Infiltration Reduction Plan

Kings Somborne

July 2024

Version 2.1

from Southern Water

Contents

Document Control

Version	Date
1	27 August 2014
1.1	23 December 2014
1.2	May 2016
1.3	September 2021
2	January 2024
2.1	July 2024

Glossary

AMP – Asset Management Programme
CCTV - Closed-circuit television
EA - Environment Agency
GW – Ground Water
IRP - Infiltration Reduction Plans
l/s - litres per second
MH – Manhole
NRV – Non-return valve
ODI – Customer Outcome Delivery Incentive
RPS - Regulatory Position Statement
SW – Southern Water
WaSC – Water and Sewerage Companies
WC – Water Closet
WPS - Wastewater Pumping Station
WTW - Wastewater Treatment Works

1. Background

This Infiltration Reduction Plan (IRP) for King's Somborne in the King's Somborne Wastewater Treatment Works catchment has been prepared in response to the Environment Agency's (EA) Regulatory Position Statement (RPS). Southern Water has been carrying out work for many years to survey and repair sources of infiltration in the catchment for King's Somborne Wastewater Treatment Works (WTW) in Hampshire. The IRP covers the villages of King's Somborne and Broughton but, for convenience, reference is just made to King's Somborne.

Figure 1.1 shows flow to King's Somborne WTW. Flow from the northeast of King's Somborne gravitates to Vicarage Lane WPS from where it is pumped to the A3057 Stockbridge Road. Flow then gravitates in a south-westerly direction to Stockbridge Road WPS from where it is pumped to Horsebridge. Flows from Broughton are pumped via Rookery Lane WPS and Roake Farm WPS to Horsebridge where it joins the flows from King's Somborne. The combined flow then gravitates southwards to King's Somborne WTW.

The repairs carried out by SW improve the integrity of the sewerage system. SW has been working with the following organisations and is dependent on their support to achieve the objective of reducing non-sewage flows into the sewers.

- Environment Agency,
- Hampshire County Council,
- Test Valley Borough Council
- King's Somborne Parish Council
- National Flood Forum
- King's Somborne Flood Action Group

Southern Water has consulted with representatives of these parties as part of meetings with the local councils.

2. Groundwater Infiltration at King's Somborne

2.1. The significance of groundwater infiltration.

King's Somborne is one of several areas in Southern Water's operating area where, during excessively wet winters, customers have been inconvenienced by the effects of groundwater infiltration into sewers. Such effects can include flooding and restricted toilet use (RTU).

Southern Water strives to maintain services for customers by a programme of investigation, repair, maintenance and mitigation. Mitigation measures include the use of tankers. Such mitigation measures are not sustainable, so during the last ten years SW has invested in carrying out major improvements to the integrity of the sewers and manholes in the vicinity of King's Somborne to minimise the occasions on which Mitigation is required.

2.2. What would happen if Southern Water did not take action?

Despite the significant groundwater flow through the valley during these conditions, incidents of sewer flooding have been relatively infrequent. Table 2.1 below show reported incidents of sewer flooding since April 2000, this is in part an illustration of the benefit of tanker mitigation.

Table 2.1 shows that there has been two reported instances of restricted toilet use since 2013 and External flooding has been reported on 18 occasions. It can be seen from Figure 2.1 that most of these incidents occurred in the winters of 2012/13, 2013/14 and in the winter of 2023/24. No incidents of internal flooding have been reported.

Table 2.1 – Reported incidents

Year	Internal Flooding	External Flooding (properties / gardens)	External Flooding (Highways / Other)	Restricted Toilet Use	Total
2013	0	3	1	1	5
2014	0	0	3	0	3
2015	0	0	0	0	0
2016	0	0	0	0	0
2017	0	0	0	0	0
2018	0	0	0	0	0
2019	0	1	0	0	1
2020	0	0	0	0	0
2021	0	0	0	0	0
2022	0	0	0	0	0
2023	0	0	0	0	0
2024	0	6	4	1	11
Total	**0**	**10**	**8**	**2**	**20**

3. Investigation & repairs

3.1. Outline Plans to Investigate Sources of Infiltration

The Generic Plan describes Southern Water's Infiltration Reduction process. The specifics of the investigations and repairs at King's Somborne are captured in Section 3.2 below, and includes the following elements:

- Manhole Inspections and CCTV Surveys
- Flow Monitoring Surveys
- Manhole and Sewer Repairs
- Follow-Up Surveys and Repairs

3.2. Investigation and Repairs in the King's Somborne

Groundwater infiltration into sewers has been a long-running issue for King's Somborne. SW has been making significant investments over many years to minimise infiltration.

SW recently completed a major programme of survey and repairs to the sewers in the King's Somborne catchment. The investigations and repairs followed the process set out in the Generic Plan. The timing and status of each step is in Table 3.1 below.

Table 3.1 – Summary of Survey and Repairs in King's Somborne

Step.	Description	Approx Date	Status
1.	Manhole lifting followed by CCTV Investigation (6000m of sewer surveyed)	May 2013 - June 2013	Completed
3.	Determination of required repairs	Summer 2013	Completed
5.a.	Dry Weather Flow Survey	August 2013 – October 2013	Completed
4.	Repairs (2250m of sewer and 14 manholes repaired)	08 September 2014 – 24 April 2015	Complete
5.b.	Wet Weather Flow Survey		Not carried out
6.	Limited follow up CCTV survey	Not appropriate	Not required
7.	Further Targeted Repairs	Not appropriate	Not required
8.	Ongoing monitoring	Commenced January 2015	Ongoing
9.	Further electroscan surveys	2023	Completed
10.	Review of electroscan surveys	March 2025	In progress
10.	Sewer sealing post surveys	Post April 2025	Planned

Repairs carried out in 2014 and 2015 were very successful in reducing infiltration, completion of this work reduced flows to Vicarage Lane WPS. The extent of the repairs is shown in the plans in Appendix A.

Flow monitoring was carried out in dry weather conditions (August 2013 to October 2013) to establish baseline flows. Comparison of 'wet' and 'dry' flow monitoring data can, on occasions, help identify areas of infiltration if it has not been found by other survey methods. In the case of King's Somborne, this was not necessary as infiltration was located by CCTV survey.

In addition to physical investigations on site, SW has instigated a long-term monitoring programme in critical catchments, including the King's Somborne catchment.

Electroscan Surveys of sewers in Kings Somborne system were undertaken in 2023 the survey results are being reviewed to identify any further sealing work required on the public sewerage system. Details of work completed are included in Appendix A.

4.0 Mitigation measures

4.1 Circumstances that lead to Mitigation

Since 2013, SW has made significant investment to reduce infiltration and to protect specific properties at risk of flooding, with the objective of reducing the frequency of mitigation measures.

If flows increase to unacceptable levels due to groundwater rising, mitigation measures at certain locations will be required. Areas likely to be the first affected are known from historic incidents so our initial work is to monitor these trigger points. The requirement for mitigation will be driven by levels in the manholes locally. Based on experience in 2014, mitigation could be expected to be required when the groundwater level at King's Somborne borehole reaches 33.1m. However, to allow time for investigation and preparation, SW is using lower 'trigger levels' in the winter planning report. A trigger level of 31.5m is currently being used. SW is considering reviewing the trigger level as it has been breached regularly without the occurrence of any sewer flooding, at this stage it remains useful to trigger additional monitoring.

Figure 4.1 shows the groundwater level at King's Somborne borehole from 2015 to 2024. A major part of the repair programme was completed in April 2015. It is encouraging to note that despite the very high groundwater levels recorded in 2023/24 the pump run time was less than previous years with high groundwater.

Figure 4.1 - Groundwater levels from 2015 to 2024

4.2. Steps to prevent the need for mitigation

The Generic Plan details the typical activities that Southern Water undertakes to minimise the requirement for mitigation. Since 2013, SW has undertaken extensive surveys and repaired sewers and manholes where infiltration had been found and where work has been previously carried out (Appendix A).

4.3 3rd Party Communications

Since the start of the Infiltration Reduction Programme in 2013, Southern Water has been active in communicating with stakeholders and customers about planned and completed work to improve the integrity of the sewerage system. Stakeholders have been kept informed of progress on survey and sealing work via emails and or face-to-face meetings.

SW attends and convenes meetings with a number of local groups. Meetings with stakeholders from these groups have been influential in helping to shape the IRP. The latest version of the IRP approved by the EA, will be published on SW's website.

Despite the work being undertaken, if tankering is required the locations are provided in Appendix B.

From time to time, SW updates stakeholders about completed and planned work, as part of stakeholder meetings with the local councils.

5.0 Options to Reduce Infiltration

5.1 Sewer Rehabilitation Programme

SW acknowledges that infiltration reduction is on-going process. In recent years, SW has invested in surveys and repairs in the King's Somborne catchment. The work was completed in April 2015. Due to the success of recent repairs, no further repairs are currently planned in this area. On a company-wide basis, to ensure benefit continues to be gained from the work, SW is continuing the programme of infiltration reduction with proposed investment based on performance and impact of high groundwater.Further electroscan surveys were undertaken in 2023 to identify potential leaking joints in otherwise structurally sound sewers. These surveys are being reviewed with a view to undertake high priority sealing in future investment periods.

Table 5.1 below summarises the work undertaken in the system since 2014 with an annual breakdown in Table 5.2. As infiltration only causes issues in this system very occasionally the amount of sewer sealing work here has been a lower priority than other areas which have received a much greater focus. This is evident by the low volume of work delivered post 2018.

Work type	km
Length of sewer surveyed	13.13
Sewer Length Sealed	2.05
Sewers with no work required	9.56
Sewer sealing required	1.52
Manholes Sealed No.	5
Planned Manhole Sealing No.	2

Table 5.1 – summary of work done in the catchment

Year	Surveyed (km)	Sewers sealed (km)	Manholes sealed
Pre 2014	5.53	0.15	0
2014	1.1	0	0
2015	1.1	1.2	4
2016	0.3	0.6	1
2017	0	0	0
2018	0	0	0
2019	0	0	0
2020	0	0	0
2021	0	0.1	0
2022	5.1	0	0
2023	0	0	0
2024	0	0	0
Post 2024	0	1.52	0

Table 5.2 – annual summary of work completed

5.2. Property Level Protection

Non-return valves (NRVs) have always been part of our method for dealing with the consequences of infiltration, but they are only effective if infiltration is under control on both the lateral and the main sewer. Having completed the current phase of rehabilitation work, which has improved the integrity of the main sewers, there are no plans currently to install any more NRVs, but the potential benefit of further property level protection, such as on Winchester Road, will be investigated if it is considered to be required for any further vulnerable properties.

5.3. Local Flow Control

In 2014, tankering was required between 3rd and 11th February, and further mitigation was implemented between 6th March and 27th June. Mitigation was not required in 2019/20 or 2020/21. High groundwater was managed by tankering alone in the winter of 2023-2024.

5.4 Pumping Stations

In February 2019 a pump at Stockbridge Road WPS was replaced to ensure that the station is able to deliver the required optimum flow forward. Pre-season health checks are carried out.

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5.5 Monitoring

The performance of the King's Somborne catchment at times of high groundwater is monitored via electronic data. This monitoring helps inform SW's response, in terms of when tankering is required. The Generic Plan has more detail on the overall monitoring strategy.

Southern Water is also looking at longer-term trends to monitor the effectiveness of the completed rehabilitation work. Figure 5.2 shows the groundwater levels at King's Somborne borehole plotted against flows at Vicarage Lane WPS.

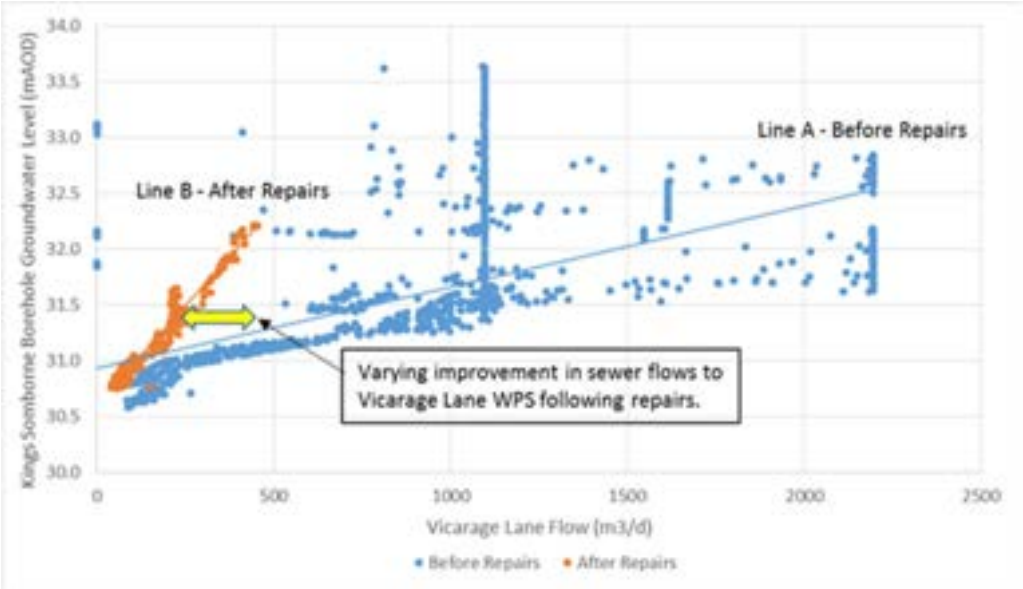

Figure 5.2 – Long Term Monitoring (Feb 2011 to Feb 2016)

Figure 5.2 quantitatively illustrates how flow varies with groundwater levels. It is reasonable that as groundwater levels increase, the rate of infiltration increases. Therefore Figure 5.2 can be used to assess how effective the repairs are at reducing infiltration. Data is only available from February 2011 to February 2016, hence two distinct periods are outlined: Feb 2011 – Sep 2014 (before major repairs in the King's Somborne catchment), and Apr 2015 – Feb 2016 (after the major repairs).

Lines A and B in Figure 5.2 show how values of flow for a given groundwater level vary before and after the repairs. For a given groundwater level, the corresponding flow is lower after the repairs than before the repairs. However, Figure 5.2 suggests that the effects of the repairs vary depending on the groundwater level. The mitigation of groundwater infiltration is larger at higher groundwater levels than at lower groundwater levels. In Figure 5.2 this equates benefit of up to 2 metres, which is illustrated by lines A and B.

It is worth noting that since the repairs have been carried out, groundwater levels have not risen particularly high until this winter. Hence there are few data points at high groundwater levels (>32 mAOD) since the repairs. Tankering was required this year however only when groundwater level reached >33.0m. It is therefore reasonable to assume that the repairs made are still holding. In order to enhance the validity of this analysis, further data points are needed.

6.0 Action Plans

A significant amount has been achieved in the King's Somborne catchment in the last eight years. To make it easy to track progress, the following tables set out the actions to reduce infiltration and also to mitigate the effects of it, if the infiltration cannot be controlled at economic cost. Tables 6.1 and 6.2 cover the actions by SW and by other parties, respectively, to reduce infiltration. Tables 6.3 and 6.4 cover mitigation of the effects of flooding (Communication and other activities).

SW is committed to continuing to pursue infiltration to reduce the frequency at which mitigation is required. This IRP describes the work that has been done by SW to improve the situation. In addition, it also describes what is being done to monitor flows, the 'winter preparation' work to be carried out to ensure assets are operating correctly, and the work to be developed with other agencies to improve an integrated plan to address flooding.

Colour coding of actions in tables:

- Green – completed
- Orange – imminent action required
- Red – overdue
- White – on-going actions with no specific end dates.

Table 6.1. Southern Water Current Activities to Reduce Groundwater Infiltration

Ref.	Item	Actions	Timescale and Status	Outcomes
1.1	Develop an approach for reduction of infiltration and maintenance of reduced levels of infiltration.	Refer to Section 1 above and the report in Appendix A.	Summer 2013, Complete	The steps are being followed to deliver results.
1.2	CCTV etc survey of sewers	Identify Strategic Manholes, survey manholes to identify clear flow and infiltration. Carry out CCTV survey where clear flow was identified.	Summer 2013 - Complete	Identify major sources of infiltration to determine scope of rehabilitation work.
1.3	Carry out sewer rehabilitation work	Use various techniques to seal infiltration points in manholes and sewers	Repairs carried out from September 2014 – April 2015. Complete	Structural integrity of sewers restored.
1.4	Further surveys (CCTV or alternative techniques), if required, where 'wet weather' flow surveys show areas of high infiltration remaining	Further surveys in areas where high infiltration flows remain.	Monitoring reveals further surveys not required.	N/A

Ref.	Item	Actions	Timescale and Status	Outcomes
1.5	Further sewer rehabilitation work, if required, in areas where surveys carried out.	As above, use various techniques to seal infiltration points in manholes and sewers	N/A	N/A
1.6	Maintain IRP as a live document	Review text of the IRP and update if appropriate to describe work carried out and/or developments	Annually	Reviewed/Updated IRP. Last issued for review 2023
1.6a	Maintain IRP as a live document	Review Tables 6.1 to 6.5 and as appropriate amend to show progress on individual activities.	Quarterly	Up to date tables of Actions
1.7	Strategy for inflows via private drains*	Southern Water to propose a strategy for dealing with infiltration via private drains*	SW, Complete. July 2014.	Improved awareness of the significance of infiltration into private drains and the importance for customers to ensure infiltration is repaired when it is discovered.
1.8	Monitor Flows	SW carry out pre-winter checks and monitor sewer flow to identify significant increases in inflows.	Commenced winter 2014/15. Repeated winter 2015/16.	Preparation for winter responses.
1.9	Action Plans	Develop SW action plans documenting set up of tankers, etc. for emergency situations.	SW, Summer 2014- Complete	Action Plan available for planning sessions with other authorities in preparation for repeat flooding events. Engagement with the local community about the potential arrangements for dealing with excess flows into sewers to mitigate disruption to customers.
1.10	Further surveys by electroscan	Commission and review surveys to identify leaking joints	2023/24	Complete

Ref.	Item	Actions	Timescale and Status	Outcomes
1.11	Review of electroscan surveys	In progress	End March 2025	Findings to inform future rehabilitation
1.12	Undertake high priority sewer sealing	Identify and prioritise sealing activity in AMP8	2025 onwards	Pending dependent on 1.11

Table 6.2. Multi-Agency Activities to Reduce Groundwater Infiltration

Ref.	Item	Actions	Owner, Timescale and Status	Outcomes
2.1	Strategy for infiltration via private drains	Southern Water to propose a strategy for dealing with infiltration via private drains*	SW supported by EA and local Parish Councils, Summer/ Autumn 2014. Completed 2014.	Southern Water objective is to improve awareness of the significance of infiltration into private drains and the importance for customers to ensure infiltration is repaired when it is discovered.
2.1a	Investigate highway 'misconnections'	Where non-sewage flow is identified, check highway drainage relative to sewers to ensure road drainage is not a source of flow into the SW sewers	Hampshire County Council with support from SW, as appropriate if connections are identified. To be pursued as and when required.	Reduced flow of surface water (if connections are found).
2.2a	Investigate groundwater infiltration on domestic drains	Where non-sewage flow is identified from domestic properties, investigate to identify source of flow into SW sewers	SW, with assistance from Test Valley Borough Council as appropriate, if connections are identified. To be pursued as and when required.	Reduced flow of surface water (if connections are found).
2.2b	Consider effects of proposed new developments on infiltration.	Borough Council to continue to consult with SW on development applications.	Test Valley Borough Council, Ongoing.	Developments in areas which would be detrimental to sewer flooding, to have conditions recommended by SW and applied, as appropriate, by the City and District Councils.

Ref.	Item	Actions	Owner, Timescale and Status	Outcomes
		SW to determine threshold above which they require to be consulted.	SW, Ongoing. SW wish to be consulted on all proposed development.	SW wishes to be consulted on all potential developments.
2.2c	Consider effects of proposed new developments on infiltration.	Sewerage materials for new developments	Consider effects of proposed new developments on infiltration.	Sewerage materials for new developments

*Note: Southern Water does not have powers to require residents to repair private drains. Hence the support of the other agencies is required. It is acknowledged that customers may not be aware of infiltration in their private drains, so SW will consider ways of obtaining information to demonstrate the presence of infiltration. District Councils would only be able to instigate action under Section 59 of the Building Act where proof/evidence is provided of the defect.

Table 6.3 Publicity / Communication Activities to Reduce / Mitigate the Effects of Groundwater Infiltration.

Ref.	Item	Actions	Owner, Timescale and Status	Outcomes
3.1	Public meetings about reducing groundwater infiltration into sewerage system	Attend public meetings with other agencies as appropriate.	SW, as required	Inform stakeholders of progress and planned activities and receive feedback.
3.2	Letters from SW to stakeholders about reducing groundwater infiltration into the sewerage system	Send letters at regular intervals to communicate progress and planned activities	SW, as required	Inform stakeholders of progress and planned activities
3.3	Multi-Agency Group meetings	Discuss and agree actions to reduce requirements for tankering and emergency discharges to watercourses.	All Parties, as required.	Improved understanding and appreciation of issues. Agreement to actions to help reduce the need for tankering and emergency discharges to watercourses
3.4	Implement local campaign to discourage misconnections	Publicise through parish councils. Include article in Parish magazines. **	District and Parish Councils, Summer 2014 Complete	Article included in Local Council magazine.

** SW can provide base information to councils to include in articles publicising the role that everyone can play in minimising non-sewage flows into sewers, and the importance of doing so to reduce the incidence of restricted toilet use during periods of high groundwater.

Table 6.4. Activities to Mitigate the Effects of Groundwater Infiltration/ Other Flood Protection Mechanisms

Ref.	Item	Actions	Owner, Timescale and Status	Outcomes
4.1	Early Warning system	Joint continuous monitoring of groundwater levels and sewer levels/flows.	SW, EA, 2014. Ongoing. Commenced Jan 2015. Re-commenced annually	Develop trigger levels by comparing historic customer complaints and tankering with BH levels (or other reference). Note trigger levels should vary as a consequence of rehabilitation. Also, they will need to reflect groundwater reaction times.
4.2	Tankering arrangements	Investigate options for improving location of mitigation units for future events. e.g. by use of longer hoses	SW, Spring 2014, Complete	Potentially less disruption to residents when tankering is essential.
4.3	Integrated approach to Mitigate effects of groundwater flooding	Attendance at multi-agency meetings and developing multi-agency actions to reduce the effects of groundwater flooding	Hampshire County Council with inputs from SW, EA, Flood Action Group and Parish/Borough Councils.	Actions for participating authorities that in unison will reduce flooding and / or the impact of flooding.
4.4	Flooding Management Plan			Plan to include actions for participating authorities, that in unison will reduce the extent of flooding and the impact of flooding.
4.5	Maintenance of watercourses	Riparian owners to carry out their responsibilities to maintain adequate flow through watercourses by clearing vegetation, desilting, etc	Riparian owners with input from District and Parish Councils – ongoing responsibility	Maximise the flow along watercourses in order to minimise surface flooding, which results in inundation of manholes to the sewerage system.
4.6	Review of utilisation of a control structure	Investigate the possible use of a fixed control structure to relieve hydraulic overloading of sewers.	SW	No current plans to progress this option.

Appendix