

# Infiltration Reduction Plan

## King's Somborne

September 2021

Version 1.3



from  
**Southern  
Water** 

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## Document Control

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## 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  
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). SW 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 flows to King's Somborne WTW. Flow from the north east 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.

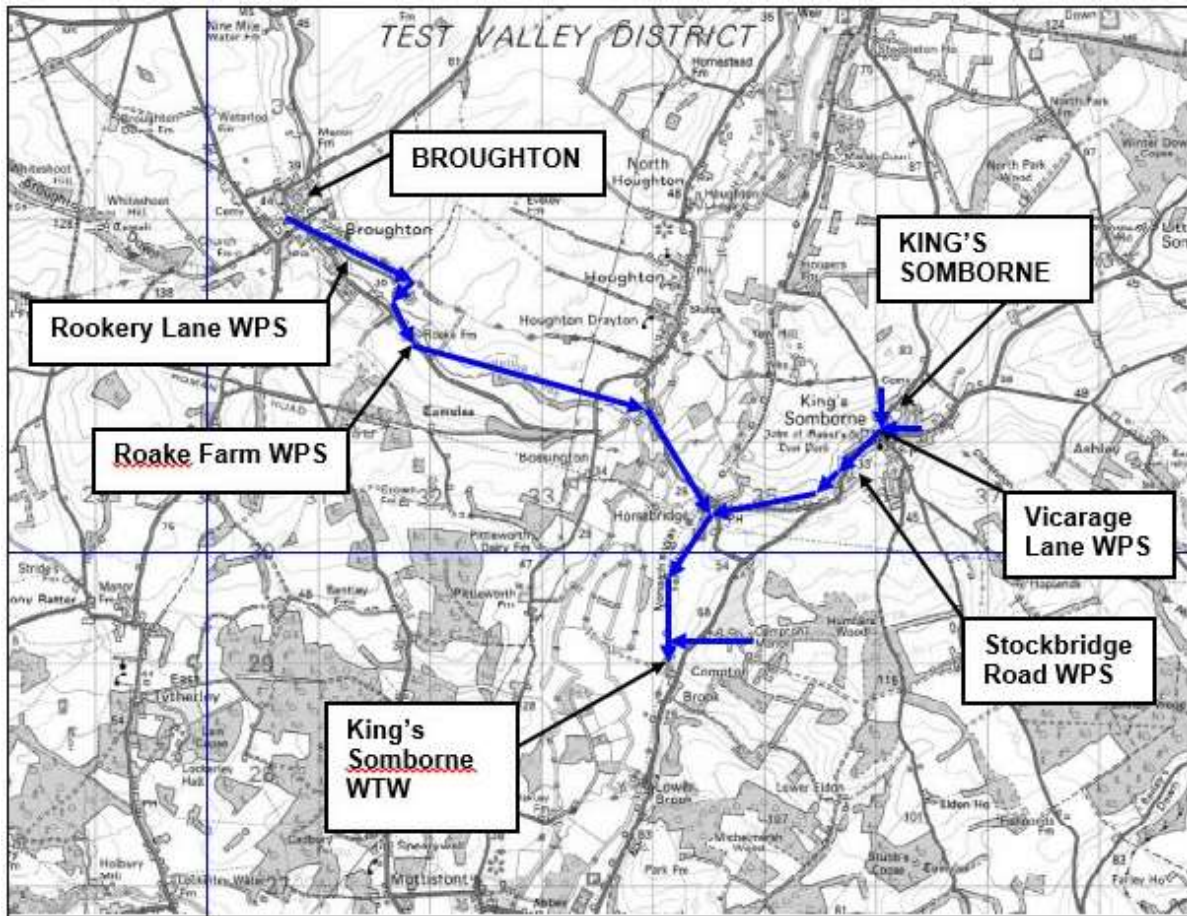


Figure 1.1 - Representation of the sewerage system for the King's Somborne WTW catchment

## **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 and over-pumping. Such mitigation measures are not sustainable, so during the last eight years SW has invested in carrying out major improvements to the integrity of the sewers and manholes in the vicinity of King's Somborne in order to minimise the occasions on which over-pumping 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. Average winter rainfall has also been included in Figure 2.1.

In some catchments, SW has hydraulic models of the sewers which can be used to predict the locations where the sewers are expected to flood during certain storm conditions. There is no model for King's Somborne but, from experience, SW is aware of the locations which are likely to suffer first from the effects of flooding.

Table 2.1 shows that there has been one reported instance of restricted toilet use since 2000/01, which occurred in winter 2013/14. Indeed, of the rainfall values recorded, that winter was the wettest, with an average daily winter rainfall of 6.1mm. Incidents of external flooding occurred more frequently. External flooding has been reported on 14 occasions since April 2000. It can be seen from Figure 2.1 that most of these incidents occurred in the winters of 2012/13 and 2013/14. No incidents of internal flooding have been reported since 2000.

The rainfall figures are average winter rainfall figures. Records were not readily available before 2005. They are provided to show the influence of rainfall / high groundwater on incidences of sewer flooding.

Table 2.1 – Reported incidents

| Year          | External Flooding | Internal Flooding | Restricted Toilet Use | Total     | Daily Average Rainfall (mm) |
|---------------|-------------------|-------------------|-----------------------|-----------|-----------------------------|
| 2000_2001     | 1                 | 0                 | 1                     | 2         |                             |
| 2001_2002     | 0                 | 0                 | 0                     | 0         |                             |
| 2002_2003     | 1                 | 0                 | 0                     | 1         |                             |
| 2003_2004     | 0                 | 0                 | 0                     | 0         |                             |
| 2004_2005     | 0                 | 0                 | 0                     | 0         |                             |
| 2005_2006     | 0                 | 0                 | 0                     | 0         | 1.59                        |
| 2006_2007     | 0                 | 0                 | 0                     | 0         | 3.42                        |
| 2007_2008     | 1                 | 0                 | 0                     | 1         | 2.86                        |
| 2008_2009     | 0                 | 0                 | 0                     | 0         | 2.47                        |
| 2009_2010     | 0                 | 0                 | 0                     | 0         | 4.15                        |
| 2010_2011     | 0                 | 0                 | 0                     | 0         | 2.55                        |
| 2011_2012     | 0                 | 0                 | 0                     | 0         | 2.09                        |
| 2012_2013     | 7                 | 0                 | 0                     | 7         | 2.73                        |
| 2013_2014     | 3                 | 0                 | 1                     | 4         | 6.14                        |
| 2014_2015     | 0                 | 0                 | 0                     | 0         | 3.32                        |
| 2015_2016     | 0                 | 0                 | 0                     | 0         | 3.4                         |
| 2016_2017     | 0                 | 0                 | 0                     | 0         | 2.3                         |
| 2017_2018     | 0                 | 0                 | 0                     | 0         | 2.28                        |
| 2018_2019     | 0                 | 0                 | 0                     | 0         | 2.6                         |
| 2019_2020     | 1                 | 0                 | 0                     | 1         | 4.16                        |
| 2020_2021     | 0                 | 0                 | 0                     | 0         | 2.79                        |
| <b>Totals</b> | <b>14</b>         | <b>0</b>          | <b>2</b>              | <b>16</b> |                             |



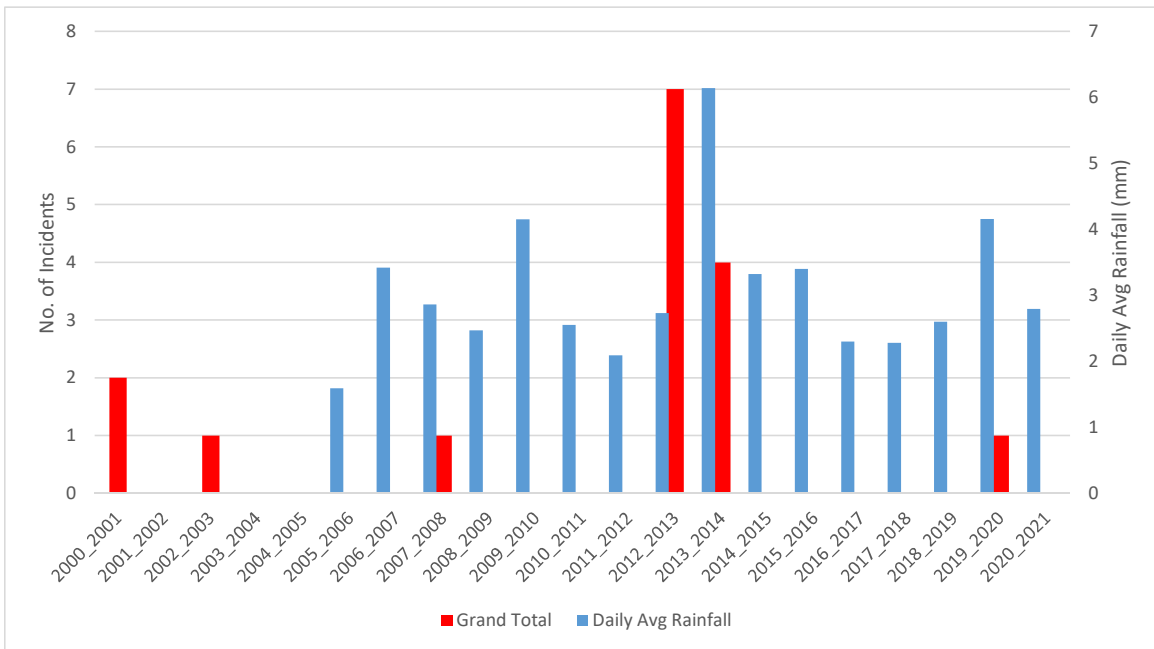


Figure 2.1 – Rainfall totals and incidents

## 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 and the need for over-pumping.

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 and Environs**

| 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 surveys and subsequent repairs                                   | Post 2022                         | As required     |

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.

Whilst no further work is scheduled, if infiltration remains an issue, the requirement for further investigation and repairs will be considered in relation to other locations which experience sewer flooding.

Additionally, 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. Details are given in Section 5.3.

## 4. Over-pumping

### 4.1. Circumstances that lead to over-pumping

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 discharges to watercourses.

If flows continue to increase, as groundwater levels rise, mitigation measures at certain locations will be required. Using previous experience, areas likely to be the first affected, are identified. The requirement for tankering or pumping will be driven by levels in the manholes locally. Based on experience in 2014, over-pumping 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. It should be noted that there was a period of excessive flooding between when tankering stopped and over-pumping commenced in the winter of 2013/14. Manholes were so inundated with water that both tankering and over-pumping would have been ineffective. SW is considering reviewing the trigger level as it has been breached in 2015 and 2016 without the occurrence of any sewer flooding. Neither tankering or over-pumping were required in 2019/20 or 2020/21.

Figure 4.1 shows the groundwater level at King's Somborne borehole from 2015 to 2021. The major part of the repair programme was completed in April 2015.

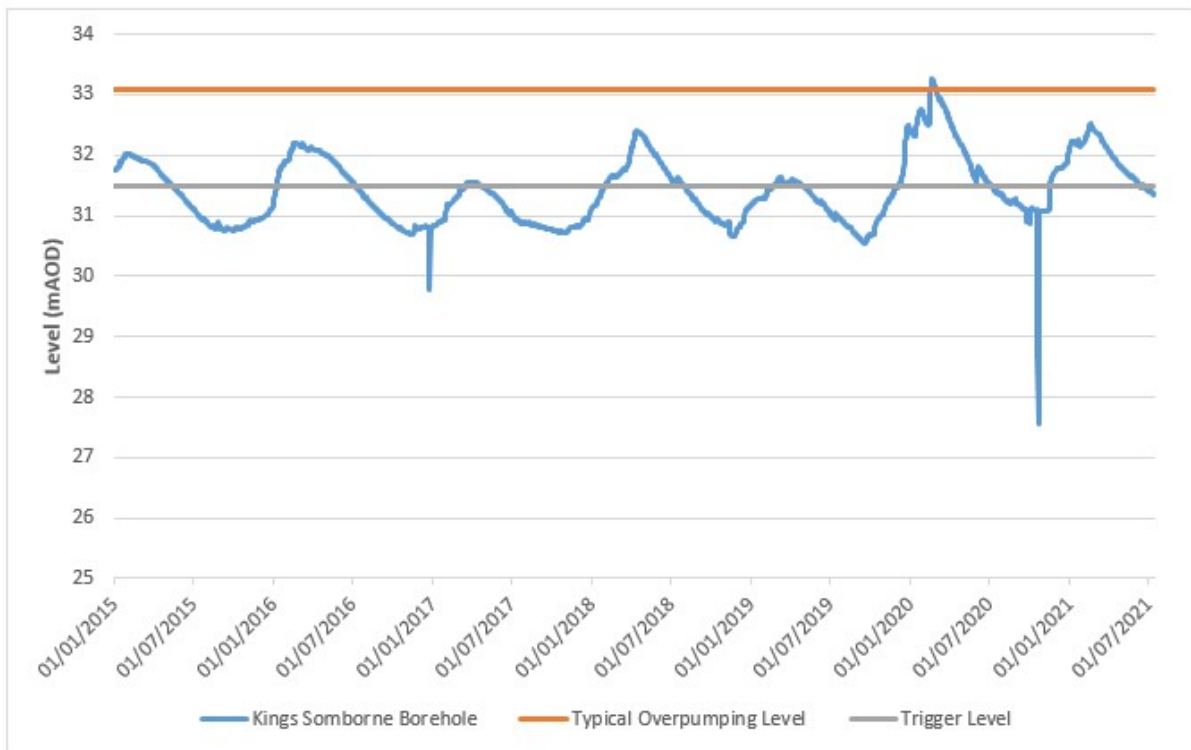


Figure 4.1 - Groundwater levels from 2015 to 2021

The details of where tankering and over-pumping has been necessary in the past are given in Appendix B. The repairs carried out, combined with the winter preparation checks, are expected to minimise the number of locations where over-pumping would be required. However, as a consequence of repairs and potentially other

factors outside SW's control (such as the severity of the weather), the hydraulics may dictate that over-pumps are required at other locations, either in place of or in addition to, the sites described in Appendix B.

## 4.2. Steps to prevent discharges and alternatives to over-pumping

The Generic Plan details the typical activities that Southern Water undertakes to minimise the requirement for discharges to watercourses. Since 2013, SW has undertaken extensive surveys and repaired sewers and manholes where infiltration had been found (the extent of the work is shown in Appendix A). This built on the repairs that had been carried out in previous years (shown in Appendix A).

## 4.3. Over-pumping arrangements (flow rates and minimisation of effect on watercourse)

A typical arrangement of an over-pumping setup is provided in the Generic Plan.

The locations where tankering and over-pumping has been used in recent years are shown in Appendix B. These locations were effective in restoring service to customers and are the default locations should the situation re-present itself. Dates of historic tankering and over-pumping are also provided in Appendix B.

## 4.4. Steps to minimise the volume and duration of over-pumping

The Generic Plan outlines a detailed rationale behind the use of tankers and over-pumping, and summarises the benefits and disadvantages. Some specific issues in relation to the King's Somborne catchment are captured below.

### 4.4.1. Tankering

#### Benefits:

- See Generic Plan.

#### Disadvantages

- See Generic Plan.
- The flow rate is low (approx. 2l/s per tanker over a 24 hour period). Tankers operating in the King's Somborne catchment discharge at Chickenhall WTW - a round trip of approximately 2 hours including loading and discharging.

### 4.4.2. Over-pumping

#### Benefits:

- Typical pump fuel consumption is 23% of the fuel that one tanker would use in a day.
- The discharge rate is significantly greater. A 100mm pump will discharge typically 30 l/s; the equivalent of a fleet of 14 tankers.
- See also the Generic Plan.

#### Disadvantages

- See Generic Plan.

The graph in Figure 4.2 shows the estimated carbon emission per m<sup>3</sup> of dilute effluent removed by tanker and by pump. In this example, data has been used for an averaged 3,500 gallon tanker and 100mm pump at King's Somborne in 2014.

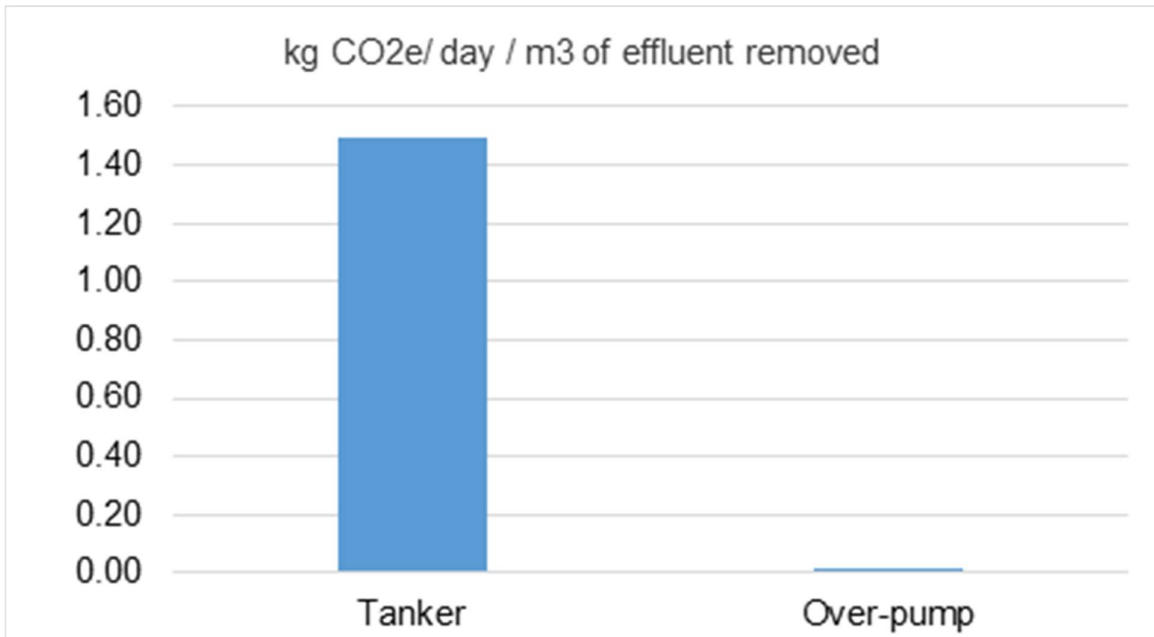


Figure 4.2 – Carbon Footprint figures for Tankers and Over-pumps per m<sup>3</sup> of effluent removed.

## 4.5. 3rd Party Communications about over-pumping

Since the start of the Infiltration Reduction Programme in 2013, Southern Water has been proactive 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 or over-pumping is required, the location of the over-pumps is also provided in Appendix B. The Generic Plan provides more detailed arrangements around over-pumping.

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

## 4.6. Monitoring quality of the downstream watercourse

The Generic Plan provides details of water quality monitoring that will be undertaken, should over-pumping be required.

## 5. Options to Reduce Infiltration

### 5.1. Sewer Rehabilitation Programme

SW acknowledges that infiltration reduction is an 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 King's Somborne. On a company-wide basis, to ensure that benefit continues to be gained from the work that has been done, SW is continuing the programme of infiltration reduction with proposed investment across its region based on performance and impact of high groundwater.

### 5.2. Property Level Protection

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 3<sup>rd</sup> and 11<sup>th</sup> February, and over-pumping was implemented between 6<sup>th</sup> March and 27<sup>th</sup> June. Neither tankering or over-pumping were required in 2019/20 or 2020/21.

### 5.4. Pumping Stations

In July 2014 two new pumps were fitted at Vicarage Lane WPS, and in February 2019 a pump at Stockbridge Road WPS was replaced to ensure that both stations are able to deliver the required optimum flow forward.

### 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 and over-pumping are required. The Generic Plan has more detail on the overall monitoring strategy.

The graph below, in Figure 5.1, is an example of those used for predicting the earliest, average, and latest dates for when the trigger levels are forecast to be breached. This graph shows groundwater levels and an indication of flows, based on the pumping running times at Vicarage Lane WPS. It can be seen that over the last two winters, high groundwater levels have triggered extended pump run times at the pumping station.

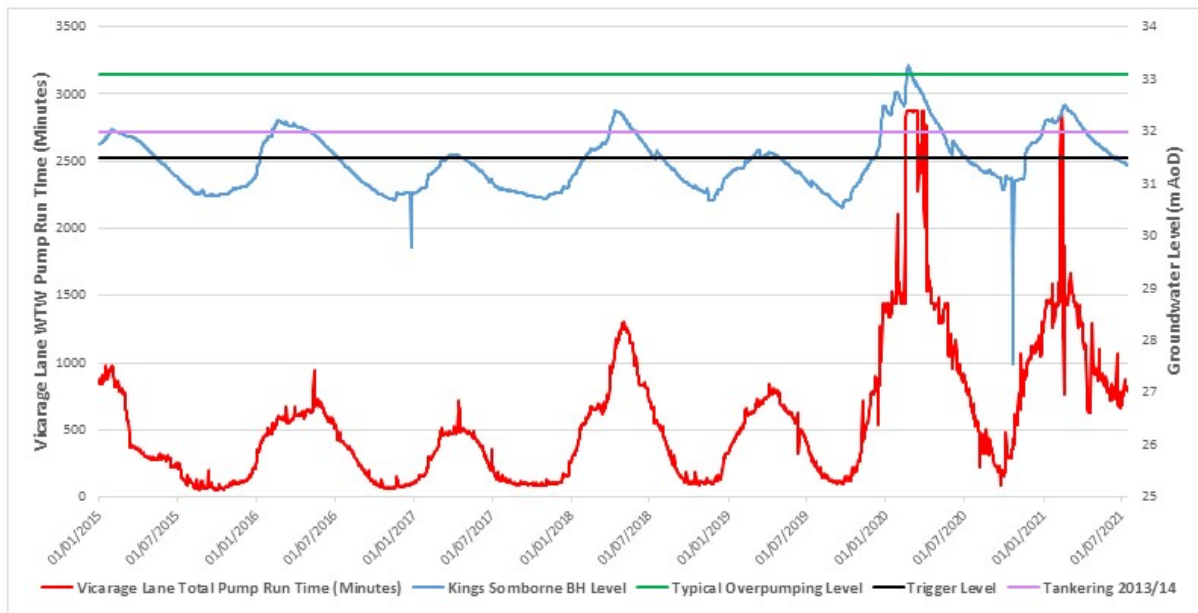


Figure 5.1 – Forecasting of Trigger Dates

In addition to the groundwater flooding forecasts explained above, SW 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.

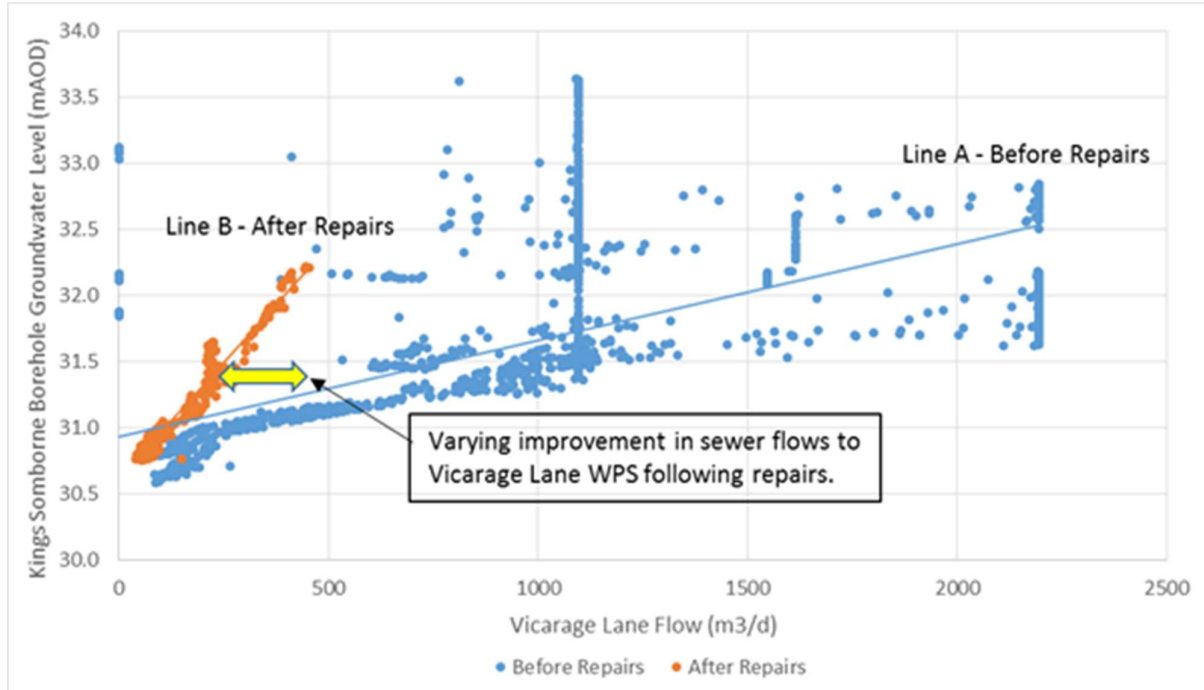


Figure 5.2 – Long Term Monitoring (Feb 2011 to Feb 2016)



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. Hence there are few data points at high groundwater levels (>32 mAOD) since the repairs. It is therefore not possible to confidently conclude how effective the repairs are at mitigating infiltration at high groundwater levels. However, the analysis suggests encouraging results, which is supported by operational experience. In order to enhance the validity of this analysis, further data points are needed.

## 6. Action Plans

A significant amount has been achieved in the King's Somborne catchment in the last eight years. Some actions are ongoing which reflects the continuous improvement process for dealing with infiltration due to groundwater. 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 of over-pumping. 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**

| <b>Ref.</b> | <b>Item</b>   | <b>Actions</b>   | <b>Timescale and Status</b>                                    | <b>Outcomes</b>   |
|-------------|---|--|--|---|
| 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 1.   | 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   |

King's Somborne Infiltration Reduction Plan

| 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 2017. Re-issued 2020.   |
| 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  | Over-pumping Sites: improve effluent quality  | Investigate potential for improved screening and basic treatment at points of discharge into watercourse. | SW, Summer/Autumn 2014                             | Improved arrangements for discharges when required.  |
| 1.10 | Over-pumping Sites: minimise flow   | Add level control to pumps to reduce durations for pumping  | SW, 2014, Complete                                 | Establish whether seasonal discharge (s) will be necessary in order to maintain use of sewerage services for customers during periods of very high groundwater levels. |

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| Ref. | Item  | Actions  | Timescale and Status           | Outcomes  |
|------|---|--|--------------------------------|---|
| 1.11 | Standards for emergency discharges                                      | SW to discuss with EA about best practice set up for over-pumping arrangements.              | SW, 2014, included in this IRP | Agree with EA acceptable treatment for discharges and acceptable flow rates.  |
| 1.12 | Flow, location, screening arrangements for emergency discharges         | Determine potential flow rates and screening arrangements and most appropriate locations,    | SW, included in this IRP       | Agree with EA, HCC and local Parish Councils acceptable arrangements for future emergency discharges.   |
| 1.13 | Action Plans  | Develop SW action plans documenting set up of pumps, 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. |
| 1.14 | Further survey and sealing work proposed for the public sewerage system | SW to gain approval to undertake necessary work  | Post 2022 if required          | To be assessed following next high groundwater period   |

**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 'mis-connections'                          | 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.                            |

King's Somborne Infiltration Reduction Plan

| 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 tankers and over-pump units for future events. e.g. by use of longer hoses/ pumping         | SW, Spring 2014, Complete   | Potentially less disruption to residents when tankering / pumping 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 including 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

A Survey Findings and Rehabilitation Scope

B Emergency Discharge Sites