

Infiltration Reduction Plan

Appleshaw and Penton Mewsey

September 2021

Version 2.3



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 Appleshaw and Penton Mewsey in the Fullerton 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 Fullerton Wastewater Treatment Works (WTW) in Hampshire.

Figure 1.1 shows the gravity flow from Appleshaw village being pumped from Cleaver Cottages WPS via rising mains to Weyhill Bottom WPS and to Harroway Lane WPS, where the flow from Penton Mewsey also enters the system. The resulting flow is pumped to Fullerton Wastewater Treatment Works (WTW) which is south of Andover. Groundwater infiltration into the sewerage system in Appleshaw would result in an increase in the potential for sewer flooding in both villages. Groundwater infiltration into the sewerage system in Penton Mewsey would reduce the capacity for discharges from Appleshaw and also increase the potential for sewer flooding in Penton Mewsey.

The map also shows Fyfield, Kimpton, Thruxton and Monxton which are also part of the Fullerton WTW catchment, but given that they are on a separate branch of the sewerage network they are covered in a separate IRP.

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,
- Appleshaw Parish Council
- Penton Mewsey Parish Council
- Campaign to Protect Rural England

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

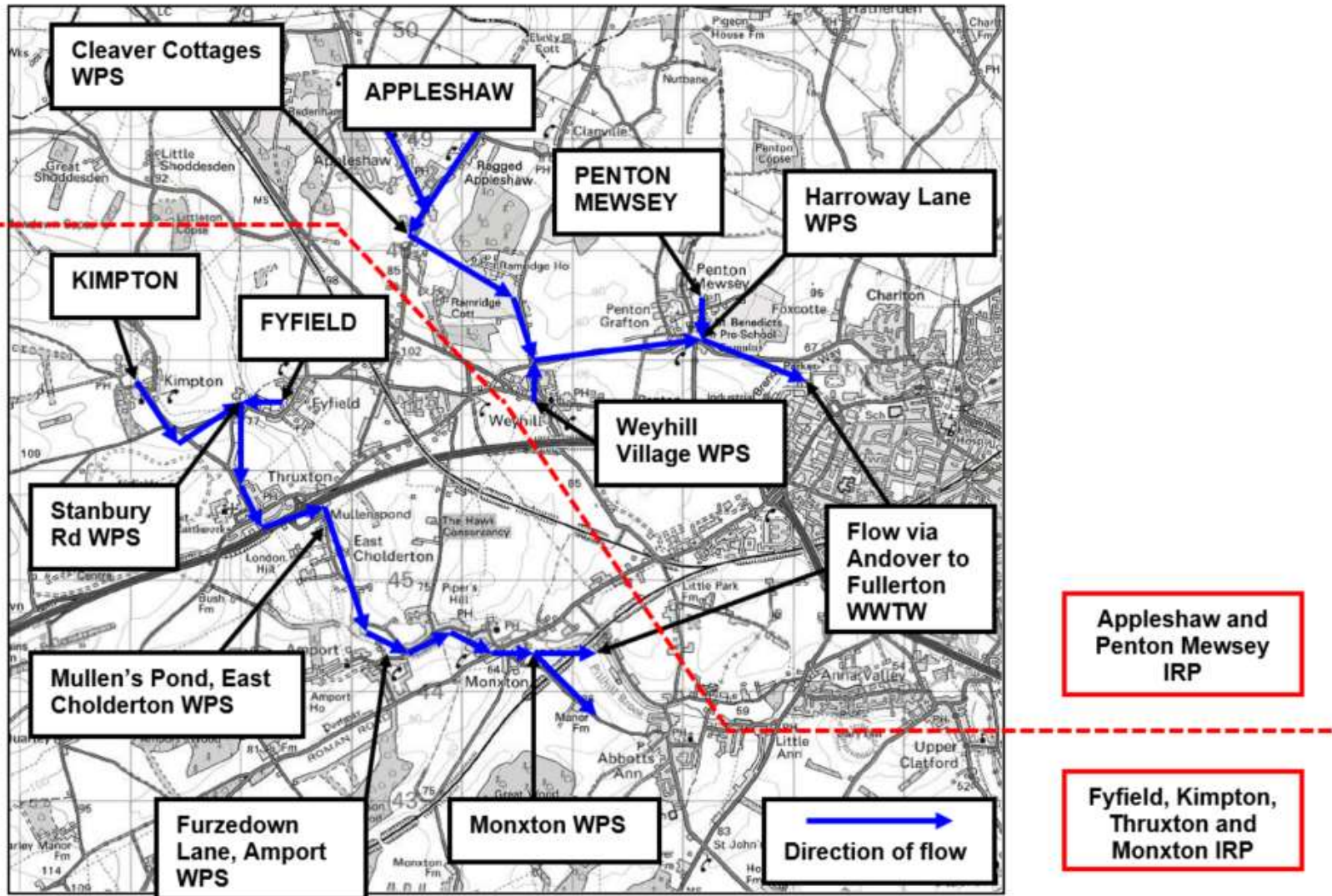


Figure 1.1 - Representation of the sewerage system serving the villages west of Andover in the Fullerton WTW catchment

2. Groundwater Infiltration at Appleshaw and Penton Mewsey

2.1. The significance of groundwater infiltration.

Appleshaw and Penton Mewsey are 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 since 2013 SW has invested in carrying out major improvements to the integrity of the sewers and manholes in the vicinity Appleshaw and Penton Mewsey 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 2010.

A hydraulic model of the Fullerton treatment works catchment can help SW to understand the performance of the system and determine options to address risks. Furthermore, SW is aware of the locations which are likely to suffer first from the effects of flooding.

It is noted that despite the groundwater levels in 2020/21 being comparable to those experienced in 2013/14 (see Figure 4.1), the impact of this on the customers with respect to flooding and restricted toilet use was much lower. This demonstrates the effectiveness to date of the sewer sealing work undertaken in the network.

Table 2.1 shows that there have been five reported instances of flooding since 2010; with four of them occurring in 2013/14. Indeed, of the rainfall values recorded, 2013/14 was the wettest, with an average daily winter rainfall of 7.47 mm respectively as shown in Figure 2.1.

Table 2.1 - Reported Flooding Incidents by Category, In Appleshaw & Penton Mewsey

Year	External Flooding	Incident Flooding	Total
2010_2011	0	0	0
2011_2012	0	0	0
2012_2013	1	0	1
2013_2014	2	2	4
2014_2015	0	0	0
2015_2016	0	0	0
2016_2017	0	0	0
2017_2018	0	0	0
2018_2019	0	0	0
2019_2020	0	0	0
2020_2021	0	0	0
Totals	3	2	5

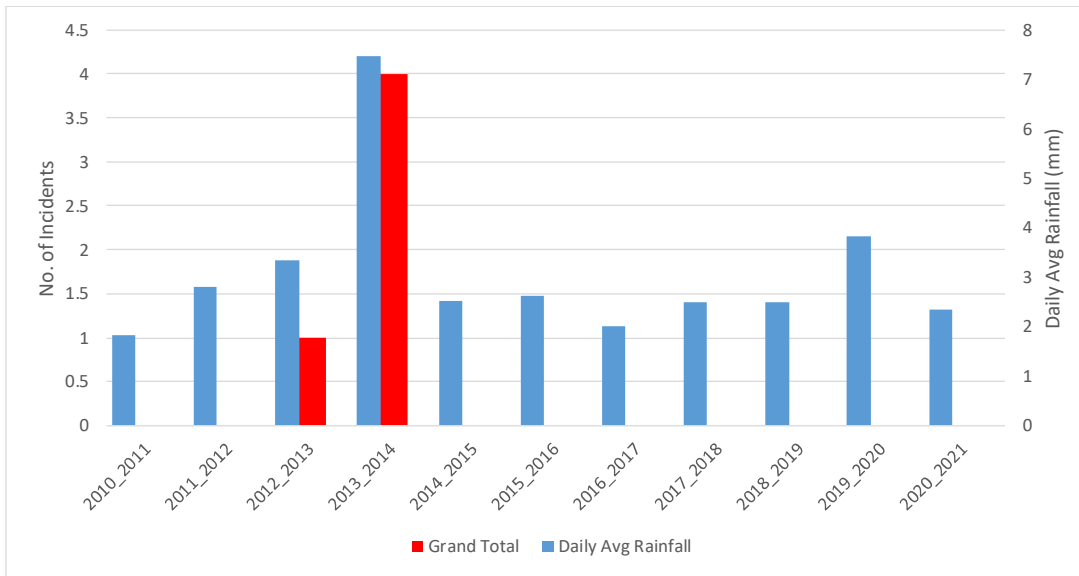


Figure 2.1 - Historic Flooding Records

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 Appleshaw and Penton Mewsey 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 Appleshaw and Penton Mewsey

Groundwater infiltration into sewers has been a long-running issue in Appleshaw and Penton Mewsey. 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 Appleshaw and Penton Mewsey 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

Step.	Description	Approx. Date	Status
1.	Manhole lifting followed by CCTV Investigation	Spring 2013	Completed
3.	Determination of required repairs	Summer 2013	Completed
5a.	Dry Weather Flow Survey in Appleshaw and Penton Mewsey	4 November – 16 December 2013	Completed
4.a.	Repairs at Appleshaw (1,418m of sewer and 19 manholes repaired/sealed)	July 2013 – October 2013	Completed
4.b.	Repairs at Penton Mewsey (980m of sewer and 14 manholes repaired/sealed)	October 2013 August 2014 – December 2014	Completed Completed
5b.	Wet Weather Flow Survey at Appleshaw	8 April – 29 April 2014	Completed for part of the catchment*
6.	Limited follow up survey	Spring 2014 and Spring 2015	Completed
7.	Further Targeted Repairs in Appleshaw	Winter 2015/16	Completed February 2016
8.	CCTV Investigation	March 2016 – August 2018	Completed
9.	Sewer Rehabilitation	March 2016 – January 2019	Completed

Step.	Description	Approx. Date	Status
10.	Ongoing monitoring	Commenced Jan 2015	Ongoing.
11.	Further surveys and subsequent repairs	Summer 2021 – Spring 2022	Planned

*Wet weather flow monitoring was constrained by levels in the catchment. The lower end of Appleshaw had surcharged sewers, whilst at the top end flow was in the channels.

Although extensive repairs were carried out from Since July 2013 in Appleshaw, they were not successful in preventing infiltration and eliminating the need for tankers. The programme of surveys and subsequent repairs is therefore ongoing.

As noted in Table 3.1 above, flow monitoring was carried out both in dry weather conditions to establish baseline flows, and in wet weather conditions in part of the Appleshaw catchment.

The objective of the 'Wet' and 'Dry' flow monitoring data is to help identify areas of infiltration if it has not been found by other survey methods. In the case of Appleshaw, because the levels dropped very quickly when the sewers in the village were no longer surcharged, it was not possible to obtain a comprehensive set of data. However, because of SW's extensive presence in the village during the flooding, the likely locations for infiltration were known and these were then targeted for CCTV survey in late spring 2014, when the flows in the sewers decreased. Further CCTV Investigations were carried out from March 2016 to August 2018, which led to Sewer rehabilitation from March 2016 to January 2019.

Appleshaw

In Appleshaw, 35 manholes were surveyed and CCTV surveys were carried out on 2.8km of sewers in 2013 which identified infiltration in a number of locations. In 2013, SW carried out significant repairs which included the sealing of 19 manholes and repair/sealing of approximately 1.4km of sewer. Work to carry out repairs to approximately 27 laterals began in 2013 and was completed in February 2016.

A CCTV survey in 2014 has identified further infiltration in laterals and repairs were carried out in winter 2015/16.

Penton Mewsey

In Penton Mewsey, 38 manholes were surveyed and CCTV surveys were carried out on 1.8km of sewers in 2013 which identified infiltration in a number of locations. In October 2013, SW carried out significant repairs in the vicinity of Newbury Hill, which included sealing of 3 manholes and repair/sealing of approximately 85m of sewer.

Additional CCTV surveys were carried out in 2014. Further sealing of 11 manholes and repair/sealing of 900m of sewer was completed in December 2014.

Coloured plans showing the rehabilitation carried out since 2013 are provided in Appendix A.

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.

Despite the investment, following prolonged wet weather, to maintain services and avoid significant spills, SW expects that there will continue to be occasional need to remove excess flow from the network.

Based on experience in 2013 and 2014, over-pumping could be expected to be required when the groundwater level at Clanville Gate BH exceeds 90.0mAOD. However, to allow time for investigation and preparation, SW is retaining the 'trigger level' of 88.0m in the winter planning report. Whilst SW would not expect to start physical measures such as tankers or pumps at that level, the purpose of the 'trigger level' is to trigger actions to obtain more information and prepare for an appropriate response.

Figure 4.1 shows the groundwater levels recorded at Clanville Gate BH since 2009. Pumping was required in 2012/13 and 2013/14, with some repair activities in 2013/14. Tankering and over-pumping were required across selected dates in March – May 2020; full details are given in Appendix B.

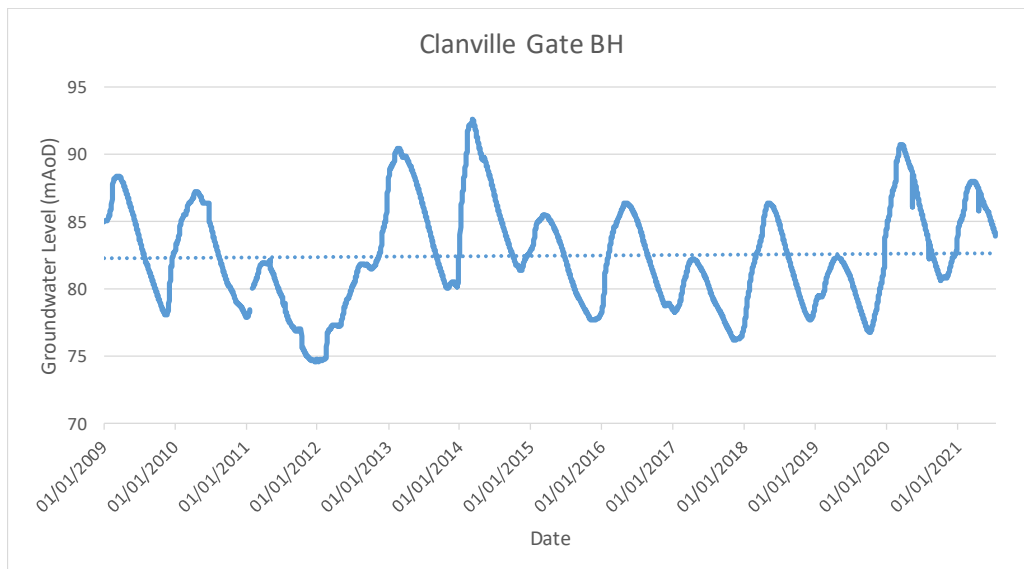


Figure 4.1 - Groundwater levels from 2009 to 2021

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).

Following the main repairs, property level protection was installed in 2014, and further targeted repairs were completed. In addition to this work, SW also carries out other activities to minimise the requirement for discharges to watercourses.

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.

In addition to the measures described, SW invested in River quality monitoring to check ammonia levels and bacteria content is carried out when over-pumping is required.

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 Appleshaw and Penton Mewsey 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*).
- Rural roads are not designed to take the load of repeated visits by tankers – potentially resulting in damage to the road.

*Tankers operating in Appleshaw and Penton Mewsey discharge at Fullerton WTW - round trips of an average of approximately 2 hours including loading and discharging.

4.4.2. Over-pumping

Benefits:

- See Generic Plan.
- Typical pump fuel consumption is 27% of the fuel that one tanker would use in a day.
- The discharge rate is significantly greater. A 75mm (3") pump will discharge typically 15 l/s; the equivalent of a fleet of 6 tankers.

Disadvantages

- See Generic Plan

Figure 4.2 shows the estimated carbon emission per m³ of dilute effluent removed by tanker and by pump. Averaged data has been used for the tankers and pumps deployed in 2014.

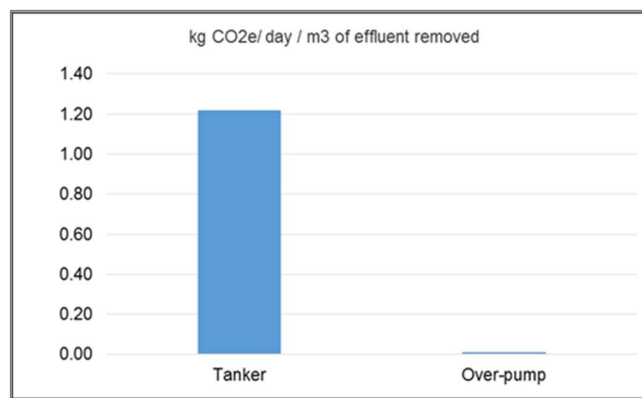


Figure 4.2 – Carbon Footprint figures for Tankers and Over-pumps per m³ of effluent removed.

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. In particular the Multi-Agency Group was influential in helping to shape the IRP. During the winters of 2014/15 and 2015/16, SW and the EA held weekly conference calls to discuss locations where total flows in the sewers were reaching the point where SW would need to respond imminently with tankering or over-pumping. The latest version of the IRP approved by the EA, will be published on SW's website.

Despite the work being undertaken, if over-pumping is required, the locations are 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 on-going process. Since 2013, SW has undertaken surveys and repairs at Appleshaw and Penton Mewsey. The major repair work was completed in 2013, property level protection and pump replacement at Cleaver Cottages WPS in Appleshaw in June 2014, and in July 2014 at Harroway Lane WPS. In the winter of 2015/2016 further targeted repairs were completed in Appleshaw. However, on a company-wide basis, to ensure that benefit continues to be gained from the work that has been done, SW continued the programme of infiltration reduction investment across its region for AMP6 (2015 – 2020). Further CCTV Investigation were carried out from March 2016 to August 2018, which led to Sewer rehabilitations from March 2016 to January 2019.

5.2. Property Level Protection

In Appleshaw, the existing NRV's were inspected in October 2015 in order to ensure appropriate performance. In Penton Mewsey, 2 NRV's were installed in June 2014. Beyond this, there are no plans currently to install non-return valves. However the potential benefit of further property level protection will be investigated, if it is deemed appropriate.

5.3. Local Flow Control

As noted in Section 4.1 Pumping was required in 2012/13 and 2013/14. Tankering and over-pumping were required across selected dates between March and May 2020. Full details are given in Appendix B.

5.4. Pumping Stations

In order to minimise infiltration, SW is continuing to ensure that design discharges are maintained at pumping stations. Pump replacements were completed in June 2014 at Cleaver Cottages WPS in Appleshaw, and in July 2014 at Harroway Lane WPS in Penton Mewsey. This will help to ensure that the design discharge continues to be reliably delivered.

5.5. Monitoring

The Appleshaw and Penton Mewsey catchment is one of ten locations, where groundwater levels have been monitored via electronic data since January 2015. 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.

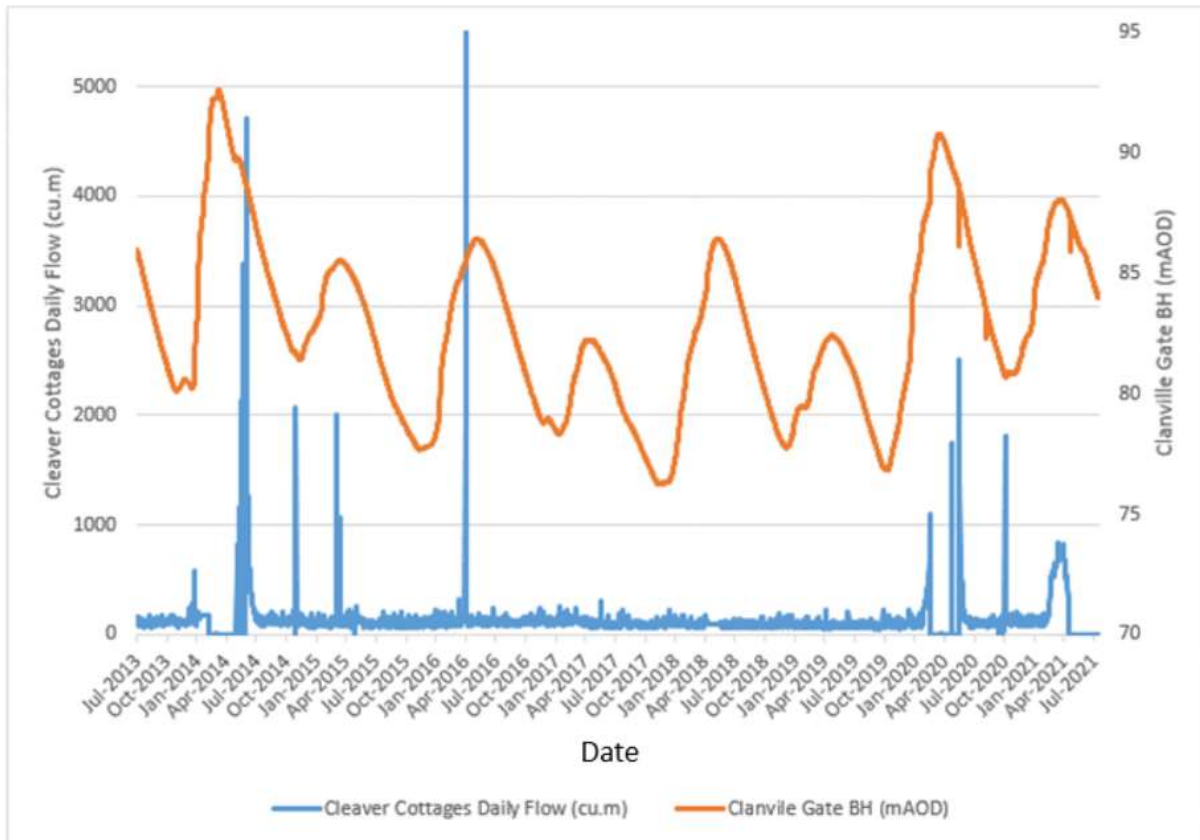


Figure 5.1 - Forecasting of Trigger Dates

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.

Figures 5.2 and 5.3 show the groundwater levels at Clanville Gate BH plotted against wet well levels at Cleaver Cottages WPS, Appleshaw. Figure 5.2 displays data obtained from August 2009 – July 2013 (before major repairs at Appleshaw), and Figure 5.3 displays data obtained from November 2013 – November 2015 (after major repairs).

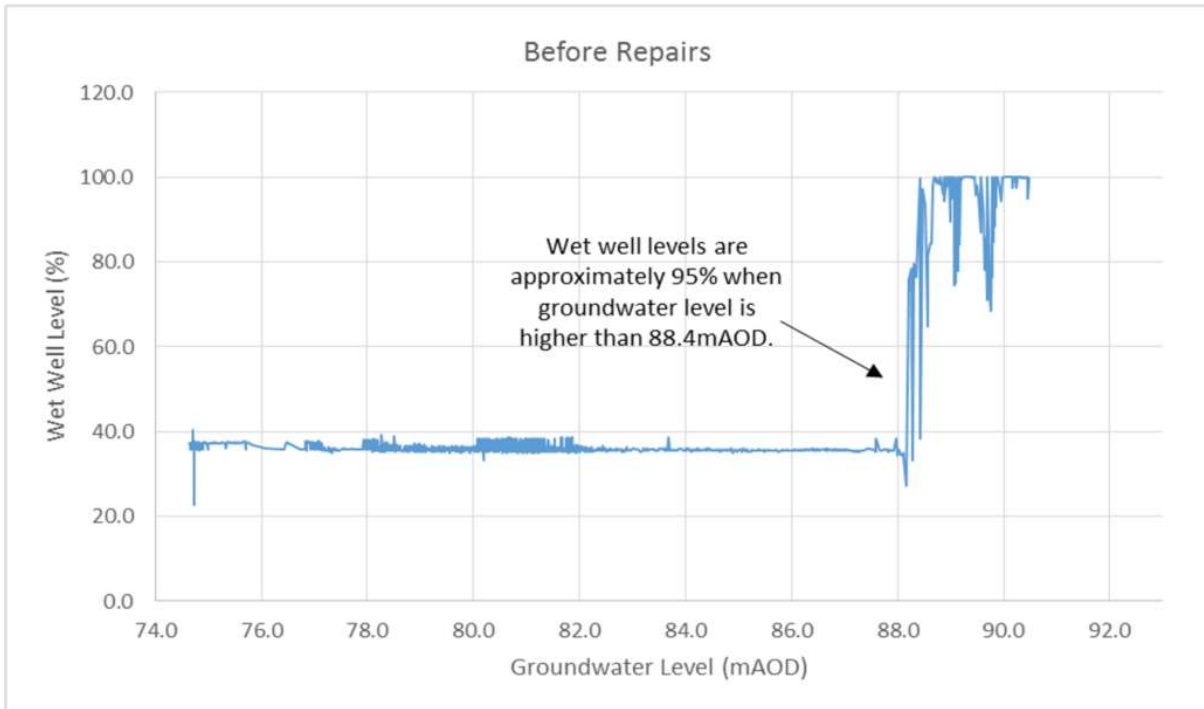


Figure 5.2 - Long Term Monitoring: Before Major Repairs (Aug 2009 to Jul 2013)

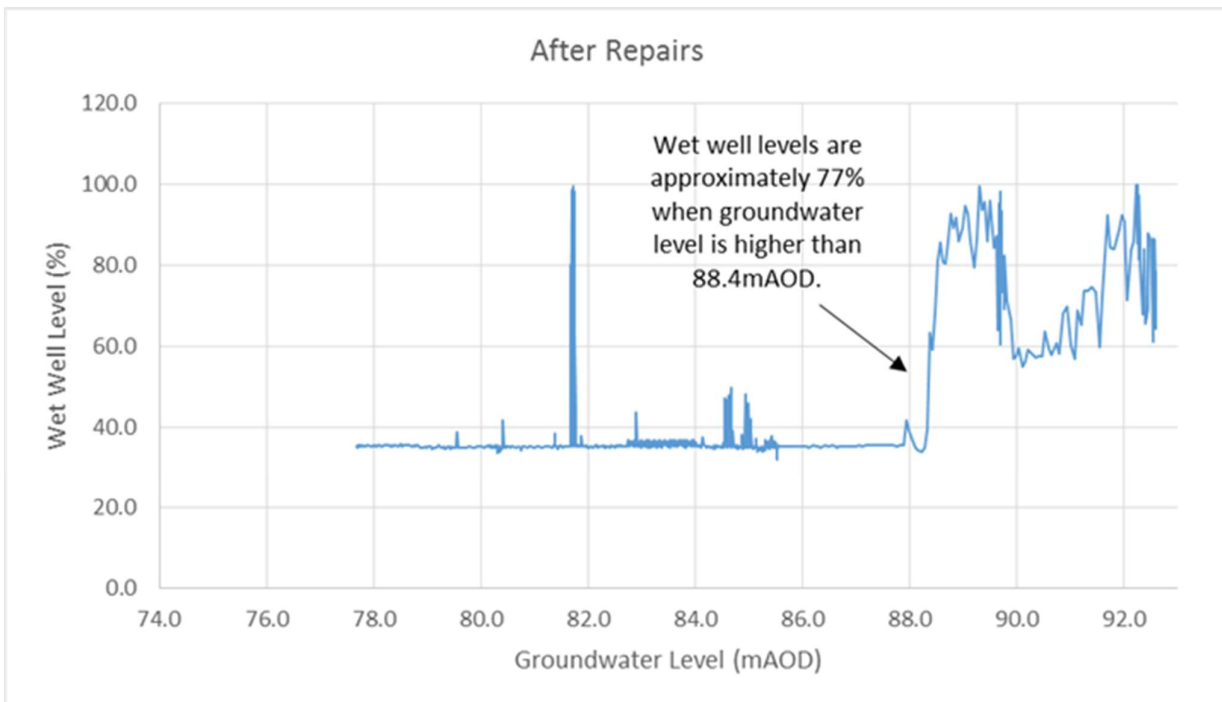


Figure 5.3- Long Term Monitoring: After Major Repairs (Nov 2013 to Nov 2015)

Comparison of Figures 5.2 and 5.3 clearly suggests that when the groundwater level is above approximately 88.4mAOD, the wet well levels have been lower (average of 77 %.) since the repairs were carried out compared to the average wet well level prior (95%).

It can also be seen that when the groundwater level is below 88.0mAOD, the wet well levels are relatively low at approximately 36%. This is why a 'trigger level' of 88.0mAOD has been adopted by SW.

In order to provide a thorough analysis of how effective the repairs have been, it is evident that data needs to be obtained when the groundwater level rises above 88.0mAOD for a significant period of time (similar to that of winters 2012/13 and 2013/14). As this has not occurred since all repairs have been carried out, it is not possible to compare data before and after repair work, and therefore it is not possible to provide further quantification of how effective repairs have been.

6. Action Plans

A significant amount has been achieved in the Appleshaw and Penton Mewsey catchments in the last 8 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

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 3 above and the report in Appendix A.	Summer 2013. Complete	The steps are being followed to deliver results.
1.2	'Dry weather' flow surveys (to measure background levels of infiltration during low groundwater periods)	Identify suitable measurement points, carry out survey over four week period in Summer, match rainfall records with flow data.	November 2013 – December 2013. Complete.	Groundwater infiltration was greater than would be expected for summer conditions.
1.3	'Wet weather' flow surveys (to identify remaining areas of infiltration following initial sewer rehabilitation/repair).	Identify suitable measurement points, carry out survey over four week period, match rainfall records with flow data.	April 2014. Complete.	Comparison between wet and dry weather surveys can be used to assist with identifying if further survey is required in localised areas.
1.4	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.	Spring 2013 – Complete.	Sources of high Infiltration identified by the 2013 CCTV surveys have been repaired. Rehab arising from 2014 CCTV is scheduled for winter 2015/16.

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Ref.	Item	Actions	Timescale and Status	Outcomes
1.5	Carry out sewer rehabilitation work	Use various techniques to seal infiltration points in manholes and sewers	Appleshaw: Repairs carried out from July 2013 to October 2013. Complete. Penton Mewsey: Repairs carried out from August 2014 to January 2015. Complete.	Rehabilitation will restore structural integrity of the sewers.
1.6	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.	Spring 2014. Complete. March 2016 – August 2018. Complete.	Determine scope and carry out further rehabilitation if identified as required from the CCTV survey results.
1.7	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	Winter 2015/16. Complete. March 2016 – January 2019. Complete.	Rehabilitation will restore structural integrity of the sewers.
1.8A	Maintain IRP as a live document	Review text of the IRP and update if appropriate to describe work carried out and/or developments	Annually – on anniversary of EA approval	Up-to-date IRP.
1.8B	Maintain IRP as a live document	Review Tables 6.1 to 6.5 and as appropriate amend to show progress on individual activities.	Quarterly (December, March, June, September)	Keep the Environment Agency informed of progress on a regular basis
1.9	Consider alternative solutions that involve some risk	Investigate unconventional options such as vacuum sewers or consider conventional combined sewer overflows	2020	Ongoing.

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Ref.	Item	Actions	Timescale and Status	Outcomes
1.10	Strategy for inflows via private drains*	Southern Water to propose a strategy for dealing with infiltration via private drains*	SW, Complete. July 2014.	Southern Water's 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.
1.11	Monitor Flows	SW will carry out pre-winter checks and monitor sewer flow to identify significant increases in inflows.	SW, ongoing – In progress. Commenced winter 2014/15. Reports recommenced mid-September 2015.	Preparation for winter responses.
1.12	Over-pumping Sites: improve effluent quality	Investigate potential for improved screening and basic treatment at points of discharge into watercourse.	SW, 2014. Complete.	Improved arrangements for discharges when required.
1.13	Over-pumping Sites: minimise flow	Add level control to pumps to reduce durations for pumping	SW, 2014. Complete.	Minimises volumes of discharge if seasonal discharge(s) are necessary in order to maintain use of sewerage services for customers during periods of very high groundwater levels.
1.14	Standards for emergency discharges	SW to discuss with EA about best practice set up for over-pumping arrangements.	SW, 2014. Complete.	Agree with EA acceptable standards for discharges and acceptable flow rates.
1.15	Flow, location, screening arrangements for emergency discharges	Determine potential flow rates and screening arrangements and most appropriate locations,	SW, 2016. Included in this IRP. Complete.	Agree with EA, HCC and local Parish Councils acceptable arrangements for future emergency discharges.

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Ref.	Item	Actions	Timescale and Status	Outcomes
1.16	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.
1.17	Identification of lengths of sewer to survey or resurvey in the period 2021-25	Review sewer records with available ground water profile date	Post 2022	To be determined after the winter 2021/22

Table 6.2 - Multi-Agency Activities to Reduce Groundwater Infiltration

Ref.	Item	Actions	Owner, Timescale and Status	Outcomes
2.1a	Long-term Monitoring	SW will monitor sewer flow to identify significant increases in inflows.	Ongoing	Early identification of areas where infiltration has increased
2.2a	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).
2.2b	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).
2.3	Consider effects of proposed new developments on infiltration.	District 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.
		SW to determine threshold above which they require to be consulted.	District Council, Ongoing. SW wish to be consulted on all proposed development.	
		Sewerage materials for new developments	SW & District Council, when developments are at planning approval stage. Ongoing.	

*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	Communication from SW to stakeholders about reducing groundwater infiltration into the sewerage system	Send comms 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	Communicate with stakeholders about optimum arrangements for emergency discharges	Explain potential flow rates and screening arrangements and most appropriate locations.	SW will communicate when further emergency discharges are required.	Agree with EA, HCC and Parish Councils acceptable arrangements for future emergency discharges.

** 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	Monitoring of winter groundwater levels and sewer levels/flows. Discuss with EA in weekly calls (when groundwater levels are high).	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 and Parish/District Councils.	Actions for participating authorities that in unison will reduce flooding and / or the impact of flooding.

Appendix

A Survey Findings and Rehabilitation Scope

B Emergency Discharge Sites