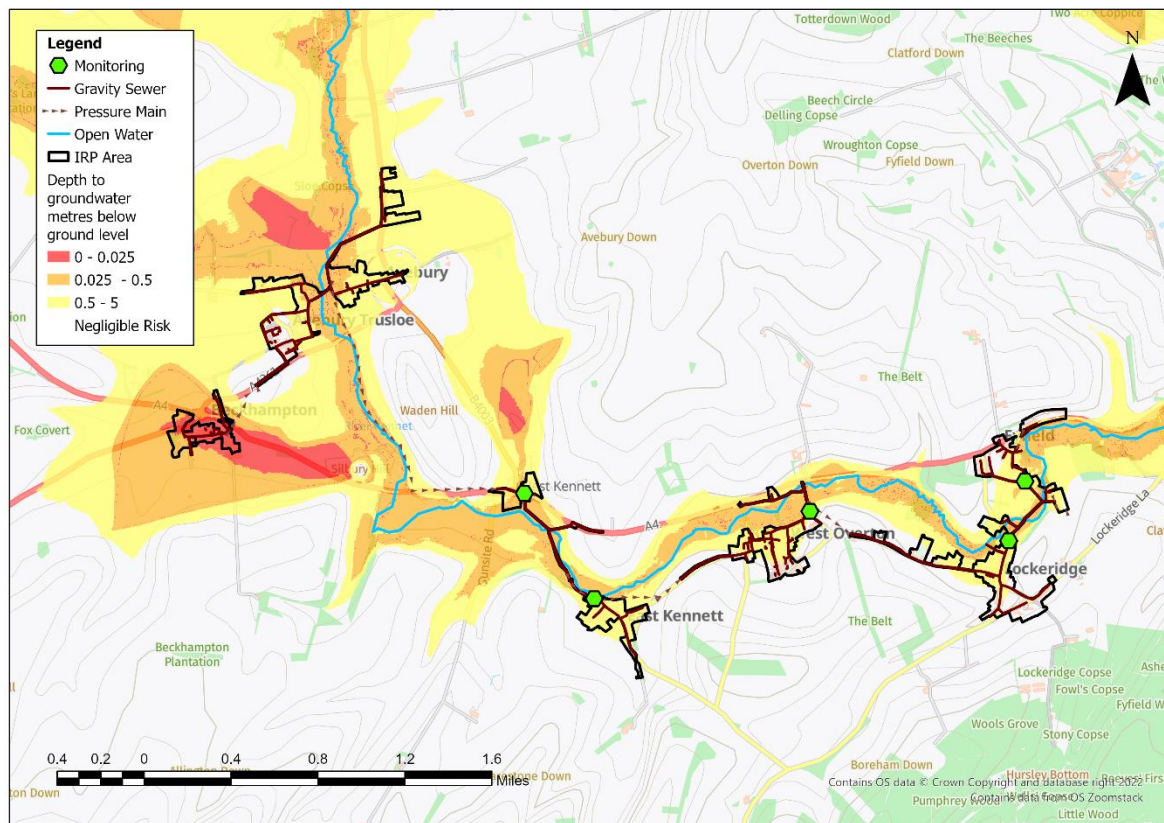


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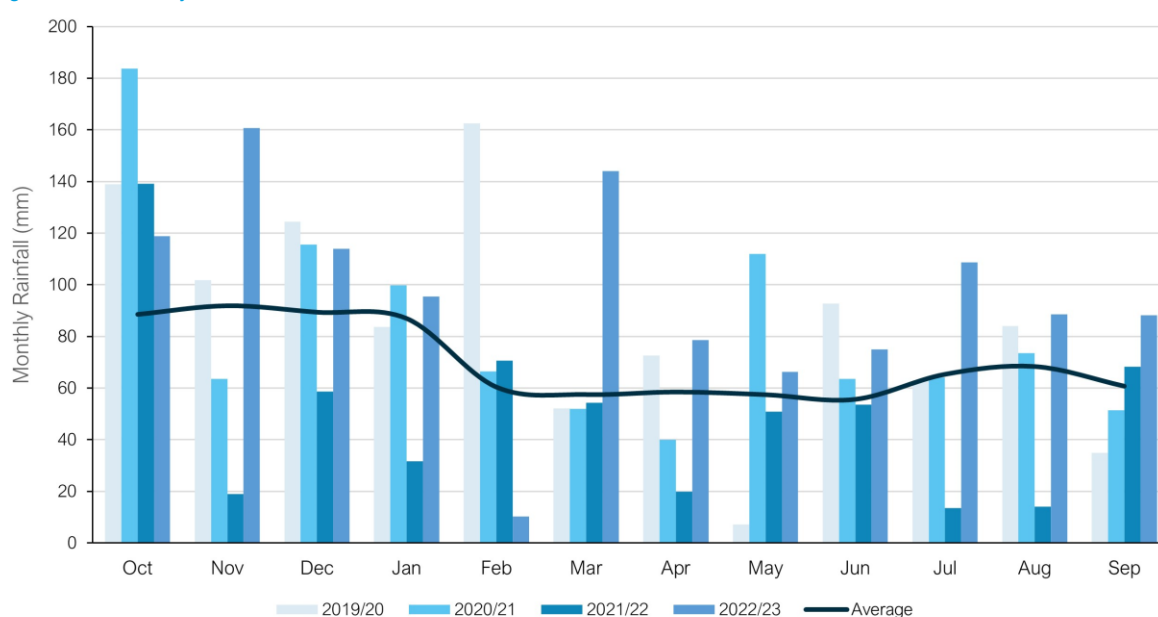
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### Catchment Rainfall

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.

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

The total rainfall for the 2022/23 hydrological year is 37% above the annual average total. Total rainfall values are presented in Table 3 below.

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## Groundwater / Local River Level

The Fyfield catchment is situated in the Berkshire Downs water resources area. The extended Fyfield catchment is situated across a number of different rock types within its base geology; however, the predominant rock type is sedimentary bedrock within the Holywell Nodular Chalk formation and New Pit Chalk formation. The Fyfield Catchment and all of its base geology lies within a designated principal aquifer within the UK.

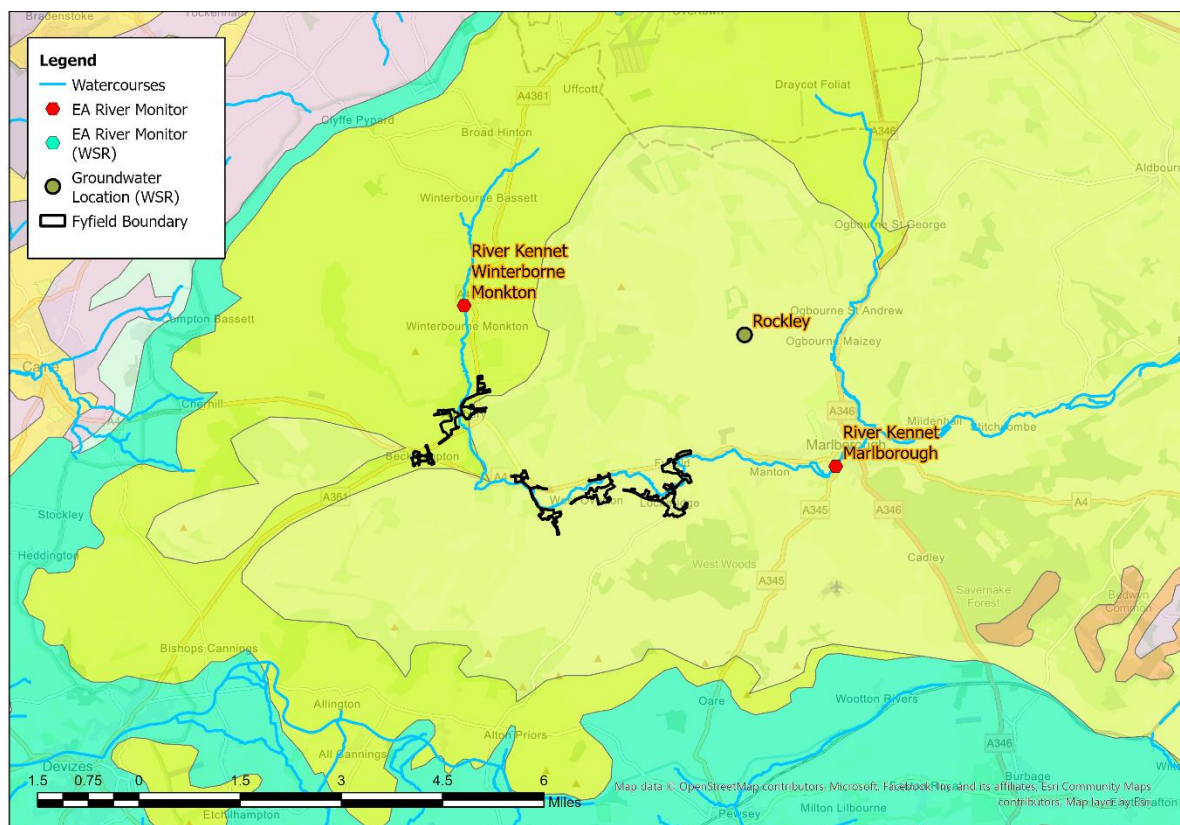
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From previous investigations we have identified the following sites are good indicators of groundwater levels within the catchment.

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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



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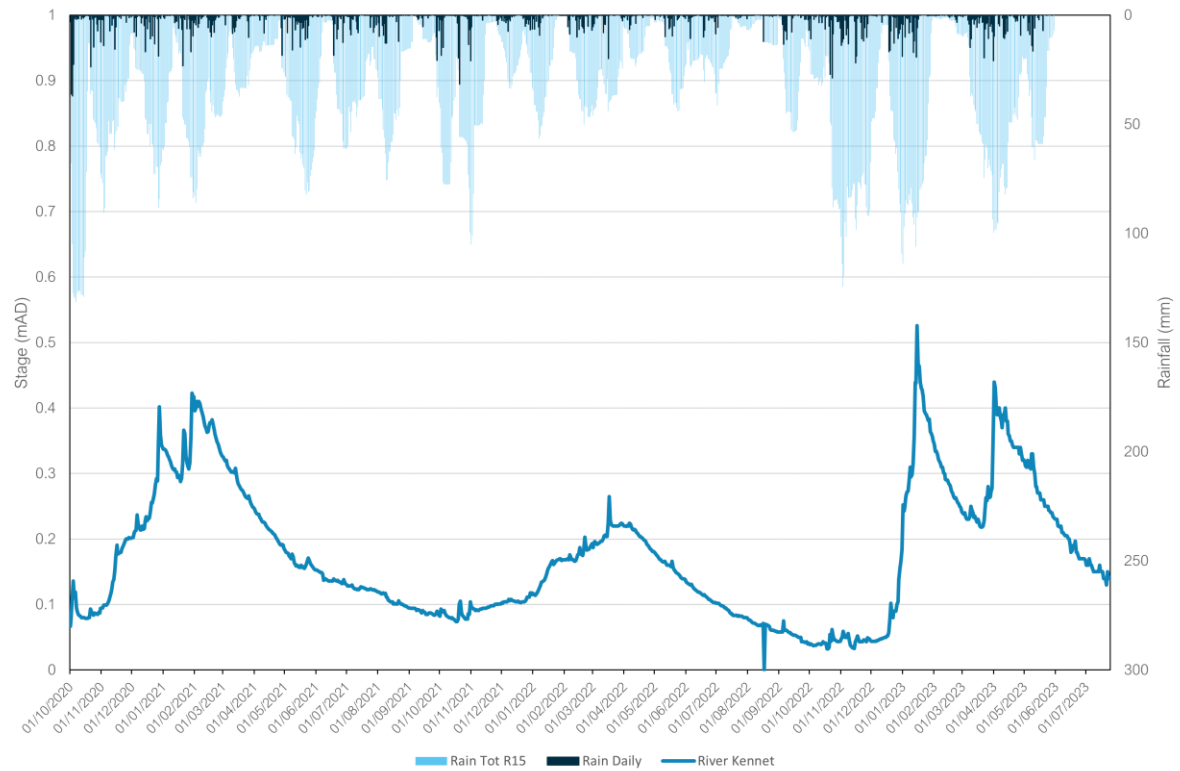
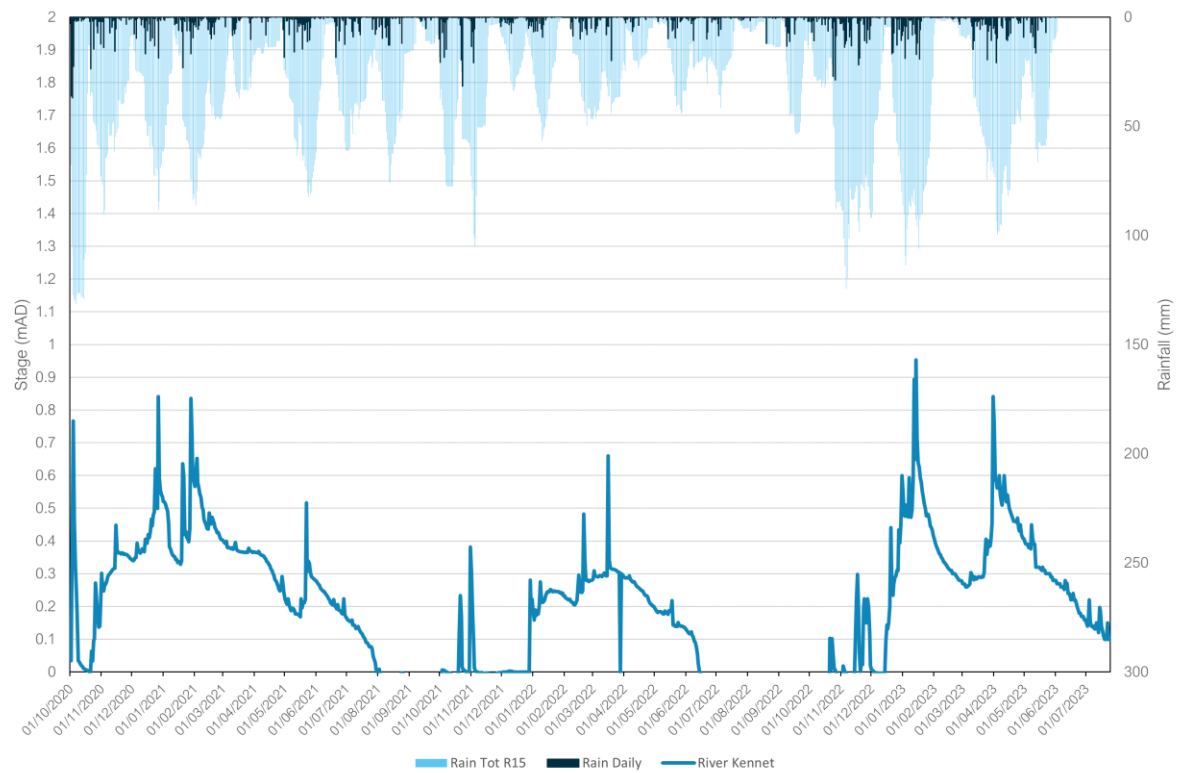
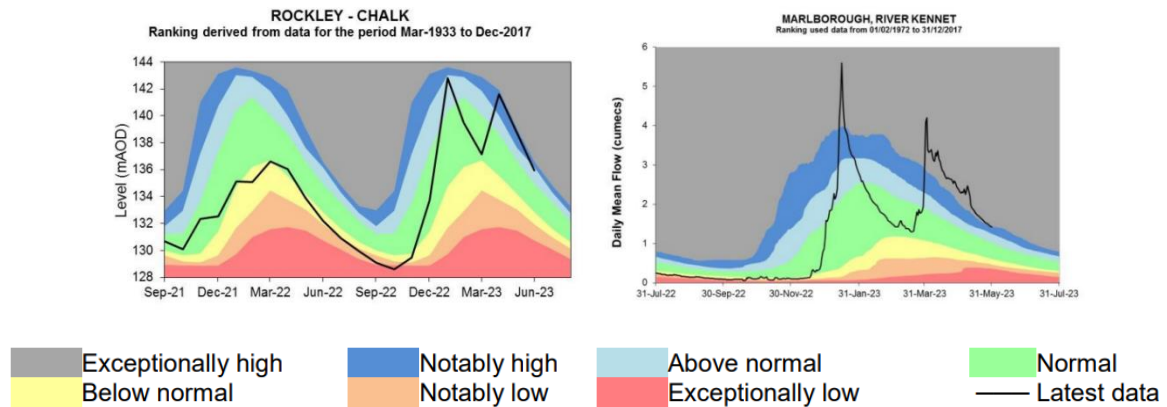


Figure 5B – River Kennet, Winterborne Monkton



In addition to these specific stations, the wider groundwater context is illustrated in the Water Situation Report for Berkshire Downs. The nearest groundwater reference station is Rockley. This site shows groundwater levels generally at or below normal in 2022, as well as reaching notably low levels. Groundwater levels rise towards the end of the year and are observed at normal, above normal, and notably high levels in 2023. This can be seen in the figure below alongside the river indicator Marlborough on the River Kennet.

Figure 6 – Water Situation Report



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



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

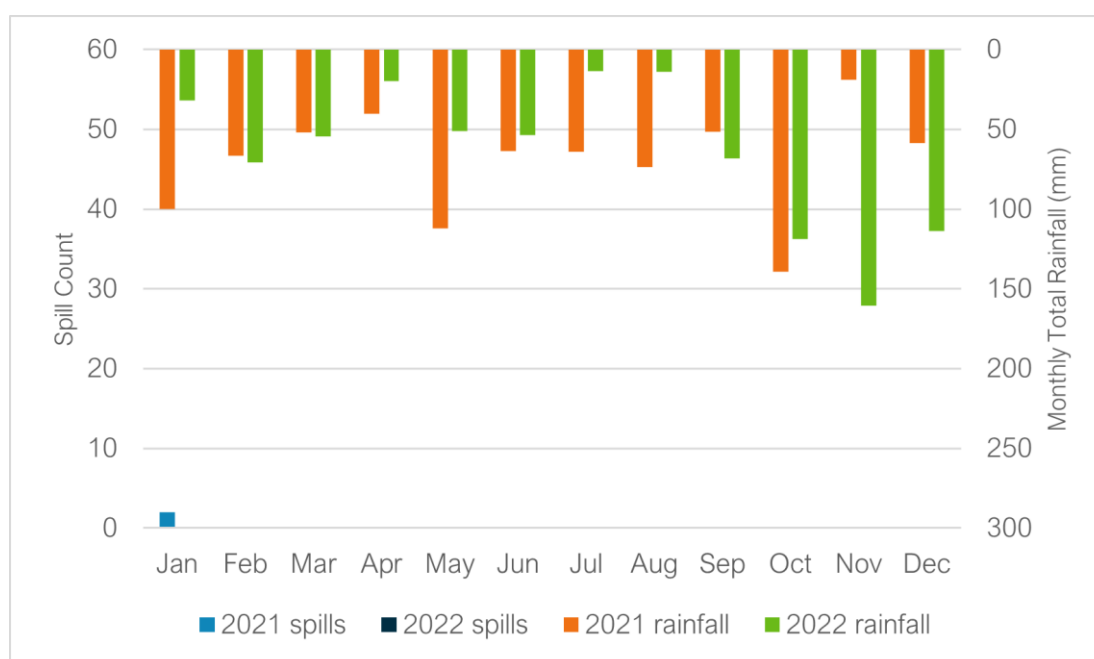
Table 7 below details the last 2 years performance of overflows within the catchment.

Table 7 – Event Duration Monitoring

Overflow	2021		2022	
	Spills	Duration (hours)	Spills	Duration (hours)
Fyfield STW	2	11.00	0	0.00

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. Note that in 2022, the EDM was only operational for 4% of the year, which may have affected the recorded spill count.

Figure 8 – EDM Monthly Performance



As only two spills were recorded in the catchment in 2021, and the EDM was only operational for 4% of the year in 2022, the utility of the data to suggest a wider relationship between rainfall, elevated groundwater levels and spill frequency is limited. However, the only spills recorded in 2021 were in January, when the indicator site data shown in Figure 5 suggests groundwater levels in the catchment were particularly elevated, indicative of a potential relationship between groundwater levels and overflow spill frequency. Future year's EDM data will be reviewed to identify further patterns and trends in the data that may exist, indicative of this relationship.

See the 2022 Addendum Report, included in this PDF document, for discussion regarding spill performance at Fyfield STW in 2020.



## 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 5 monitors installed within the Fyfield 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 Fyfield 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	370 metres
Look and lift survey	N/A	4 surveys
Sewer lining	N/A	N/A
Patch lining	N/A	N/A
Manhole sealing	N/A	N/A
Manhole sealing plates	N/A	N/A
Manhole covers and frames replaced	N/A	N/A

Fyfield STW has also been upgraded at a cost of £2 million. This included an increase in treatment capacity, reducing the need for untreated discharges to the environment. The project completed in 2023.

## Summary

Indicator site data suggests groundwater levels in the Fyfield catchment were generally lower in 2022 than in 2021. This hydrological year (October 2022 – September 2023), indicator site data suggests groundwater levels have generally been higher than the previous hydrological year, and EDM data for 2023 will be analysed once available to continue to examine the relationship between groundwater levels and overflow spills in the catchment.

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 2024

## Table of contents

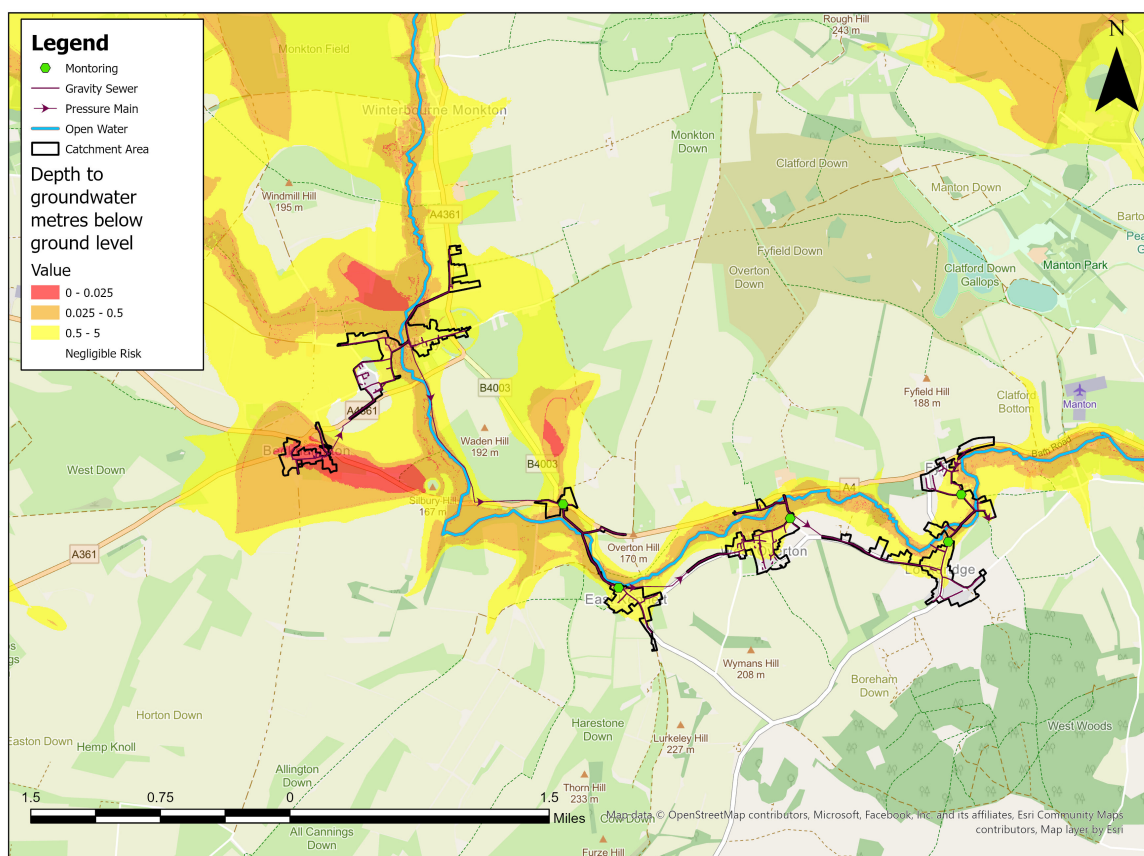
Overview	1
Hydrological Review – 2023-24	2
Network Performance	6
Investigations & Interventions	7
Summary	8

## Overview

This addendum to the Fyfield Groundwater Impacted System Management Plan 2021 (GISMP) provides an update on performance/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 being planned
- Summary and plan for 2024/25

Figure 1 – Fyfield Monitoring Plan



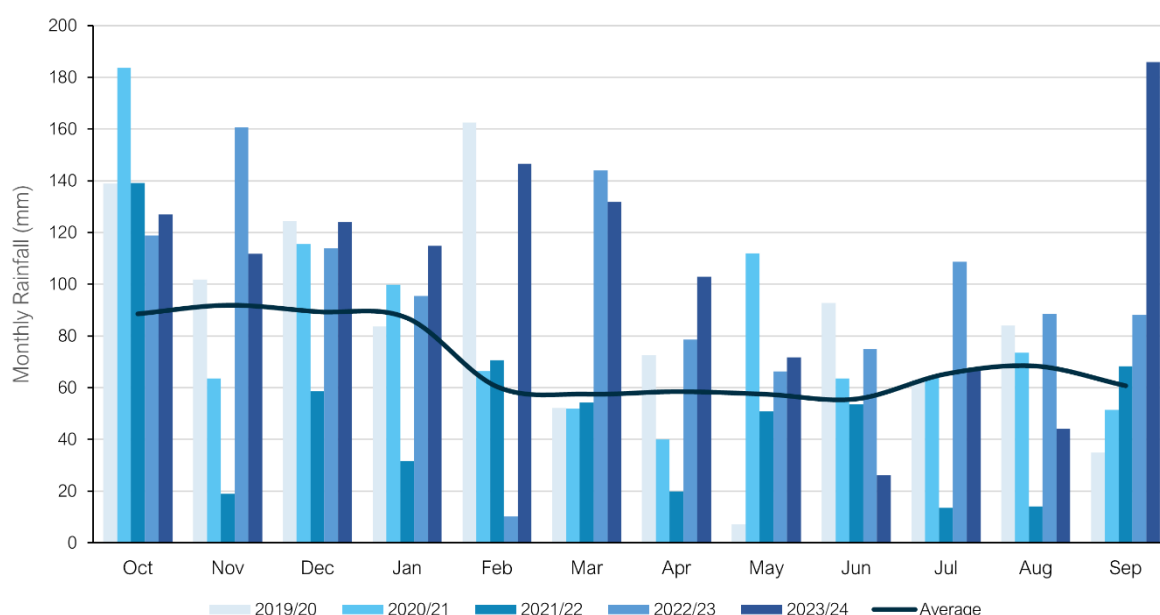
## Hydrological Review – 2023-2024

This section summarises the hydrological conditions within the Fyfield 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 Marlborough based on the period 1991-2020

The total rainfall for the 2023/24 hydrological year is 49% 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)
841	1018	985	594	1148	1254

## Groundwater / Local River Level

The Fyfield catchment is situated in the Berkshire Downs water resources area. The extended Fyfield catchment is situated across a number of different rock types within its base geology; however, the predominant rock type is sedimentary bedrock within the Holywell Nodular Chalk formation and New Pit Chalk formation. The Fyfield Catchment and all of its base geology lies within a designated principal aquifer within the UK.

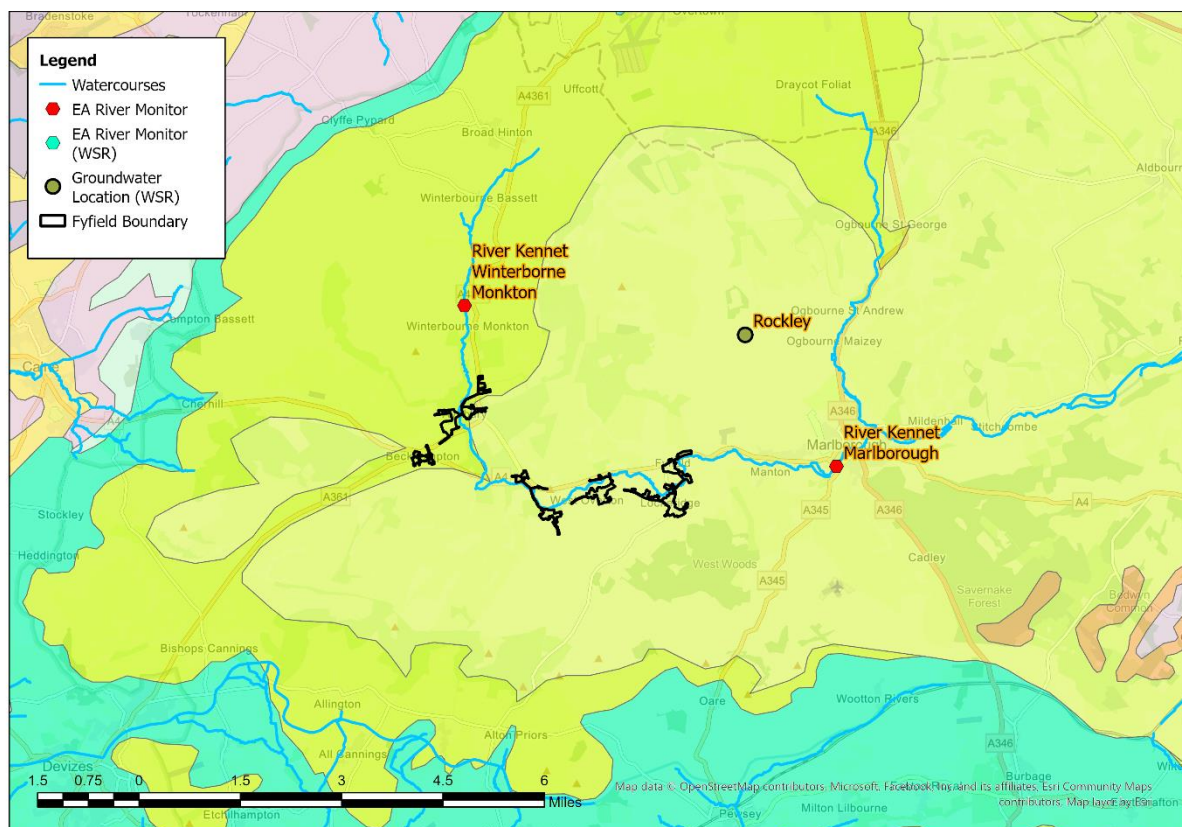
The Environment Agency has gauging stations on local watercourses measuring stage and observation boreholes (OBH) measuring groundwater levels locally to the catchment which can be used to provide indicative local groundwater performance.

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

- River Kennet, Marlborough.
- River Kennet, Winterborne Monkton.

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.



Figure 5A – River Kennet, Marlborough

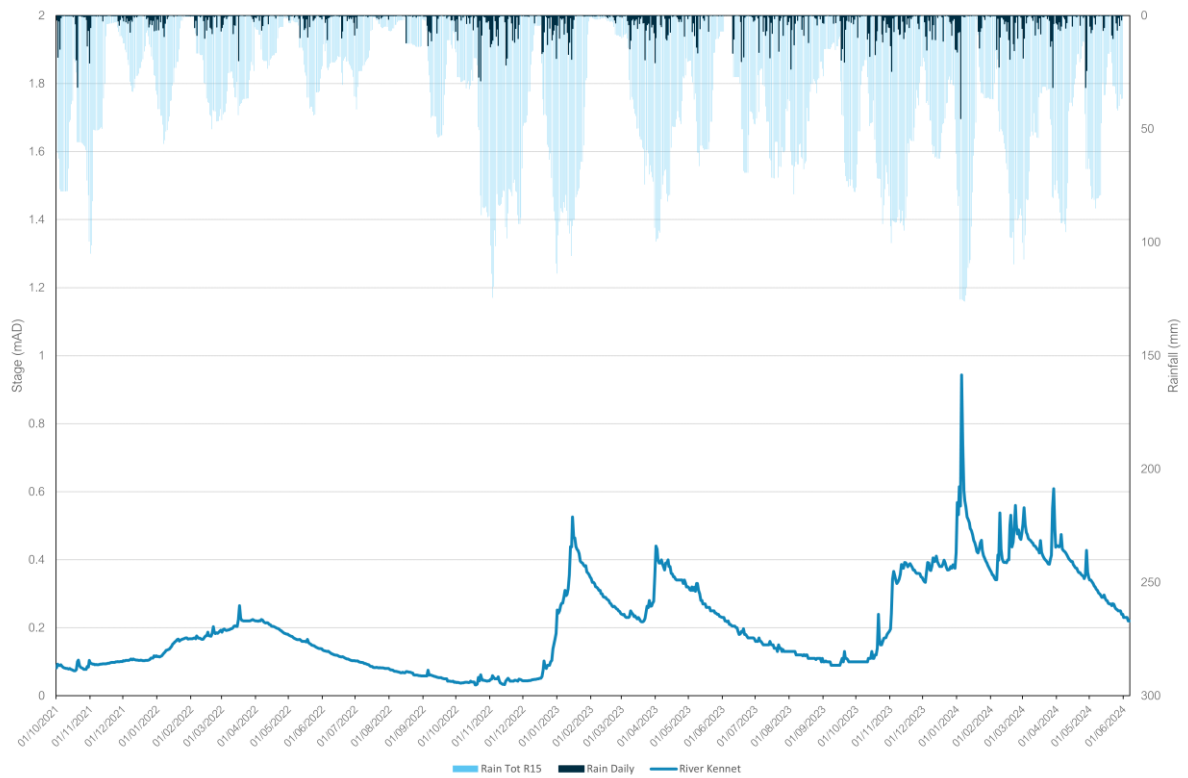
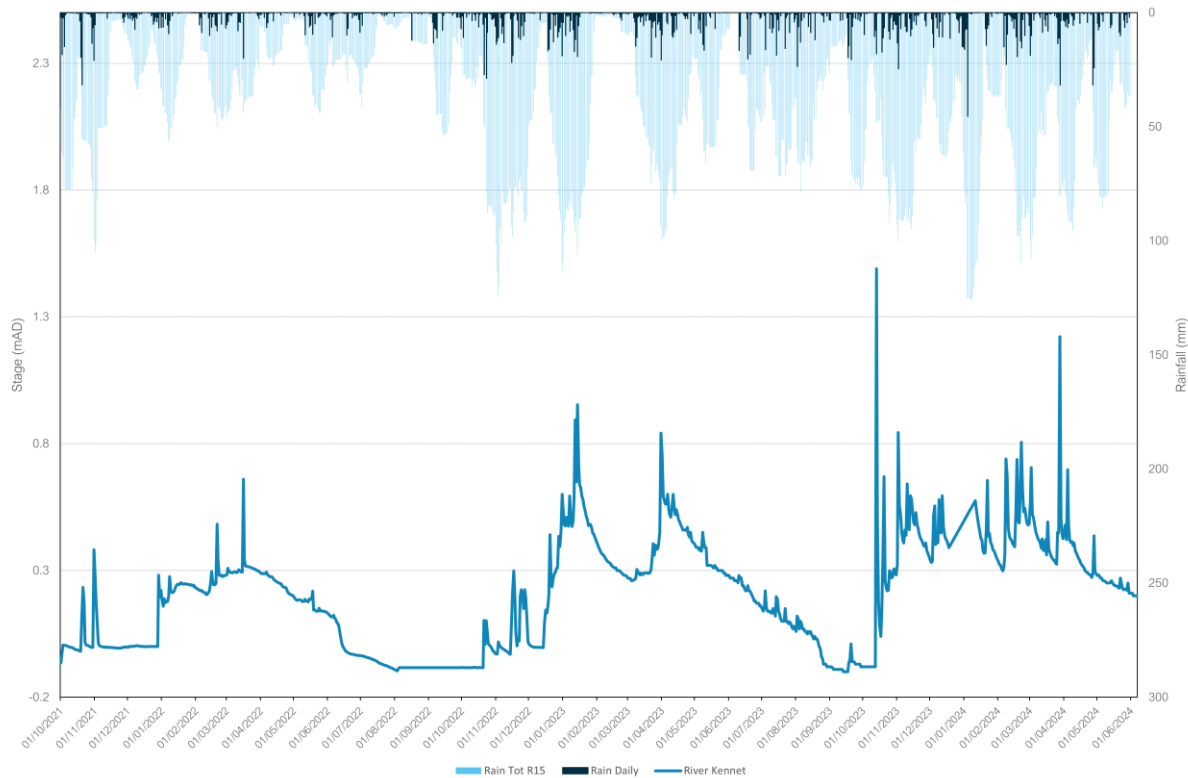
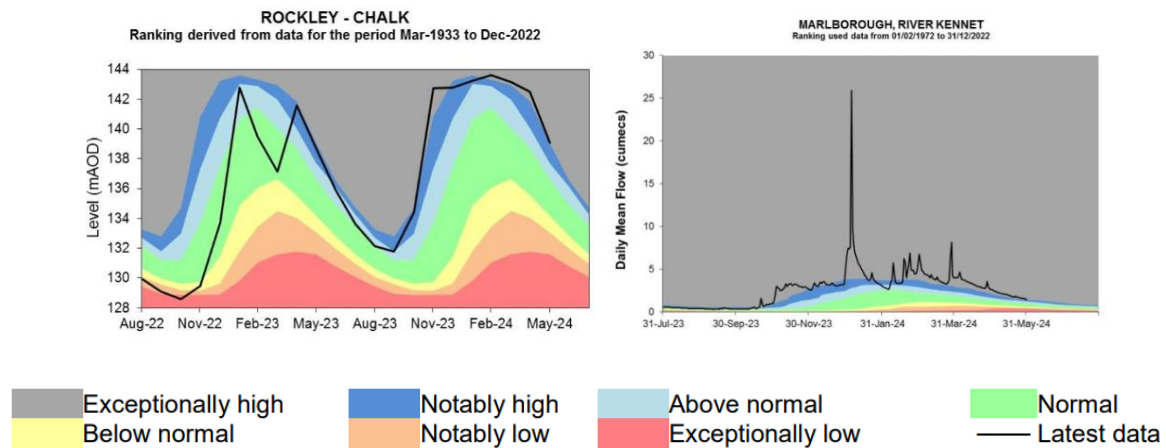


Figure 5B – River Kennet, Winterborne Monkton



In addition to these specific stations, the wider groundwater context is illustrated in the Water Situation Report for Berkshire Downs. The nearest groundwater reference station is Rockley. This site shows groundwater levels peaked at above normal/ notably high levels in 2023. Groundwater levels have generally been higher during the first half of 2024 compared to the equivalent period in 2023, consistently at notably high/ exceptionally high levels. This can be seen in Figure 6 alongside the river indicator Marlborough on the River Kennet.

Figure 6 – Water Situation Report



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

## Network Performance

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

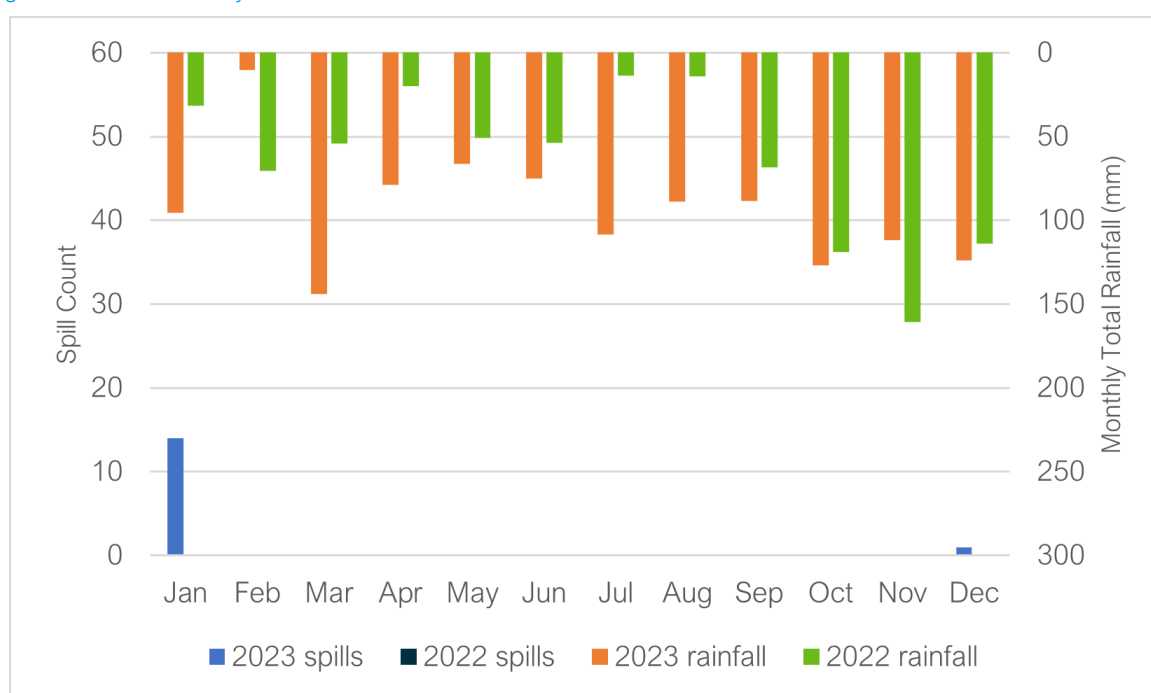
Table 7 below details the last 2 years performance of overflows within the catchment.

Table 7 – Event Duration Monitoring

Overflow	2022		2023	
	Spills	Duration (hours)	Spills	Duration (hours)
Fyfield STW	0	0	15	238.5

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. Note that in 2022, the EDM was only operational for 4% of the year, and in 2023 the EDM was only operational for 85% of the year, which may have impacted the recorded spill counts for Fyfield STW.

Figure 8 – EDM Monthly Performance



As the EDM was only operational for 4% of the year in 2022, the utility of the data to suggest a wider relationship between rainfall, elevated groundwater levels and spill frequency is more limited. However, all 15 spills recorded at Fyfield STW in 2023, occurred in January. The indicator site data shown in Figures 5 and 6, suggests that groundwater levels in the catchment peaked in January 2023. The data is therefore indicative of a wider relationship between rainfall, elevated groundwater levels and spill frequency in the catchment. Note that an upgrade to provide increased treatment capacity at Fyfield STW, was completed in 2023. The EDM data for 2024 will be analysed once available, to understand the impact of this upgrade on spill frequency at Fyfield STW. The indicator site data shown in Figures 5 and 6 suggests groundwater levels in the catchment were consistently high over the first half of 2024.

## 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 5 monitors installed within the Fyfield 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 Fyfield 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	370 metres	N/A
Look and lift survey	N/A	4 surveys	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
Manhole sealing plates	N/A	N/A	N/A
Manhole covers and frames replaced	N/A	N/A	N/A

Tankering was required in the catchment during the 2023/24 Hydrological Year. A total of 426 days of flow management was undertaken across four locations: West Overton SPS, East Kennett SPS, Beckhampton SPS and Avebury SPS.

Fyfield STW has been upgraded at a cost of £2 million. This included an increase in treatment capacity, providing a higher quality of treated effluent going to the river. The scheme aimed to reduce the need for untreated discharges to the environment. The project completed in 2023. EDM data for 2024 will be analysed once available to understand the impact of the upgrade on spill frequency at Fyfield STW.

The catchment is expected to meet all government targets for storm overflows by 2030.

## Summary

The EDM spill data for Fyfield STW for 2023 is indicative of a wider relationship between rainfall, elevated groundwater levels and spill frequency in the catchment. This hydrological year (October 2023 – September 2024), indicator site data suggests groundwater levels in the catchment have been higher than those observed in the previous hydrological year. The EDM data for 2024 will be analysed once available to further understand the impact of groundwater infiltration on spills in the catchment, and whether the upgrade completed at Fyfield STW has had an impact on spill frequency here.

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.



It's everyone's water