Groundwater Impacted System Management Plan

Cranleigh, Cranleigh Water

November 2021

Thames Water

It's everyone's water

Version control

Version	Date	Amendment	Author	Checked	Reviewed
1-d1	29/10/2021	Draft for EA	SS/NW	AJ	SE
1-V1	22/11/2021	Version 1	SS/NW	SE	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

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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 excessive and likely to be the source of uncontrolled escape of untreated or partially treated sewage.

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

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

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

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

To line all sewers and manholes within most catchments would be prohibitively expensive to do so. Our approach to date has been centered on a 'find and fix' basis which has involved monitoring and investigating the networks in periods of high groundwater to identify sources of ingress and fix as we find them. This approach is constrained for the reason that investigations are typically limited to periods of high groundwater and when high groundwater occurs there are limited windows of time in which investigations can be successfully undertaken before flows either subside or the system is fully surcharged meaning CCTV surveys are not possible[2]. Once sections of sewers have been lined, it will be a case of waiting until high groundwater levels reoccur to assess the effectiveness of the work undertaken, which may not be the subsequent winter but several years later.

It is recognised that the approach to date lacks a degree of certainty of resolution and for this reason Thames Water has in 2020 undertaken a different approach for the medium to long-term management of groundwater, which is covered within this

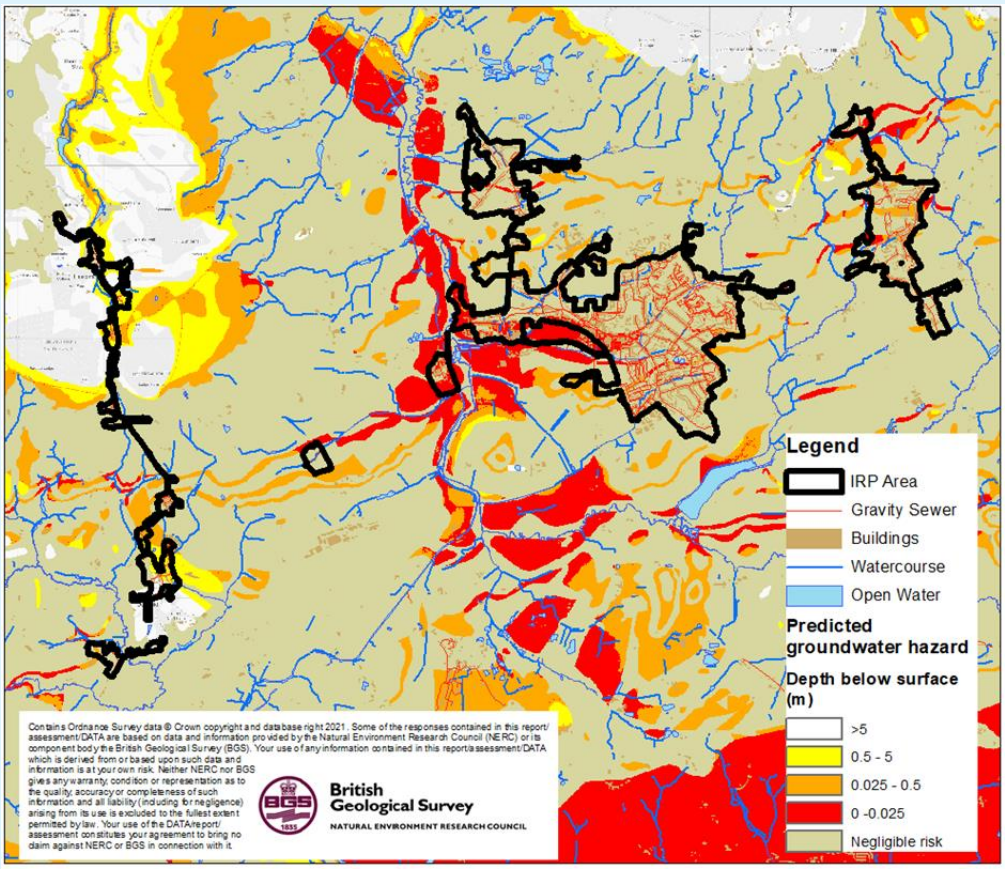
[1] Sewers for Adoption makes an allowance for 10% of normal wastewater flow to allow for unaccounted flows such as groundwater infiltration.

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

document under the plan section. These plans require significant investment which Thames Water will seek to secure. 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 Cranleigh catchment



1.0 – Cranleigh catchment

Cranleigh is located in Surrey, England, approximately 8 miles south-east of Guildford. Cranleigh serves a population equivalent[3] of 16,253 with a partially separate sewerage network totaling some 140 km in length excluding private drains and sewers. The extent of the catchment is shown in Figure 1.0 above.

Problem characterisation

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

There's a strong link between the rising river levels related to rising groundwater levels and the increased flows seen within the sewerage network and at the Sewage Treatment Works.

[3] 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.

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.

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

We believe it is likely that groundwater infiltration in the Cranleigh catchment is the most probable cause of incidents where the sewage treatment works (STW) has not been able to cope with all incoming flows, triggering problems at the STW. The root causes of unwanted flow in the sewers require all stakeholders responsible for drainage in the catchment to resolve them together.

Our permit conditions for Cranleigh STW state:

"The effluent shall consist only of storm tank effluent." and "No discharge of storm tank effluent shall be made until such time as the rate of flow of sewage arriving at the works exceeds 157.64 l/s."

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 Waverley District Council as Lower Tier 1 and Surrey County Council as the Higher Tier Council, Lead Local Flood Authority and Planning Authority, in addition to the Environment Agency to ensure that a collaborative approach can be developed to address the problems.

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

Anticipated unavoidable discharges

We do not believe there to have been unplanned or unconsented discharges in the network as a result of groundwater infiltration, only increased flows to the STW, triggering spills to the river.

General outline plan & timescale

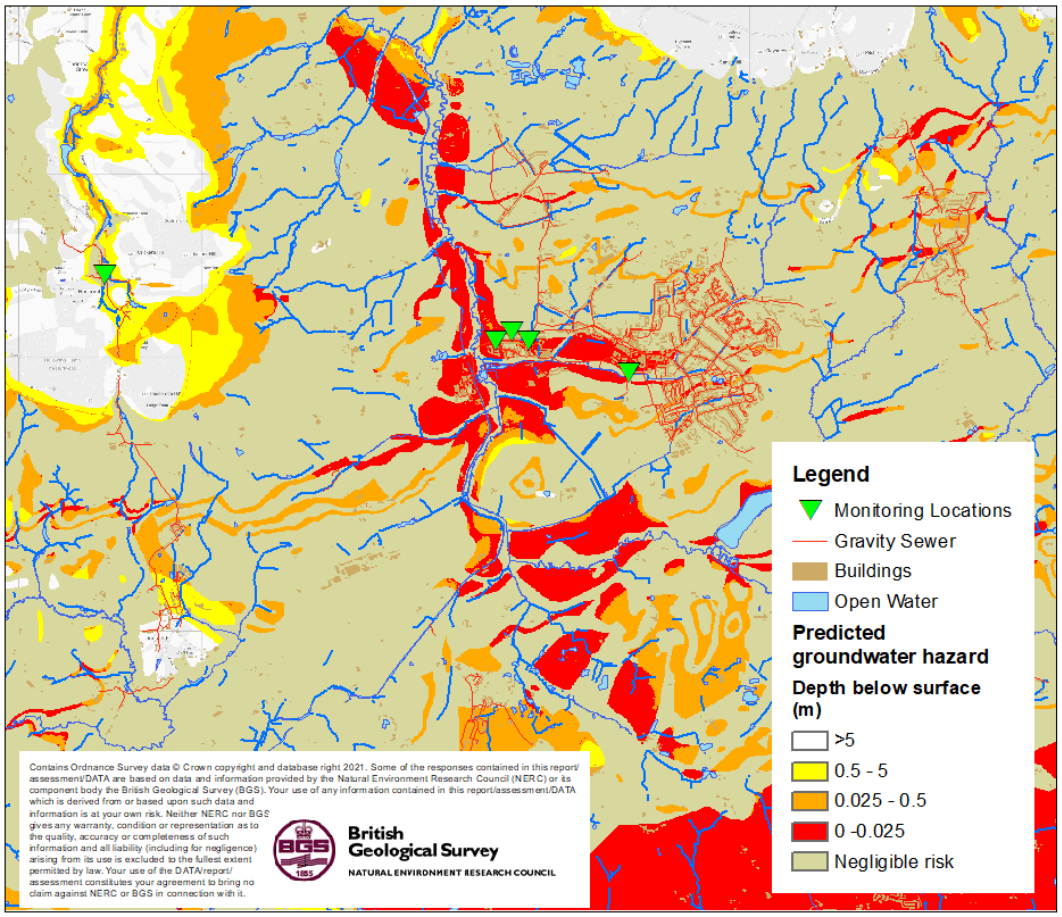


Figure 2.0 – Cranleigh monitoring and infiltration zones

Key to bringing the impact of groundwater infiltration under control is an enhanced monitoring regime. We have identified and have installed telemetered depth monitors in the Cranleigh system. Figure 2.0 presents a plan of the 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 Cranleigh 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 are sited in and around these zones to verify and calibrate the risk in each of the zones.

If following the proposal to the sealing in part or wholly[4] of the high risk zones in AMP8[5], 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. The decision on this will be based on information obtained from the monitors and depending on the scale of further work required this may need to form part of PR29[6] investment planning.

The monitors are also to be used to monitor change within the system hence even should we determine that infiltration has been brought under control, we will continue to monitor for potential trends in infiltration suggesting the need for further work. We also anticipate monitoring the response of the catchment to surface water and where appropriate will use the monitor data to address this source of storm flow.

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

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	2021-2023	Monitors have been installed 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.

[4] Decision of extent of sealing will be based on outcomes of works undertaken in AMP7, results of monitoring and successful submission of our plans for investment for AMP8.

[5] Asset Management Plan 8 – covering work between 2025-2030

[6] Price Review 2029

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	2025-2030	Sealing of high-risk zone undertaken subject to need being demonstrated.

Cranleigh Infiltration Management Plan

As detailed above the impact of infiltration is experienced mainly at the STW.

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

High level approach statement

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

1. We will investigate the network further with a view to identifying sources of ingress of infiltration that are cost effective[7] to address. To investigate the network, we have:

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

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

To investigate the network, we will:

- 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 and need. Significant investment needs may need to be included in our next investment planning cycle at PR24.

[7] 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 we have commissioned JBA Consulting to undertake an exercise involving 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 within the network, make use of pumps to contain flows or deploy settlement tanks to part treat sewage before release to the environment.

With regard to Cranleigh 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	7.31	10.9
Medium	Predicted groundwater extreme 0-1m above pipe invert	0.91	1.4
Low	Predicted groundwater extreme 0-1m below pipe invert	2.41	3.6
Very Low	Predicted groundwater extreme >1m below pipe invert	56.73	84.2
Total		67.37	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	186	10.5
Medium	Inundation risk in 1% AEP fluvial or pluvial event	137	7.7
Low	Inundation risk in 0.1% AEP fluvial or pluvial event	345	19.5
Very Low	All other manholes	1102	62.3
Total		1770	100.0

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

Lift and Look and CCTV surveys have not yet commenced in the Cranleigh 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 Programme

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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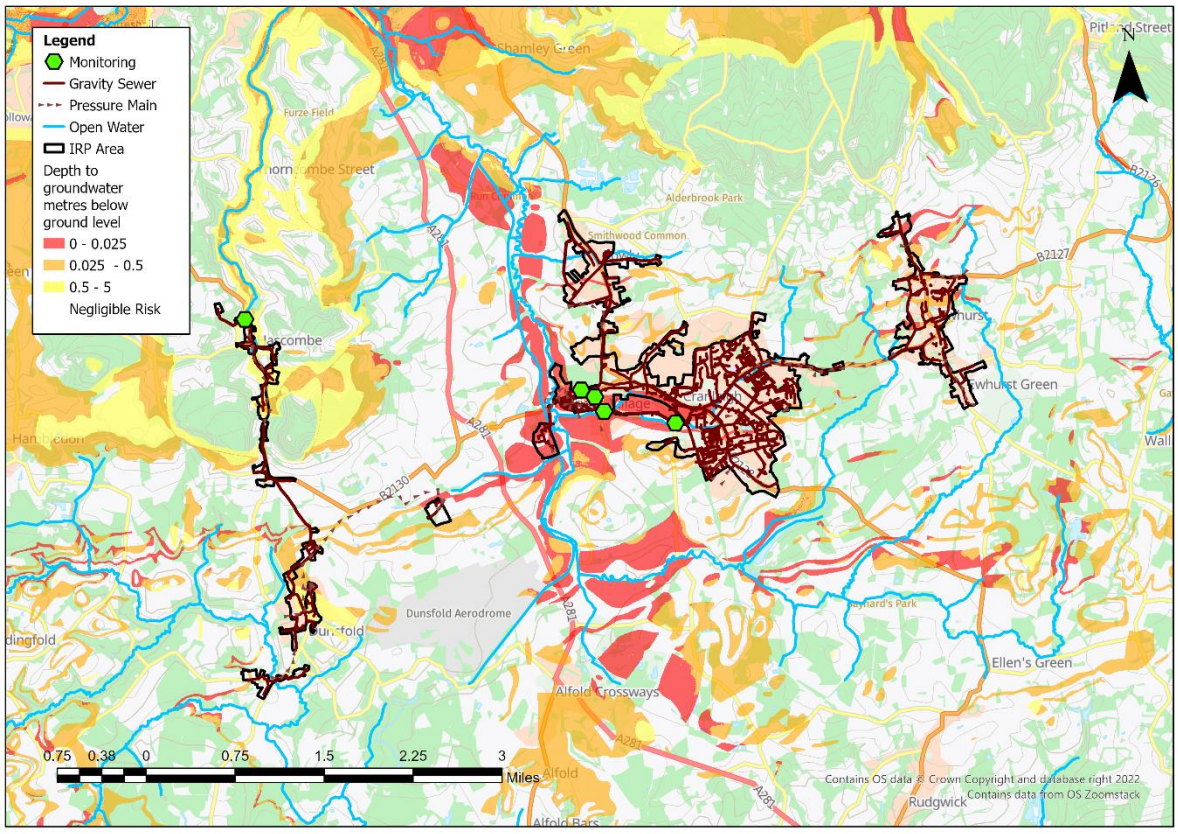
Overview

This addendum to the Cranleigh 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 – Cranleigh Monitoring Plan



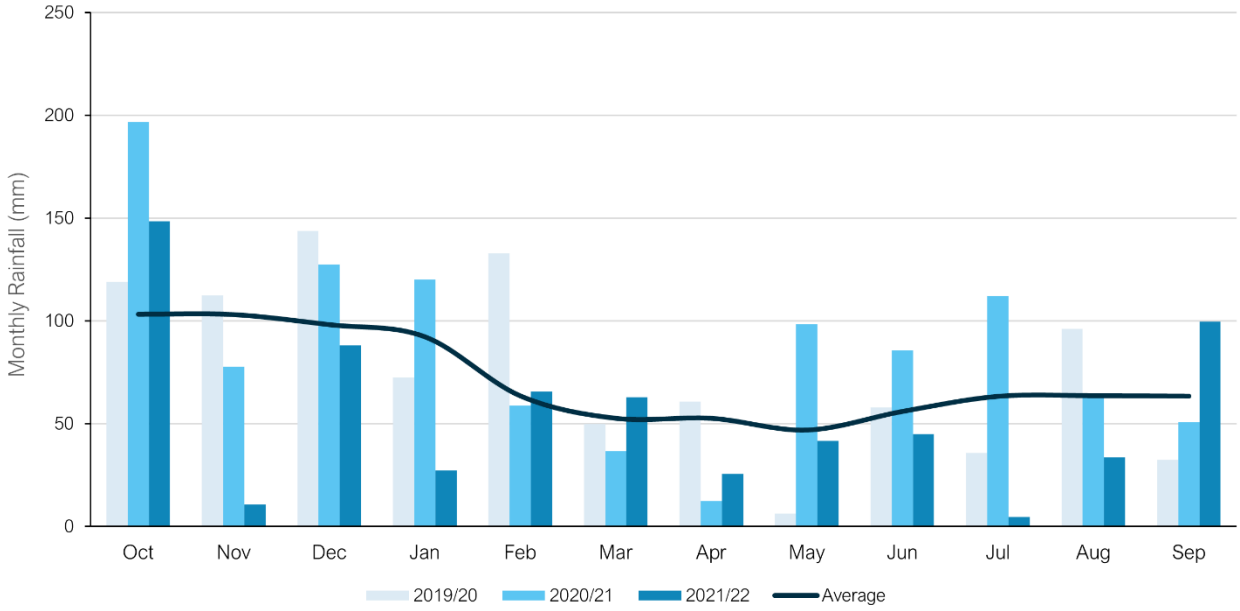
Hydrological Review – 2021-2022

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

Catchment Rainfall

Representative Radar rainfall has been used to generate monthly data at catchment level for comparison with average data generated by local Met Office Weather Station Records. Figure 2 presents the comparison of this data for the last 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 North Heath based on the period 1991-2020

The total rainfall for the 2021/22 hydrological year is 23% 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)
859	920	1041	659

Groundwater / Local River Level

The Cranleigh catchment is situated in the Wey – Greensand and Arun water resources areas. It sits in the Weald Clay Formation of mudstone and the Hythe Formation of sandstone. The Hythe Formation is a designated principal aquifer within the UK.

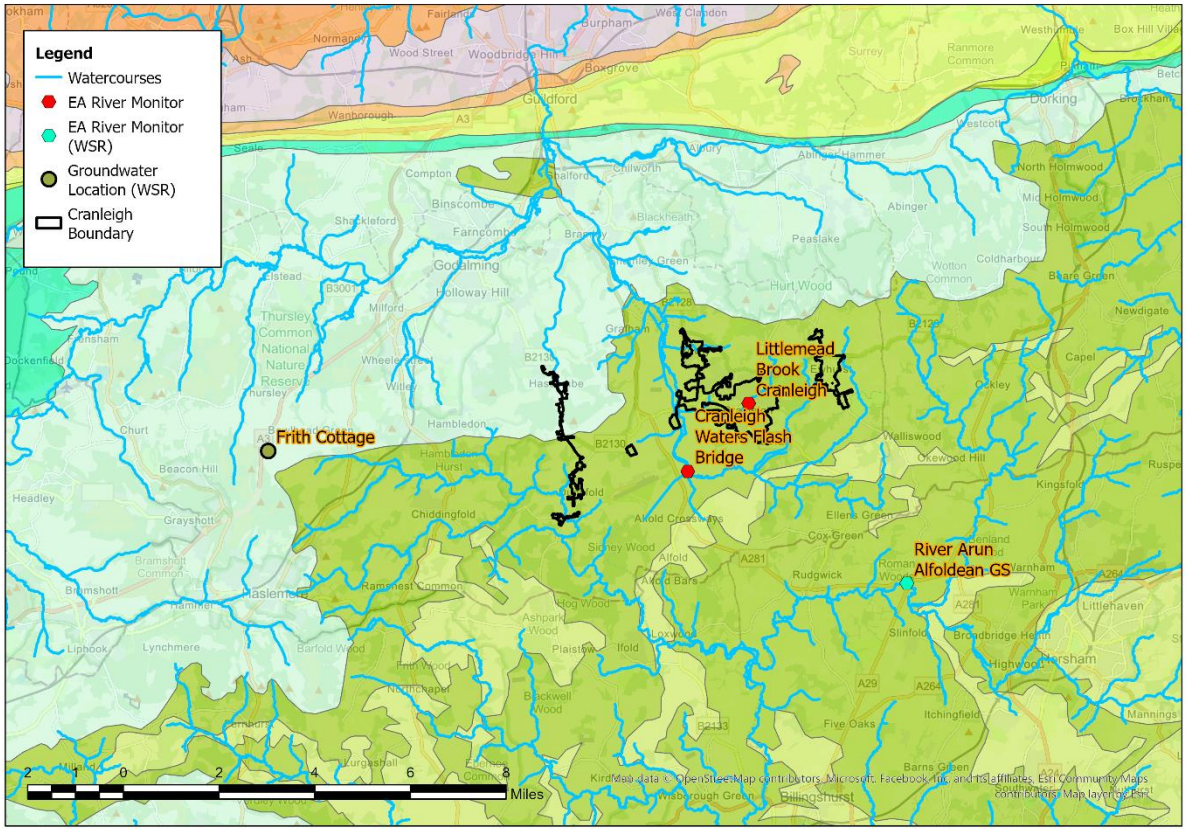
The Environment Agency has gauging stations on local watercourses measuring stage and observation boreholes measuring groundwater levels locally to the catchment which can be used to provide indicative local groundwater performance.

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

- Cranleigh Waters, Flash Bridge.
- Littlemead Brook, Cranleigh.

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 – Cranleigh Waters, Flash Bridge

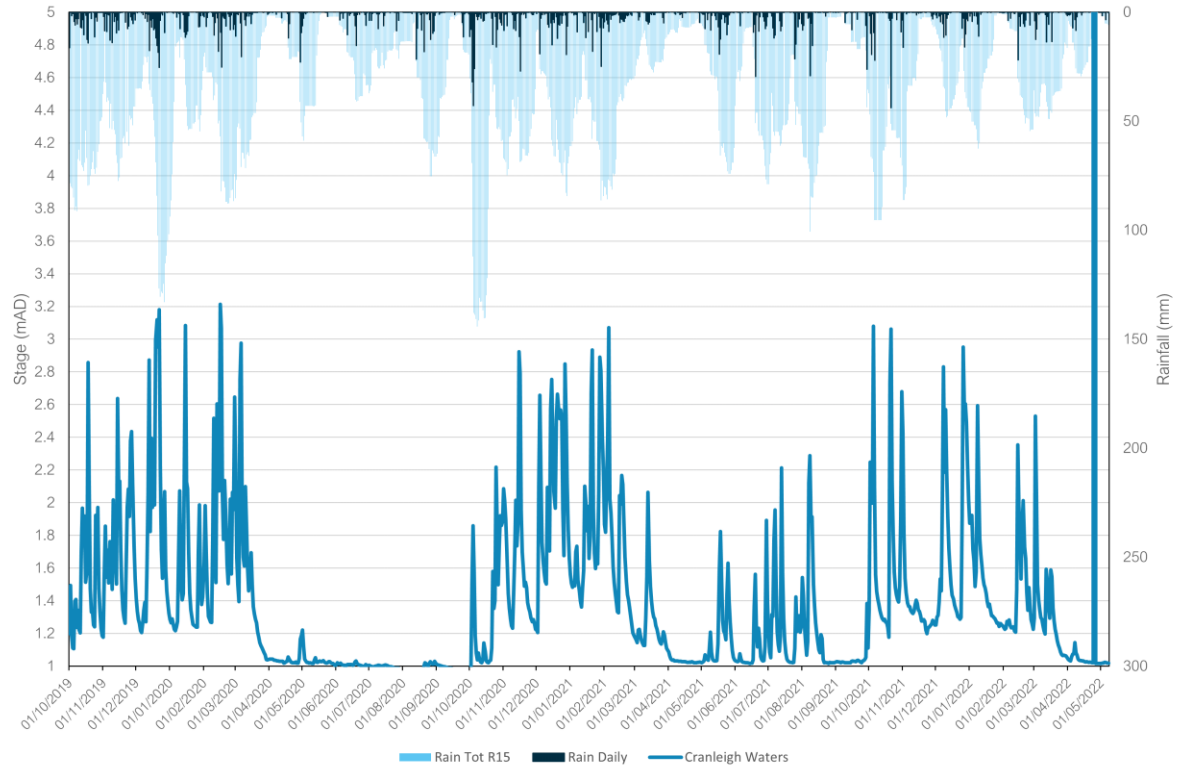
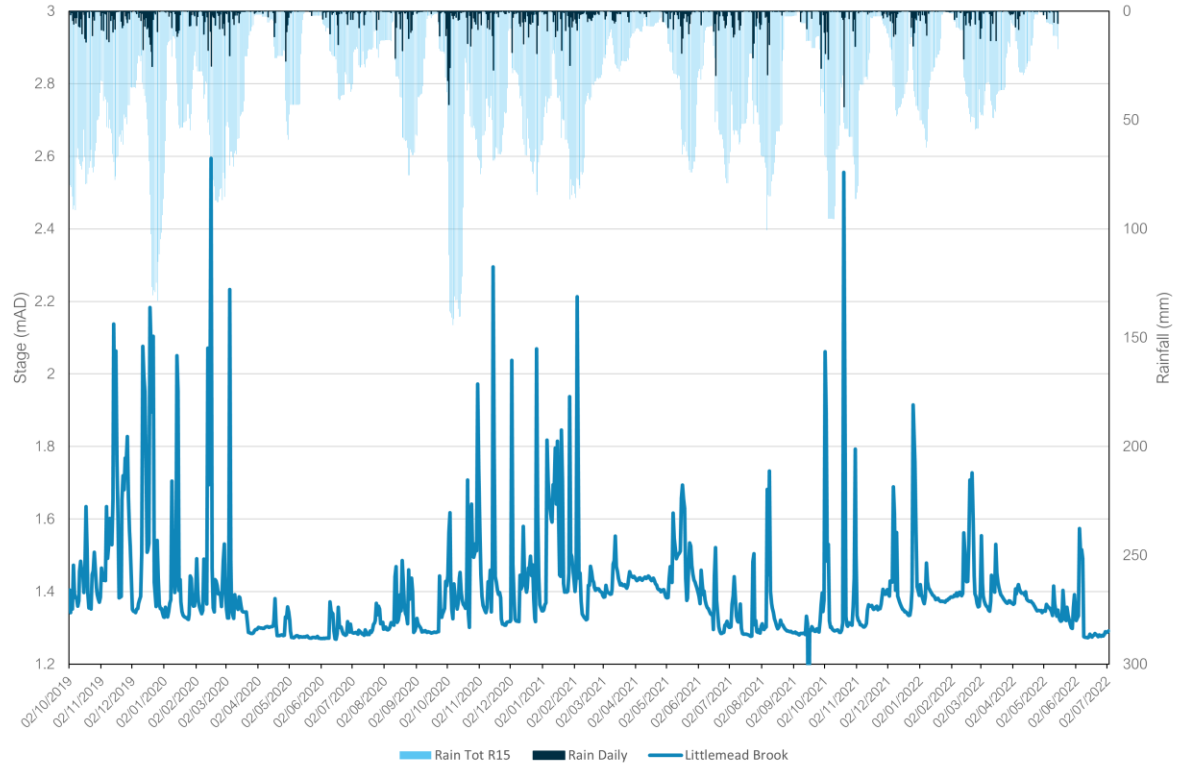
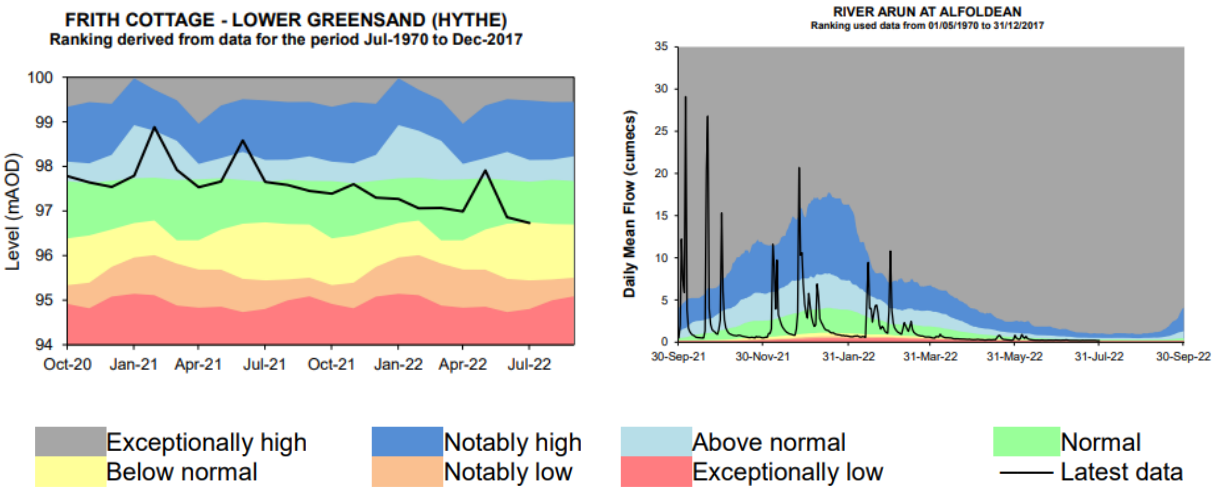


Figure 5B – Littlemead Brook, Cranleigh



In addition to these specific stations, the wider groundwater context is illustrated in the Water Situation Report for Wey – Greensand and Arun. The nearest groundwater reference station is Frith Cottage. This site shows lower overall groundwater than the previous year. This can be seen in the figure below alongside the river indicator Alfoldean on the River Arun.

Figure 6 – Water Situation Report



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

Network Performance

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

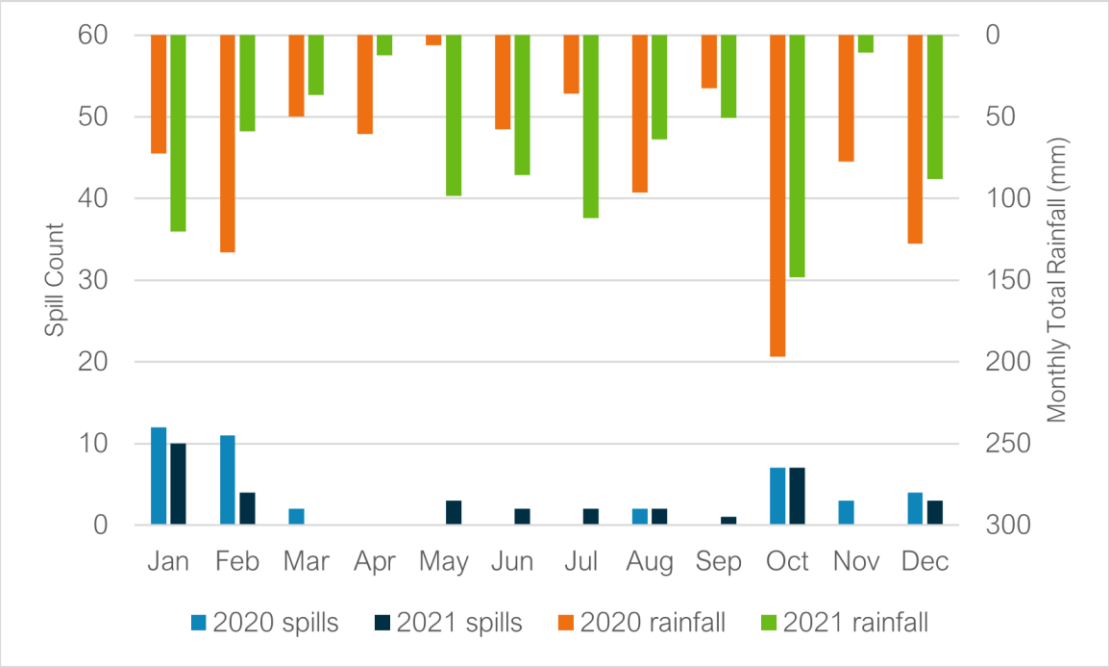
Table 7 below details the last 2 years performance of overflows within the catchment.

Table 7 – Event Duration Monitoring

Overflow	2020		2021	
	Spills	Duration (hours)	Spills	Duration (hours)
Cranleigh STW	41	369.49	34	273.28

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 autumn and winter months. This suggests a wider relationship between rainfall, elevated groundwater levels and spill frequency as the indicator sites show groundwater levels to be generally higher in the autumn and winter months.

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 Cranleigh 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 Cranleigh 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 Cranleigh catchment over the 2021/22 hydrological year has been below average, with groundwater levels in the aquifer beneath Cranleigh not reaching the levels seen in previous years which triggered groundwater ingress into the sewerage network and elevated flow/depth readings at monitoring sites.

Lift and look and CCTV surveys will continue throughout the remaining wet winter periods within this AMP7 period (2020- 2025) with the aim of finding further priority locations for remediation and investigating/justifying the need for future larger scale lining as part of our 2024 Price Review (PR) process if required.

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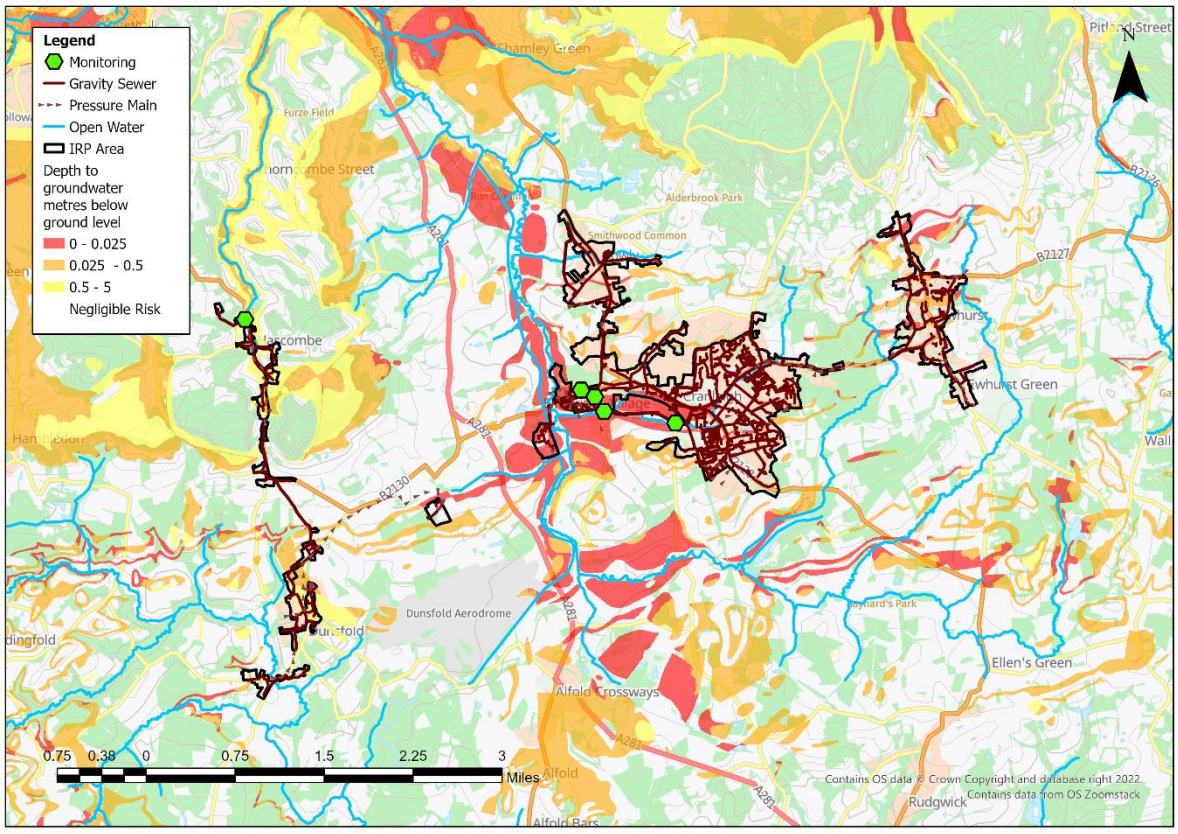

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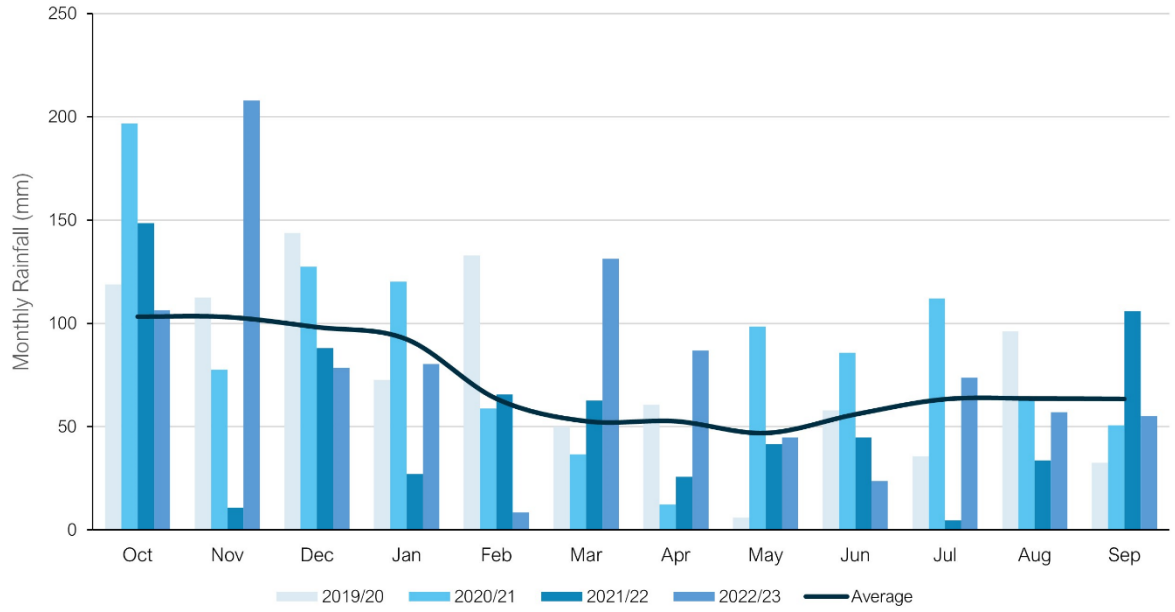

Average Values taken from Met Office Weather Station at North Heath based on the period 1991-2020

The total rainfall for the 2022/23 hydrological year is 11% 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)
859	920	1041	659	954

Groundwater / Local River Level

The Cranleigh catchment is situated in the Wey – Greensand and Arun water resources areas. It sits in the Weald Clay Formation of mudstone and the Hythe Formation of sandstone. The Hythe Formation is a designated principal aquifer within the UK.

The Environment Agency has gauging stations on local watercourses measuring stage and observation boreholes (OBH) measuring groundwater levels locally to the catchment 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.

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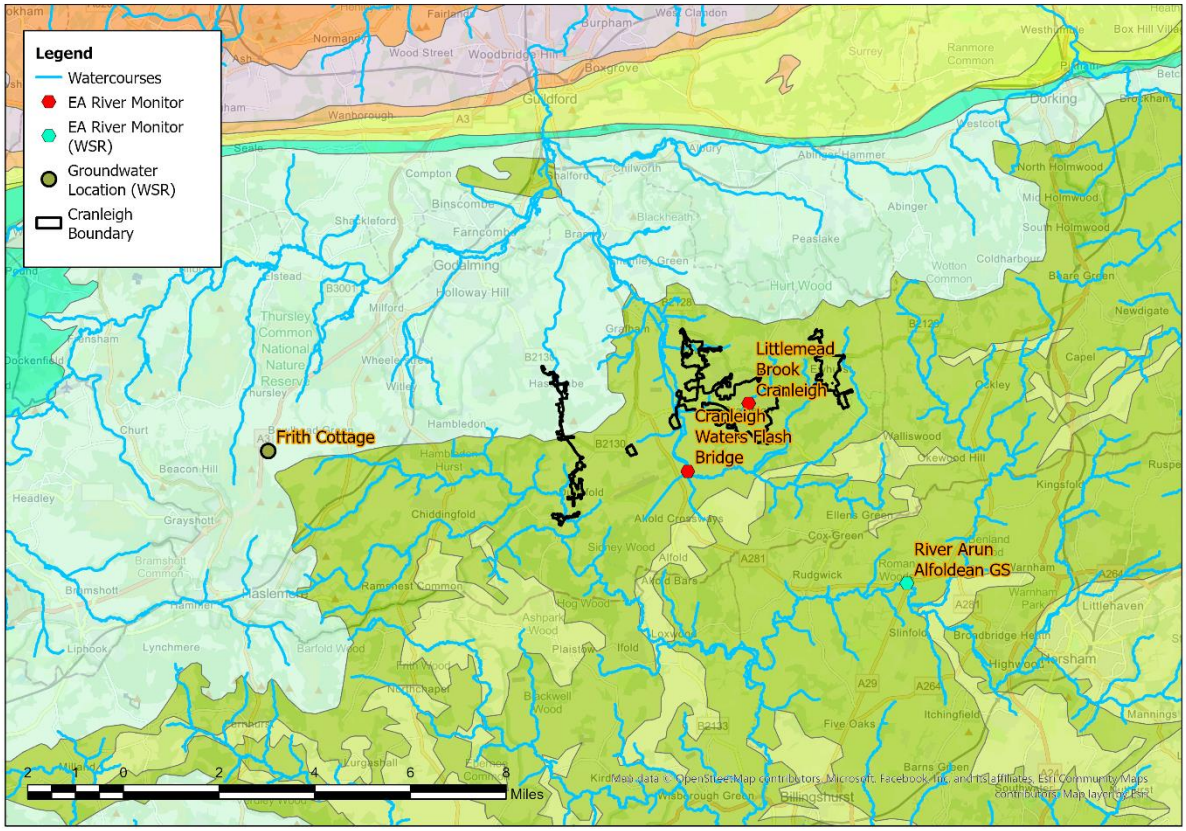

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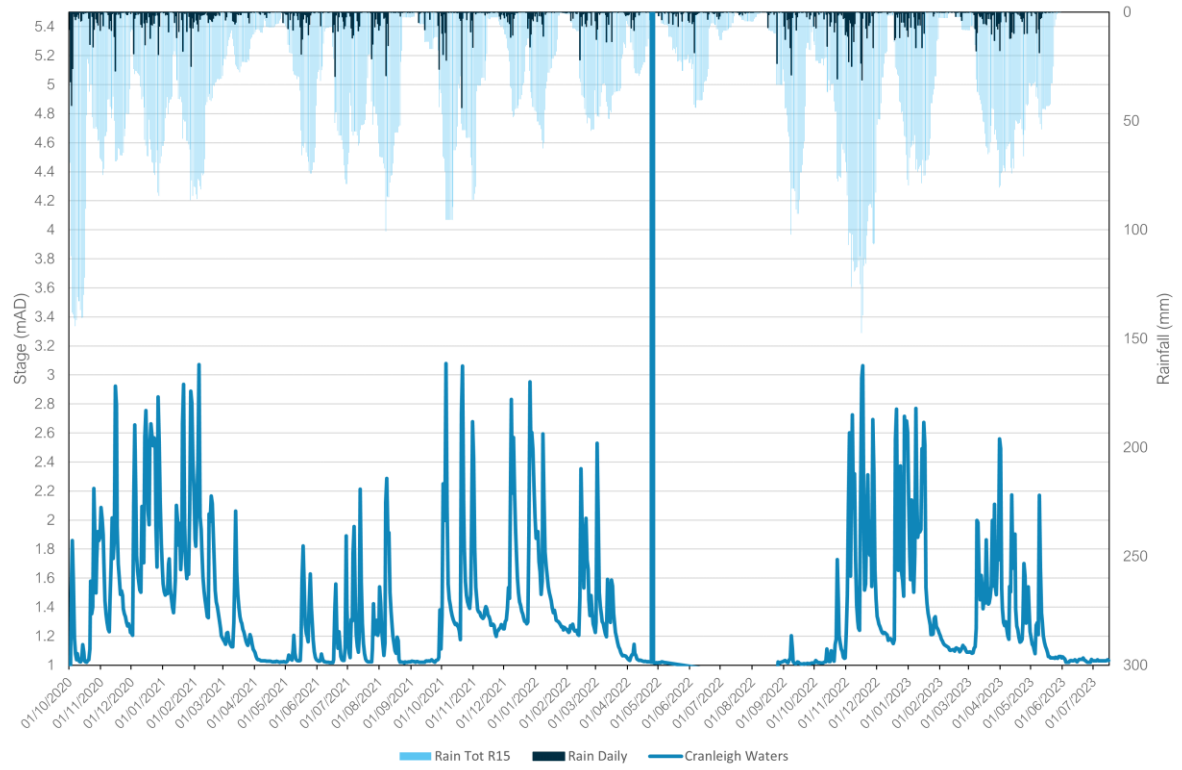

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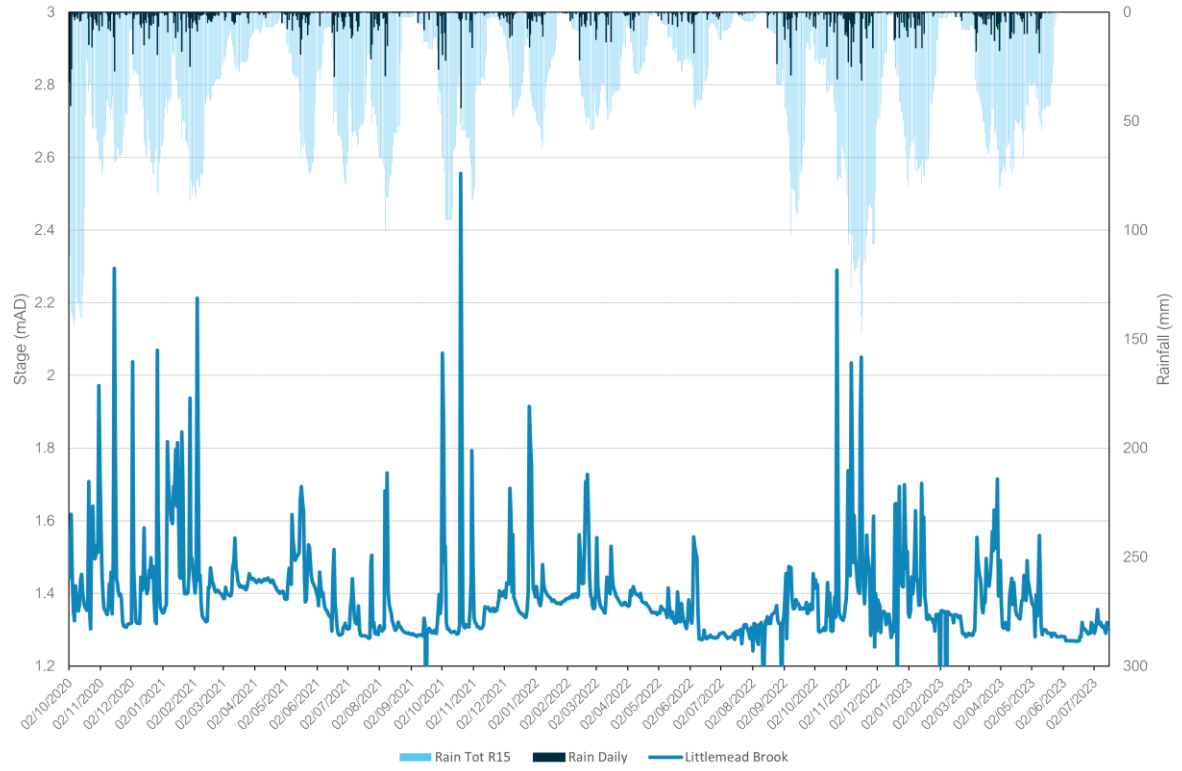
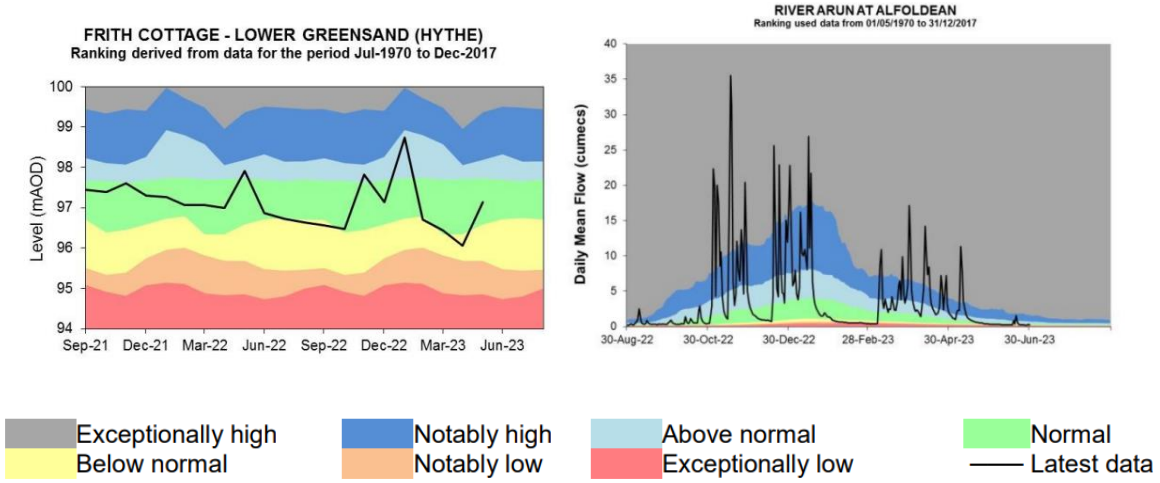


In addition to these specific stations, the wider groundwater context is illustrated in the Water Situation Report for Wey – Greensand and Arun. The nearest groundwater reference station is Frith Cottage. This site shows groundwater levels generally at normal or below normal levels in 2022. Groundwater levels rise towards the end of the year and are observed at above normal levels at the start of 2023, before dropping to normal and below normal levels. This can be seen in the figure below alongside the river indicator Alfoldean on the River Arun.

Figure 6 – Water Situation Report



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Network Performance

Within the Cranleigh catchment there are six sites detailed within the Environment Agency Consents Database which have an Event Duration Monitor (EDM) fitted.

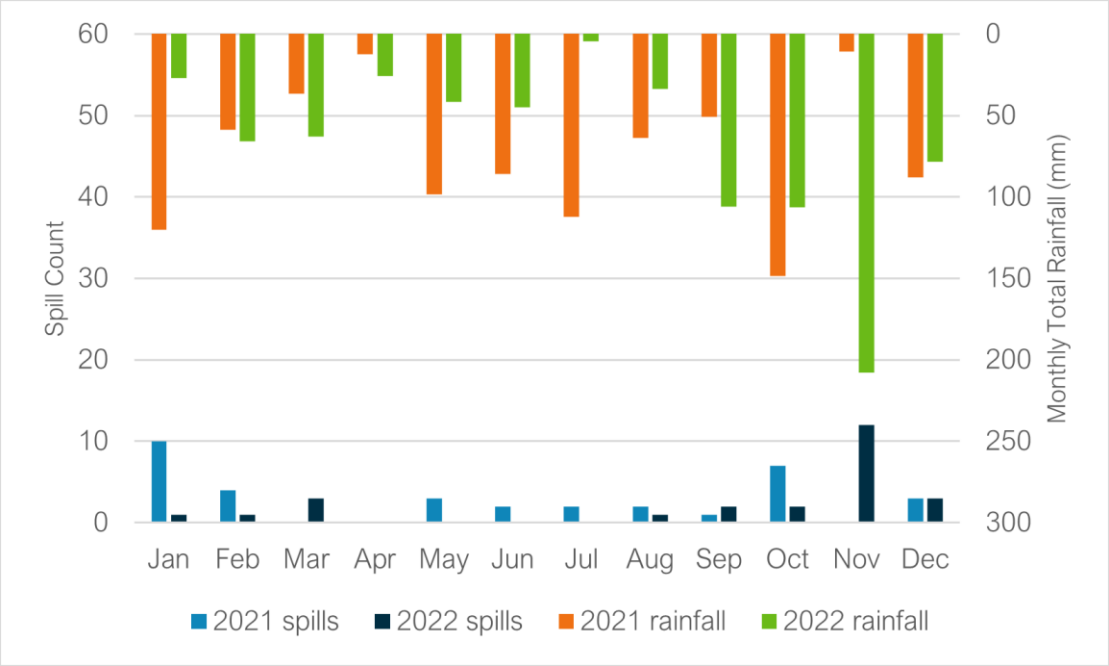
Table 7 below details the last 2 years performance of overflow 'Cranleigh STW'.

Table 7 – Event Duration Monitoring – Cranleigh STW

Overflow	2021		2022	
	Spills	Duration (hours)	Spills	Duration (hours)
Cranleigh STW	34	273.28	25	166.17

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 – Cranleigh STW



The trend in spill performance across the two recorded years does show variation in spills, with an overall focus on spills during the autumn and winter months, which indicates a potential groundwater influence. However, a significant number of spills are recorded across the spring and summer months also, with a correlation between monthly rainfall totals and spills evident. This indicates spills also occurring in the catchment during prolonged or intense rainfall events, outside of periods of elevated groundwater levels.

As part of the process of matching GISMP catchments to EDM sites, several additional EDM sites have been identified for inclusion in this year's report, which were not included in last year's Addendum Report.

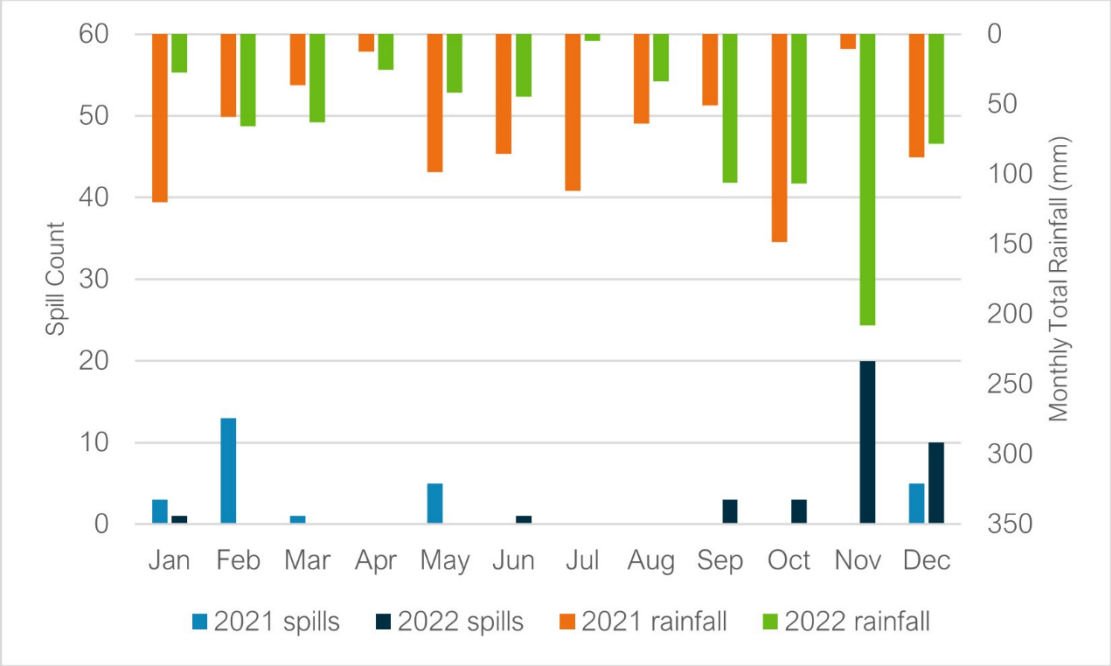
Table 9 below details the last two years performance of overflow 'Littlemead Industrial Estate CSO'. Note that in 2022, the EDM was only operational for 75% of the year, which may have affected the recorded spill count for the year. In 2021, the EDM was only operational for 80% of the year.

Table 9 – Event Duration Monitoring – Littlemead Industrial Estate

Overflow	2021		2022	
	Spills	Duration (hours)	Spills	Duration (hours)
Littlemead Industrial Estate	27	354.34	38	365.18

Figure 10 below presents the EDM performance trend and rainfall for recent years.

Figure 10 – EDM Monthly Performance – Littlemead Industrial Estate



There is a clear relationship between monthly rainfall totals and spills at the overflow, with the higher rainfall totals correlating with the higher spill counts, particularly evident in November 2022. The data suggests a wider relationship between rainfall, elevated groundwater levels and spill frequency at the overflow. Despite a lower rainfall total than September and October 2022, more spills were recorded in December 2022. Figure 6 suggests groundwater levels peaked around 'above normal' during the November/ December period. Similarly, despite broadly similar rainfall totals, no spills were recorded at the overflow in February 2022, however a significant number of spills were recorded in February 2021. The indicator site data shown in Figure 5, suggests groundwater levels in the catchment were generally higher in February 2021.

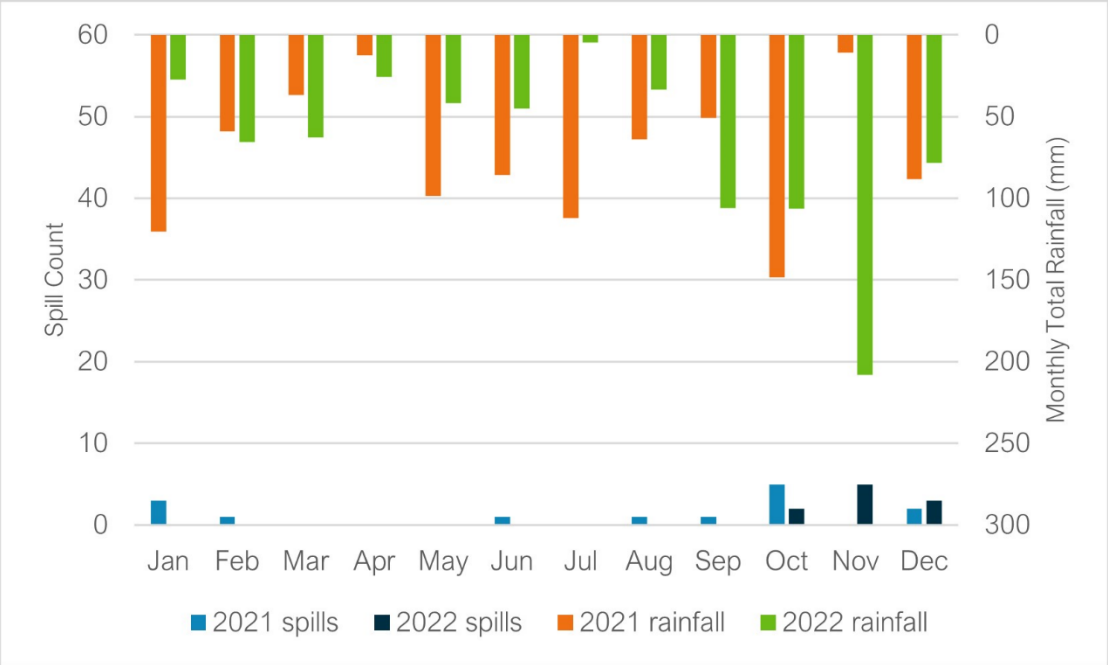
Table 11 below details the last 2 years performance of overflow 'Knowle Lane CSO'. Note that in 2022, the EDM was only operational for 87% of the year, which may have affected the recorded spill count for the year.

Table 11 – Event Duration Monitoring – Knowle Lane

Overflow	2021		2022	
	Spills	Duration (hours)	Spills	Duration (hours)
Knowle Lane	14	51.90	10	46.03

Figure 12 below presents the EDM performance trend and rainfall for recent years.

Figure 12 – EDM Monthly Performance – Knowle Lane



The data suggests a wider relationship between rainfall, elevated groundwater levels and spill frequency at the overflow. Despite a lower rainfall total than September and October 2022, more spills were recorded in December 2022. Figure 6 suggests groundwater levels peaked around 'above normal' during the November/ December period.

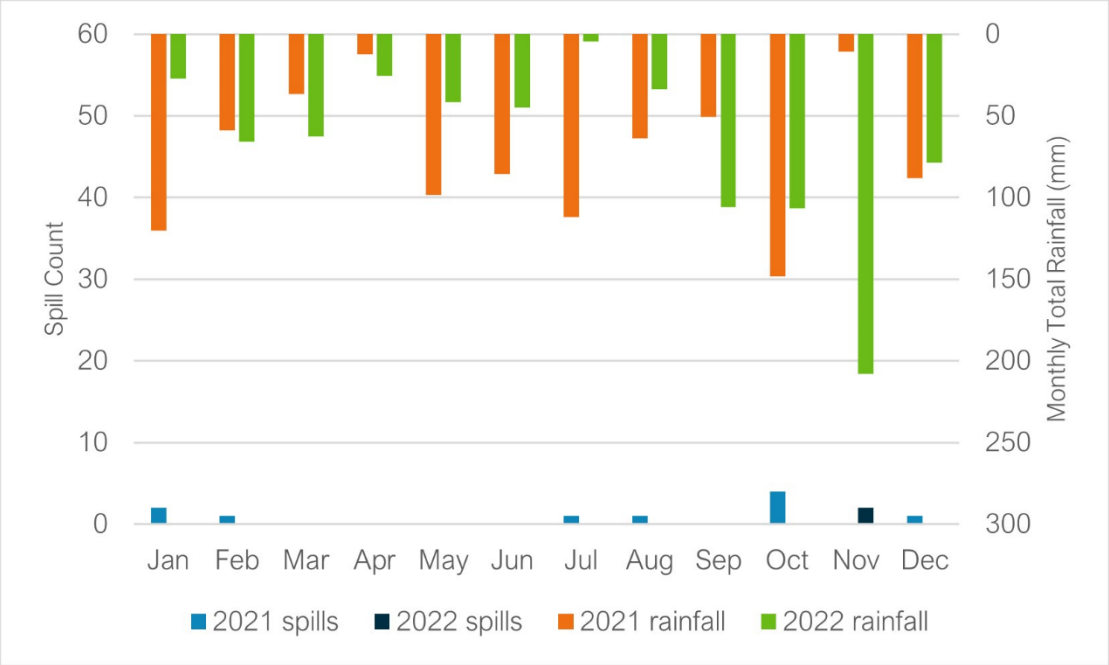
Table 13 below details the last 2 years performance of overflow 'Taylors Crescent CSO'. Note that for 2021, the spill count of ten, is one higher than the published figure of nine. The data has been revised/ re-validated, and the value of ten is the post-validation value.

Table 13 – Event Duration Monitoring – Taylors Crescent

Overflow	2021		2022	
	Spills	Duration (hours)	Spills	Duration (hours)
Taylors Crescent	10	39.68	2	6.84

Figure 14 below presents the EDM performance trend and rainfall for recent years.

Figure 14 – EDM Monthly Performance – Taylors Crescent



The data does not strongly indicate a wider relationship between rainfall, elevated groundwater levels and spill frequency at the overflow, with a correlation between monthly rainfall totals and spill counts evident, and spills also occurring in the summer months. This suggests that the depth and intensity of rainfall events, is critical to determining spill performance at Taylors Crescent.

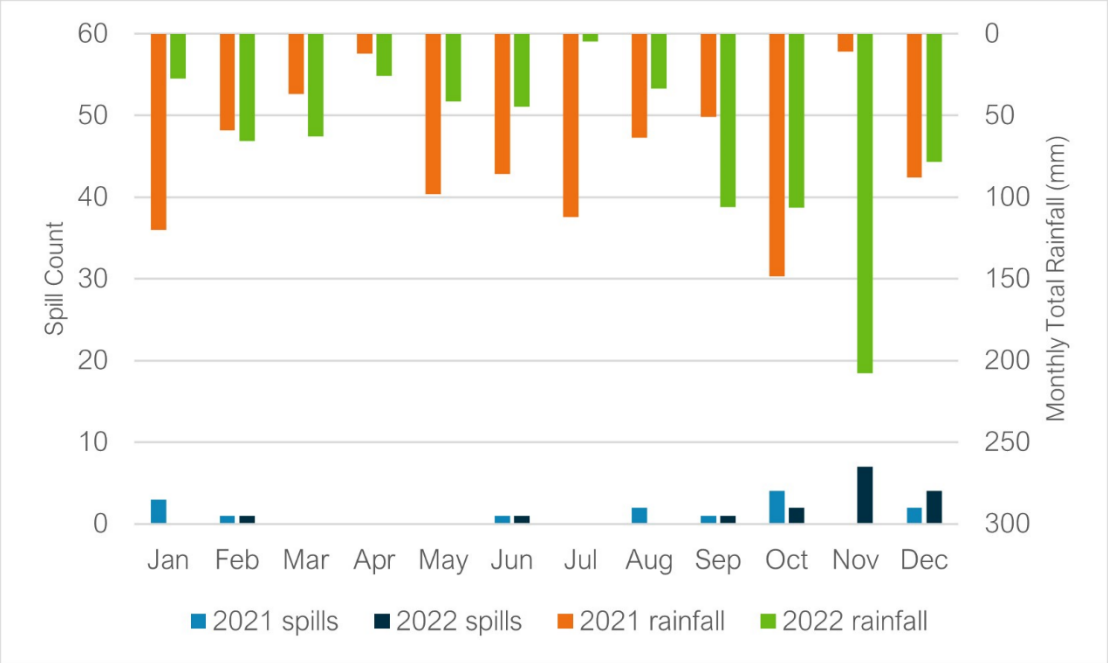
Table 15 below details the performance the last 2 years performance of overflow 'Canfold Wood SPS'.

Table 15 – Event Duration Monitoring – Canfold Wood SPS

Overflow	2021		2022	
	Spills	Duration (hours)	Spills	Duration (hours)
Canfold Wood SPS	14	67.69	16	76.79

Figure 16 below presents the EDM performance trend and rainfall for recent years.

Figure 16 – EDM Monthly Performance – Canfold Wood SPS



There is a clear relationship between monthly rainfall totals and spills at the overflow, with the higher rainfall totals correlating with the higher spill counts, particularly evident for November 2022. The data suggests a wider relationship between rainfall, elevated groundwater levels and spill frequency at the overflow. Despite a lower rainfall total than September and October 2022, more spills were recorded in December 2022. Figure 6 suggests groundwater levels peaked around 'above normal' during the November/ December period.

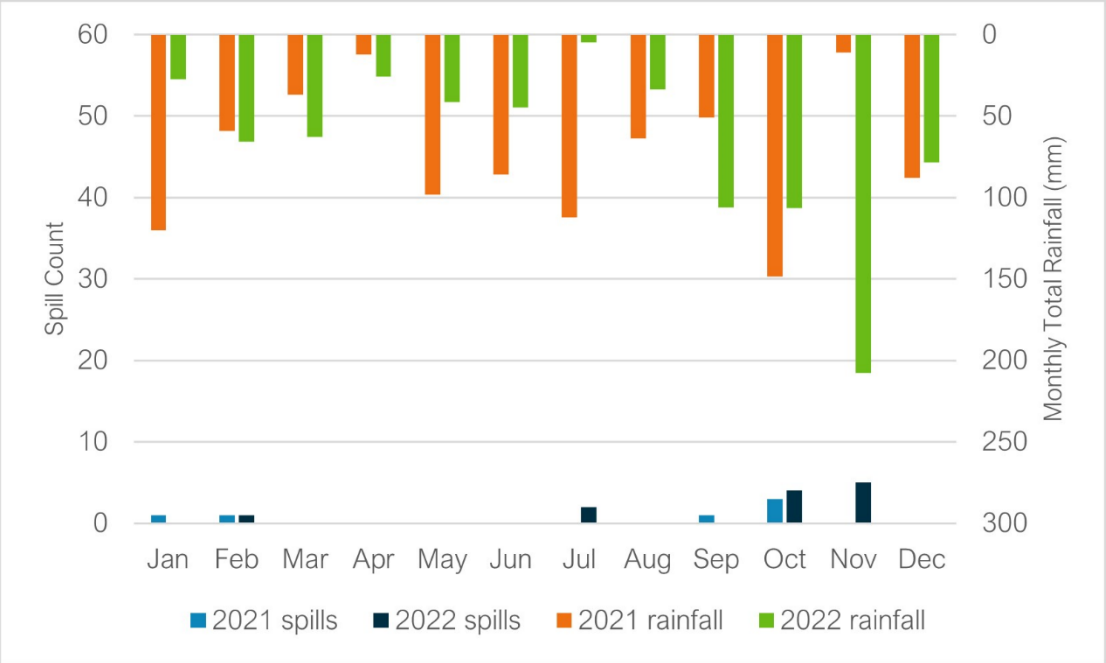
Table 17 below details the last 2 years performance 2022 of overflow 'Ockley Road SPS'.

Table 17 – Event Duration Monitoring – Ockley Road SPS

Overflow	2021		2022	
	Spills	Duration (hours)	Spills	Duration (hours)
Ockley Road SPS	6	16.07	12	61.84

Figure 18 below presents the EDM performance trend and rainfall for 2022.

Figure 18 – EDM Monthly Performance – Ockley Road SPS



The data suggests a wider relationship between rainfall, elevated groundwater levels and spill frequency at the overflow. Despite similar rainfall totals, no spills were recorded in September 2022, however spills were recorded in October 2022. The indicator site data shown in Figure 5, suggests groundwater levels in the catchment began to rise towards the end of October.

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 Cranleigh 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 19 below provides a summary of the investigations and remediation works undertaken or planned within the Cranleigh catchment in the 2022-23 Hydrological Year, as well as works undertaken in the 2021-22 Hydrological Year.

Table 19 – Works Undertaken in the 2022/23 Hydrological Year & in the 2021/22 Hydrological Year

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

No interventions/ investigations were carried out in the catchment in the 2022/23 Hydrological Year. However, the system will continue to be monitored and investigations/ interventions carried out as appropriate and when conditions allow.

An upgrade is planned for Cranleigh STW. This will improve its ability to treat the volumes of incoming sewage, reducing untreated discharges to the environment, and provide a higher quality of treated effluent going to the river. The project is expected to be completed in 2025.

Summary

EDM data is indicative of the role of groundwater infiltration on spills in the Cranleigh catchment. This hydrological year, 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 be undertaken in remaining wet winter periods if conditions allow, within this AMP7 period (2020- 2025). 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 2024 Price Review (PR) process if required.

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