Goodworth Clatford

Infiltration Reduction Plan

June  2016
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<td>André Bougard</td>
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GLOSSARY OF TERMS

AMP – Asset Management Programme
BTKNEEC - Best Technical Knowledge Not Entailing Excessive Cost
CCTV - Closed-circuit television
CIPP – Cured In Place Pipe
CIPR – Cured In Place Patch Repair
EA - Environment Agency
ESCC – East Sussex County Council
GW – Ground Water
IRP - Infiltration Reduction Plans
MH – Manhole
RPS - Regulatory Position Statement
RTU - Restricted Toilet Use
SW – Southern Water
WaSC - Water and Sewerage Companies
WC – Water Closet
WPS - Wastewater Pumping Station
WRc - Water Research Council
WTW - Wastewater Treatment Works
BACKGROUND

The Environment Agency’s (EA) Regulatory Position Statement (RPS) requires Water and Sewerage Companies (WaSC) which are aware of sewerage systems in their area which are vulnerable to infiltration, to submit Infiltration Reduction Plans (IRP) to the EA for approval. This document is produced in response to the RPS.

The purpose and nature of the IRP is that it will be updated by Southern Water (SW) annually and show the latest information regarding the progress of work in the area to reduce infiltration. Therefore, there will not be a ‘final issue’ of the plan; it is a working document, which will be updated as required.

This IRP covers the village of Goodworth Clatford in the catchment for Fullerton Wastewater Treatment Works (WTW) in Hampshire. The extent of the catchment is shown in the map on the following page. Flows from Goodworth Clatford South Wastewater Pumping Station (WPS) and Goodworth Clatford Station WPS converge at Royal Oak WPS. The resultant flows are pumped onwards via Church Lane WPS to Fullerton WTW which also treats flows from Andover.

The sewerage system in Goodworth Clatford is designed as a ‘foul only’ system. Over time surface water connections have been added to the sewerage system which leads to overloading of the system during prolonged wet weather. Infiltration of groundwater into the sewerage system also exacerbates the overloading.

In developing this plan Southern Water has been liaising with key stakeholders and particularly in flooding events has been working closely with these bodies to minimise the impact on customers

In this plan various actions have been identified to improve the integrity of the sewerage system. Southern Water has completed a number of the actions and will be completing planned activities, however, the success of the infiltration reduction programme will also be dependent on the support of the following agencies and councils:

Environment Agency,
Hampshire County Council
Test Valley Borough Council
Goodworth Clatford Parish Council
Representation of the sewerage system for the Fullerton WTW catchment (locations of pumping stations is approximate)
EXECUTIVE SUMMARY

1. In Spring 2014, a survey was carried out in the village of Goodworth Clatford which identified a number of sources of infiltration in manholes and sewers adjacent to Cottage Green and in Longstock Road (south of Meadow Drive). The locations of surveys and repairs are shown on the plan in Appendix A.

2. SW undertakes a regular review programme to monitor and seek correlation between groundwater levels, sewer flows and rainfall. Goodworth Clatford is included in the winter reporting for Winter 2015/16.

3. SW is engaging with other stakeholders, and keeping them informed about planned activities.

4. This IRP has been prepared by SW, which has carried out repairs and will be completing planned work, but the success of ultimately eliminating the requirement for emergency discharges (other than during prolonged wet winters) is dependent on a multi-agency commitment. The current set of actions shown in Tables 2-4.

5. SW is committed to detecting and repairing sources of infiltration to reduce groundwater infiltration into sewers in accordance with best technical knowledge not entailing excessive cost. (BTKNEEC).

6. Reducing infiltration is a long term activity. Due to the extreme heavy rainfall throughout the period December 2013 to February 2014, emergency discharges were necessary to ensure sewerage services for residents were maintained. (Details of emergency discharges and tankering in the winter of 2013-14 are provided in Appendices C and D).

7. Despite the significant investments being made by SW to reduce infiltration into sewers, and multi-agency actions to be taken, due to circumstances outside SW’s control (for instance the severity of the weather), there may continue to be occasions when emergency discharges will be required. The circumstances when over pumping and tankering would be expected to be required, locations and expected flow rates are included in Appendix D.

8. It should be noted that manholes in the vicinity of the tankering/pumping may spill during extreme weather events, despite our actions to maintain sewage disposal services for customers by the use of tankers and (where appropriate) pumps.
1 REPORT STRUCTURE

In response to the Environment Agency’s publication of their Regulatory Position Statement on discharges made from groundwater surcharged sewers, and the consequence of recent sewer flooding, Southern Water has produced this IRP, which sets out the steps being taken to manage the groundwater infiltration (GW infiltration) affecting Goodworth Clatford within the catchment of Fullerton WTW, Hampshire.

As required by the Regulatory Position Statement, the following are included in this Infiltration Reduction Plan.

1. **Situation** with respect to history of flooding, restricted toilet use (RTU) and other customer issues is provided in the Section 2.

2. **Outline plans and timescales (milestones) to investigate the source and severity of the infiltration problems** – This is covered in Section 3.

3. **Details of anticipated unavoidable discharges (resulting from groundwater infiltration) indicating their location and the circumstances under which they will need to be made.** This is covered in Section 4. The details of proposed over-pumping are covered in Appendix D and the over-pumping locations used in 2014, are given in Appendix C.

4. **Details of the proposed discharges such as screening that will be in place and maximum discharge rates etc.** This is covered in Section 4 and Appendices B and D.

5. **Presentation of potential actions (options) that could be considered to resolve/minimise the infiltration and remove the need for discharges.** Long-term monitoring is covered in Section 5.2, and action plans are covered in Section 7. The SW actions are given in Table 1. Multi-agency actions are given in Tables 2 - 4.

6. **A review date.** The IRP will be reviewed initially on a quarterly basis. An update will be provided to the EA quarterly.

7. **Communications** – SW is engaging with other stakeholders, and keeping them informed about planned activities. Signage in the event of over-pumping is included in Appendix E. Communications with Stakeholders and customers are covered in Section 6.

**Monitoring** – This is covered in Section 6. SW has set up a programme to monitor and seek to identify significant changes in flow.
2 SITUATION

2.1 Customer issues

The graph shows the number of incidents reported for each category of flooding, since the millennium. Whilst there are no properties affected by internal sewage flooding in the last 15 years; there were five reported incidents of external flooding in 2013/14 and one reported Restricted Toilet Use (RTU) in 2014/15.

During the winter of 2013/14 (the wettest winter on record), tankering and over-pumping was used extensively to reduce levels in sewers and to maintain services for customers. Without these measures, there would have been more extensive flooding.

2.2 Description of Flooding

External flooding (EXTC) at a property is defined as flooding to external areas within the curtilage of the property, due to sewers becoming surcharged. The flooding will normally be from a surcharged manhole, or gully. External flooding can be contaminated surface water entering the grounds of the property. There are two other categories of external flooding: Highway flooding refers to flooding on roads or footpaths. ‘Other’ external flooding refers to non-residential buildings and public open spaces.

RTUX (Restricted Toilet Use) may be experienced by customers as the sewers become surcharged. Toilet facilities still function, but effluent will be slow to drain away and sometimes facilities can only be used for limited periods – for instance after a tanker has removed dilute effluent from the local sewers.
Internal Flooding occurs when sewers either back-up to such an extent that dilute effluent floods inside dwellings from low connections to the drains. (for example through WCs or shower drains), or when contaminated surface water enters the building.

3 OUTLINE PLANS AND TIMESCALES TO INVESTIGATE INFILTRATION PROBLEMS AND CARRY OUT REPAIRS

3.1 Pressures and Consequences of High Groundwater

Sewer systems are designed for normal ‘dry weather’ conditions, but with an allowance for the effects of rainfall and infiltration. However, they are not designed to convey large groundwater flows. Consequently where SW is aware of significant infiltration which impacts on the ability to provide effective drainage, steps are required, and have been taken, to reduce infiltration to an acceptable level.

Further to the description in Section 2 above, SW has undertaken repairs at Goodworth Clatford, not only over the last few years but also over the preceding decade (see list below).

In addition Southern Water took advantage of the high groundwater levels in 2014 to carry out CCTV surveys (Spring 2014) and completed rehabilitation work to improve the situation in March 2015. Further rehabilitation works have now been scheduled for year 1 AMP 6 (April 2015 – March 2016). The approach used to investigate infiltration is described in Section 3.2 below. Details of all completed and planned rehabilitation work are provided in Section 3.3.

Plans in Appendix A show the sewers identified for investigation, those surveyed, where infiltration was found, and where repairs were carried out. An excerpt of one of a plan from another catchment is shown in Figure 2 below. The plans show how the survey and repair steps follow a process of refining the area from where infiltration is thought to be, to the precise locations where groundwater is getting into the pipes, and the lengths of sewer and manholes repaired. The plans are generated from Southern Water’s updated records.
3.2 Investigation

CCTV Survey Approach

The approach used when carrying out CCTV is for the flow to be observed at a number of manholes – identified as ‘strategic manholes’. The surveys are ideally carried out as the groundwater levels are falling; when the flow in the sewer has reduced, such that the pipe is no longer surcharged, but whilst groundwater levels are still above normal. The strategic manholes investigated in 2014 are shown on the plan in Appendix A.

Whilst SW has had responsibility for the main sewers since they were constructed, it is worth noting that maintenance of sewers in private land serving more than one property only became the responsibility of SW in 2011.

CCTV Survey in 2014

In Spring 2014, a survey was carried out in the village of Goodworth Clatford which identified a number of sources of infiltration in manholes and sewers adjacent to Cottage Green and in Longstock Road (south of Meadow Drive). The locations are shown on the plan in Appendix A.
3.3 Repairs

Southern Water has been carrying out repair work on the sewers (which are several decades old) over a number of years. The work from 2000 – 2012 is listed below, the current programme of work in 2013-15 is noted below and is shown on the plans in Appendix A.

Rehabilitation Work since 2000

The list below summarises work carried out between 2000 and 2013 amounting to over 600 metres of sewer repaired.

<table>
<thead>
<tr>
<th>Location</th>
<th>Action/ Result</th>
<th>Date</th>
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<tbody>
<tr>
<td>Longstock Road, near Goodworth Clatford Station</td>
<td>Sewer Joints sealed (~120m length)</td>
<td>2001/02</td>
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<tr>
<td>MH sealed</td>
<td></td>
<td></td>
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<tr>
<td>Junction of Longstock Road and Cottage Green</td>
<td></td>
<td></td>
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<tr>
<td>Longstock Road, in the vicinity of Meadow Drive</td>
<td>Sewer Joints sealed (~110m length)</td>
<td></td>
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<tr>
<td>Longstock Road, near Goodworth Clatford South</td>
<td>Sewer Joints sealed (~30m length)</td>
<td></td>
</tr>
<tr>
<td>Longstock Road, near Goodworth Clatford Station</td>
<td>Sewer Joints sealed (~90m length)</td>
<td>2001/02</td>
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<tr>
<td>Church Lane, in the vicinity of The Warren</td>
<td>Sewer Joints sealed (~80m length)</td>
<td></td>
</tr>
<tr>
<td>Yew Tree Cottage</td>
<td>Sewer Joints sealed (~20m length)</td>
<td>2012/13</td>
</tr>
<tr>
<td>Longstock Road, south from Goodworth Clatford</td>
<td>Sewer Joints sealed (~135m length)</td>
<td>2012/13</td>
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<td>Goodworth Clatford Station WPS</td>
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<td></td>
</tr>
<tr>
<td>Longstock Road, north of Goodworth Clatford Station</td>
<td>Sewer Joints sealed (~75m length)</td>
<td>2012/13</td>
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Recent Repairs

Using the results of the 2014 survey, approximately £60,000 of repairs were carried out in Longstock Road during 2014/15. The plans in Appendix A show the extent of surveys, significant infiltration and completed repairs. The repairs include work currently in progress.

Repair Techniques

Where rehabilitation is required, the appropriate repair technique is selected from the following:
• Sewer lining – fitting a new lining to sewers from one manhole to another or to sections of sewer to repair several leaks, by forming a leak-tight pipe within the existing sewer.

• Excavations to repair leaking joints where no-dig techniques are not possible.

• Quick-Locks – metal ‘sleeves’ which are inserted remotely into damaged pipe sections and, once located correctly, are expanded via compressed air against the inner walls of the pipe to instantly seal leaks.

• Joint Test and Seal – each joint between sewer pipes is air tested and if it does not hold the pressure, the joint is injected with a gel to seal it. Sealed joints are retested.

• Capping of leaking un-used connections.

• Top Hats – fibreglass inserts which form a leak-tight bond at the point where a lateral sewer connects to the main pipe.

• Ground Stabilisation – an alternative technique which involves the injection of gel into the ground around a leak.

• Manhole chamber sealing – a non-exavation method to repair manholes by applying a waterproof sealant to the inside of the manhole chamber.

3.4 Pumping Station Surveys

The critical pumping stations in Goodworth Clatford receive regular checks; they received special health check visits in January 2015 to ensure they are functioning in their optimum state, so that they achieve their design pass forward flow rate.

4 DETAILS OF ANTICIPATED UNAVOIDABLE DISCHARGES

The circumstances under which unavoidable discharges are expected to be required are covered in Section 4.3 below and the over-pumping locations used in 2014, are given in Appendix C.

4.1 Steps to prevent discharges and prior alternatives to over-pumping

In addition to the survey and repairs outlined above, SW also carry out other activities to minimise the requirement for discharges to watercourses. During the Winter 2014/15 SW followed the steps in the following list. These activities supplemented the rehabilitation programme. The approximate timescales for each step are included in brackets.

1. Carry out scheduled maintenance visits to key pumping stations prior to winter weather. [Autumn 2015]

2. Ensure that sewers prone to silt deposition or fat build-up have been jetted as per SW’s Scheduled Maintenance Tasks. [Autumn 2015]

3. Monitor groundwater levels in Clanville Gate borehole. [from mid-September 2015]
4. When groundwater levels start to rise, monitor WPS performance as groundwater level approaches trigger levels based on previous flood events. [Late autumn 2015, increase frequency of monitoring to weekly as levels rise]

5. Determine forecast dates for trigger levels based on previous dry, average and wet winters. [from mid-September 2015]

6. Hold weekly calls with the EA and share forecasts for potential over-pumping [from late autumn 2015, dependent on groundwater levels]

7. As each trigger level is approached, check sewer levels at selected manholes in the catchment. Continue to monitor and record sewer levels. [from late autumn 2015, dependent on groundwater levels]

8. if levels continue to rise, carry out MH lifting and record sewer levels and share data with the EA. [as required. Share data weekly]

9. Monitor customer calls. Seek to establish whether there is a common cause for the lack of capacity to maintain sewage disposal services. [ad-hoc analysis, as and when required during flood events]

10. Respond to customer calls with targeted sewer jetting, tankering or over-pumping as appropriate. [as required]

11. Keep EA informed about tankering activities and if over-pumping is expected to be required, agree this course of action with the EA. [from late autumn 2015, through weekly reports and calls]

12. Continue to monitor levels. [weekly through the winter/spring]

13. Keep EA informed about tankering, jetting and over-pumping activities in weekly calls. [from late autumn 2015, through weekly reports and calls]

14. Where over-pumping is required, ensure duration and quantity of discharges are minimised (e.g. by use of level control on pumps). Also ensure the over-pumping components (settlement tanks etc) – as agreed – refer App B of the IRP.

15. Following the flooding event, as levels in the sewers return to normal, lift MH covers in catchments where there has been over-pumping to identify sudden increases in flow. [Spring 2016, but only if there was flooding during the Winter]

16. Instigate survey and repairs if required. [Spring 2016, but only if there was flooding during the Winter]

### 4.2 Requirements

The rehabilitation work being undertaken by SW has improved the integrity of the sewerage system thus reducing groundwater infiltration. However, private drains are also a source of infiltration and SW will work with others to reduce infiltration into these pipes.

SW is committed to detecting and repairing sources of infiltration to reduce groundwater infiltration into sewers in accordance with best technical knowledge not entailing
excessive cost. (BTKNEEC). Nevertheless, currently in extreme conditions emergency discharges continue to be required. Section 2.3 iii) and iv) of the RPS, Version 2, 2014 (reproduced below) anticipates this possibility.

Excerpt from Regulatory Position Statement, Version 2, 2014 - Section 2.3 iii) and iv)

iii) Details of anticipated unavoidable discharges (resulting from groundwater infiltration) indicating their location and the circumstances under which they will need to be made.
iv) Details of the proposed discharges such as screening that will be in place and maximum discharge rates etc.

4.3 Conditions under which discharges are expected to be required

The graph below shows the groundwater level measured at Clanville Gate borehole near Andover during the winters of 2012-13 to 2014-15. The black line shows the actual level recorded, which reached a peak of 92.6m AOD in March 2014. This peak was significantly higher than the long term average (green line) of approximately 85m for March. The level set a new peak for the maximum recorded level (dark blue line).

Also shown are approximate groundwater levels when overpumping was started and stopped in the winter of 2013/14. There was no overpumping in the winter of 2012/13, although tankering was used to remove excess flows. During winter 2014/15, overpumping equipment was moved into Goodworth Clatford Station WPS as a precaution against rising GW levels, but not used. The vertical black lines at the foot of the graph show the exceptionally heavy rainfall in Spring 2014.

Figure 3. Clanville Gate Borehole Levels.

Graph contains Environment Agency Information @ Environment Agency and database right

Trigger Levels
On the basis of the information from the last three winters, the following trigger level is proposed based on groundwater levels at Clanville Gate borehole.

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<td>Trigger level for flood response</td>
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Note: the trigger level is close to the peak recorded groundwater level.

The trigger level will be reviewed following other high groundwater events. Because groundwater levels change so rapidly, pumps and tankers will not be deployed at specific groundwater levels, but the decision will be influenced by current and forecast conditions.

### 4.4 Options for dealing with excessive flows in the sewer network

It is imperative that the sewerage system and wastewater pumping stations in the catchment operate at all times and to maximum design capacity to ensure that residents and customers do not have to suffer from restricted use of their facilities, or that the sewer system becomes overloaded to the point that uncontrolled discharges occur which causes disruption and pollution incidents to the environment.

**Tankers**

If the hydraulic capacity of the sewers and wastewater pumping stations is exceeded due to additional flows from groundwater, the first response of Southern Water is to deploy tankers at strategic locations to remove some of the flows. These tankers then transfer excess flows to Fullerton WTW. Tankers are generally deployed to protect a few properties suffering from restricted use of their facilities. In these cases, it is normally sufficient for the tankers to visit these properties once or twice a day to remove excess flows from manholes in the vicinity.

During exceptional high flows, large numbers of properties may be at risk of restricted use of their facilities. However, tankers have limited capacity, can only draw off liquid at a relatively low rate and cause disturbance by their presence and noise associated with the work. Under exceptional high flows, large numbers of tankers may be required to operate continuously for 24 hours a day. This would be impracticable from an operational point of view and would be unacceptable to residents due to the associated high levels of noise and disturbance.

There is no clear rule for the exact point to change from tankering to pumping. However, the following factors are taken into account.

1. Use of the appropriate equipment to maintain services to customers (e.g. minimising restricted toilet use).

2. Avoidance of imminent internal or external sewer flooding to protect public health.

3. Forecast of sudden increase in groundwater levels due to severe or prolonged rainfall that would significantly increase risk of sewer flooding.

4. Minimising health and safety risks or disruption to residents due to tanker movements. Particularly where tankers are required at night or where tankers restrict access to properties.
5. Whether there are isolated properties suffering RTU/ flooding or whether the disruption is more widespread.

6. Traffic congestion caused by tankers

7. As flood conditions worsen, determining whether tankers remain a practical and economically viable solution.

8. The availability and proximity of a suitable receiving watercourse with sufficient flow.

9. Noise and exhaust fumes pollution of tankers versus the potential impact of over-pumping on the receiving watercourse.

10. Demand for tankers elsewhere. During the exceptional high rainfall experienced in 2014, in responding to sewer flooding events, Southern Water exhausted the available supply of tankers.

**Over pumping**

In cases of exceptional high flows in the sewers, in order to protect residents from imminent public health dangers of sewage flooding in properties or restricted toilet use (RTU), it may be necessary to supplement or replace the tankers with temporary discharges from the sewers to watercourses, should the combination of wastewater pumping stations and tankers capacity still be exceeded. When over-pumps are deployed, tanker numbers would be reduced or removed, as the pumps discharge significantly more dilute effluent than the tankers.

Discharging the diluted sewage to watercourses is seen as the last resort option, and Southern Water is investing in sewer improvement works to ensure the ingress of groundwater into the sewers is kept to a practicable minimum. However, in extreme weather conditions, such as was experienced in early 2014, emergency discharges to watercourses at one or more locations would be required.

Prior to the initiation of overpumping, there would be liaison with the Environment Agency and other stakeholders as detailed in Section 5 on Communications.

**Pros and Cons of Tankers and Overpumping**

In the winter 2013/14 SW used tankering and pumping at Goodworth Clatford. No over-pumping or tankering was carried out in the winter of 2014/15. Tankers and over-pumping are both appropriate solutions, each suiting different scenarios. The key benefits and disadvantages are noted below.

**Tankering**

**Benefits:**
- dilute sewage is discharged at a treatment works for treatment,
- Quicker response time,
- No impact to watercourse,
- Convenience – suitable for response to short duration localised flooding.

**Disadvantages**
- the flow rate is low (approx. 3l/s per tanker over a 24 hour period*)
- there are traffic issues associated with large vehicles using narrow roads
- minor roads not designed to take the load of repeated visits by tankers – resulting in damage to the road,
- tankers are noisy causing disturbance to the local properties, particularly at night time.
- High cost and carbon footprint compared to overpumping.
- Availability of tankers may be difficult during periods of high demand

*Tankers operating at Goodworth Clatford discharge at Fullerton WTW, - a round trip of approximately 2 hours including loading and discharging.

**Overpumping**

**Benefits:**
- typical pump fuel consumption is 85% of the fuel that one tanker would use in a day.
- the discharge rate is significantly greater. A 3” pump will discharge typically 10-20 l/s; the equivalent of a fleet of 10 tankers.
- pumps are quieter,
- The pumps run on level control so only operate when required.
- Located off the highway

**Disadvantages**
- Environmental impact of over-pumping dilute effluent to the watercourse
- Pumps are less noisy than tankers but may cause disturbance to the local properties, particularly at night time.

The below chart (Figure 4) shows the estimated carbon emission per m³ of effluent removed by using a 4000 gallon tanker and 3” diesel pump assuming that the tanker is discharging at Fullerton WTW. The data indicates that per m³ of effluent removed, the use of tankers emit over ten times more carbon to the environment than a diesel pump.

![Figure 4 - Carbon Footprints - Tanker vs. Overpumping at Goodworth Clatford](image)

### 4.5 Details of the potential discharges

Depending on local conditions, a typical over-pumping site consists of a pump located within one of the pumping station compounds. The pump lifts flow (through a barrel filter) from a level which captures liquid flows rather than solids (which remain in the sewer or main well in the pumping station). The flow is pumped into a settlement tank where it passes under settlement weirs, before discharging via a hose with a filtration...
sack located on the end of the discharge pipe in the river. In-situ river sampling is undertaken regularly to check ammonia levels and bacteria content. Further details on a typical overpumping arrangement are provided in Appendix B.

There are three locations shown in Appendix B for over pumps / tankers. The are benefits and disadvantages of each are:

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<thead>
<tr>
<th>Location</th>
<th>Benefits</th>
<th>Disadvantage</th>
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<td><strong>Goodworth Clatford South WPS</strong></td>
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<tr>
<td>Over-pumping</td>
<td>• Efficient 24/7 operation</td>
<td>• Distance to watercourse (approx 200m) may prevent o/p being practical.</td>
</tr>
<tr>
<td></td>
<td>• Less disruption to residents and access road</td>
<td>• requires third party agreement to cross land. May also require a second (booster) pump near the river (same as the set up at Longparish across the fields)</td>
</tr>
<tr>
<td>Tanker</td>
<td>• Effluent is not discharged to the environment.</td>
<td>• Noise, disruption and damage to access road.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Less efficient hydraulically, intermittent removal of effluent. (smaller volumes removed)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• option of drawing from manholes in the road not possible due to restricted width.</td>
</tr>
<tr>
<td><strong>Goodworth Clatford Station WPS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over-pumping</td>
<td>• Easy to set up in the WPS compound</td>
<td>• the discharge is close to a popular bridge/footpath – which impacts on amenity</td>
</tr>
<tr>
<td></td>
<td>• Quiet and efficient pumping operation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Discharge point in watercourse gives high dilution.</td>
<td></td>
</tr>
<tr>
<td>Tanker</td>
<td>• Off road access.</td>
<td>• Noise, disruption and damage to access road.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Only space for one tanker, so may require tankers to queue on the road.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Less efficient hydraulically, intermittent removal of effluent. (smaller volumes removed)</td>
</tr>
<tr>
<td><strong>Royal Oak WPS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over-pumping</td>
<td>• off road location</td>
<td>• Access for maintenance can be restricted</td>
</tr>
<tr>
<td></td>
<td>• Offers good hydraulic benefit to the whole village.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Electric power supply available. (quiet)</td>
<td></td>
</tr>
<tr>
<td>Tanker</td>
<td>• off road location</td>
<td>• Restricts car parking at Royal Oak</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Noise complaints from nearby residents/ businesses.</td>
</tr>
</tbody>
</table>
In 2013/14 the most appropriate locations were
- Overpumping at Goodworth Clatford Station WPS
- Tankering at Goodworth Clatford South WPS
- Tankering at Royal Oak WPS

SW liaised with the local flood action group and local residents about siting and daily management of the tankers to minimise disruption.

Typical discharge rate for over pumps used at Goodworth Clatford was between 10 l/s and 20 l/s. At Goodworth Clatford Station WPS power was taken from the pumping station. Maintenance of the over pumping units is carried out regularly which includes checking the flow, cleaning/replacement of filtration sacks and cleaning the tanks.

Details of tankering and over pumping sites during the winter of 2013-14 are provided in Appendix C. On the basis of future flooding at Goodworth Clatford being similar to that experienced that winter, Southern Water propose that the set up used would be as described in Appendix C. However, as a consequence of repairs and potentially other external factors (such as the severity of the weather), the hydraulics may dictate that over-pumps are required at other locations either in place or, or in addition to, the sites described in Appendix C.

5 MONITORING

5.1 Water quality monitoring

Southern Water has been carrying out regular monitoring of receiving watercourses at locations where it has been over pumping. At each site SW will require sampling/measurement at each of the following points:

1. 15m upstream of the effluent discharge
2. The effluent discharge
3. Downstream of the effluent discharge

The upstream/downstream locations provided above are typical positions and may vary depending on the watercourse depth, width or flow.

If SW has to over pump, then a laboratory sample would be taken at each of the above points once a week for:

- E. coli
- Enterococci
- Total coliforms
- COD
- BOD
- Suspended solids

In addition, Southern Water will discuss the requirement for sondes with the Environment Agency. If required, the sondes would be provided at these locations and would record half hourly measurements of:

- Ammonium (NH4+)/ ammonia(NH3)
- Dissolved oxygen
• Turbidity
• Oxidation reduction potential
• Additional standard parameters that come with sondes (pH, temperature, conductivity, total dissolved solids etc)

5.2 Long Term Monitoring

SW has commenced work to investigate, monitor and seek correlation between groundwater levels, sewer flows and rainfall. This will be used to detect flow increases. Repairs will then be carried out as appropriate. A monitoring programme for groundwater flooding sites was initiated winter 2014/15. Initially this focussed on the locations that are the first to exhibit sewer flooding when groundwater levels rise. This winter Goodworth Clatford has been added to the sites being monitored. The principle is to set up a simple monitoring programme that will give advance warning.

The information is used each winter to forecast the trigger dates for a response to flooding being required. Secondly, the longer term trends are also monitored to identify increases changes in levels of infiltration.

The graph below shows both functions. The earliest, mean, and latest trigger dates are shown at the top of the graph. These are based on rates of groundwater rise over the last seven years.

The longer term trend is indicated by the red line on the graph (which is a function of flow). Groundwater level is shown by the light blue line. The graph shows that for a given groundwater level (say 80m), the flow dropped significantly at the time the repairs were carried out, and has remained lower in 2015 than it was in 2013. A factor affecting the residual flow may have been the rainfall. As can be seen from the graph in Figure 3 rainfall was slightly higher in 2013. The purpose of Figure 5 is not to draw a specific conclusion, but to show that monitoring is ongoing and that information can be gleaned from the data to help identify whether infiltration is increasing. The flow will be monitored against groundwater levels during winter 2015/16 to seek to establish the long-term benefits of the rehabilitation work; both the completed work and the further work being carried out in 2015.

Figure 5 - Sewer Flow vs Groundwater Levels
6. COMMUNICATIONS

Since the start of the infiltration reduction programme early 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 face-to-face meetings, and customers informed via letters. SW has also attended local public meetings with stakeholders. When it has been approved by the EA, an approved copy of this infiltration reduction plan will be published on the Southern Water web-site.

Despite the work being undertaken, over-pumping may still be required during extreme conditions. In such situations, prior to commencing over pumping, SW will liaise with the local EA team in order to agree the requirement for overpumping and to discuss proposed locations for the emergency discharges to watercourses. Immediately prior to overpumping, SW will notify the EA National Incident Communication Service (Tel. 0800 807 060).

The local public, local authorities and Test Valley Borough Council Environmental Health Department would also be kept informed of discharges to watercourses (overpumping) before and during the operation.

Immediately prior to over-pumping being operated, Southern Water will put up advisory signs at the over-pumping discharge location(s) and at appropriate locations downstream along the receiving watercourse, advising the public that over-pumping is in operation. The wording on the signs will be as, or similar to, the example in Appendix E.

Prior to the cessation of overpumping, SW will also liaise with the local EA team and also inform the EA National Incident Communication Service following cessation. The normal step down approach would be to stop over pumping and re-introduce tankers once it was determined to be a practical alternative. Once levels in the sewers recede further then the tankers would be withdrawn as well.
7. ACTION PLANS

7.1 IRP Updates

The current rehabilitation work will improve the integrity of sewers at the locations where repairs have been carried out. However, it is expected that during periods of high groundwater, some infiltration will occur at new locations. The monitoring described above will be used to identify significant increases in infiltration.

The table below summarises the key actions by SW and other agencies, and the status of actions. SW has some outstanding rehabilitation work to complete in Goodworth Clatford, which has been delayed by high groundwater levels, but other actions are up to date. The multi-agency actions are to be carried out as required.

SW is committed to continuing to pursue infiltration to reduce the frequency of over-pumping, by taking actions to reduce infiltration and mitigate the effects of it, if the infiltration cannot be controlled, at economic cost (in line with BTKNEEC see below).


<table>
<thead>
<tr>
<th>SW Actions</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Infiltration Reduction</strong></td>
<td></td>
</tr>
<tr>
<td>Activities to investigate infiltration and carry out repairs</td>
<td>Refer Section 3.3</td>
</tr>
<tr>
<td>Annual IRP updates and quarterly reporting to EA</td>
<td>In 2016, Q1 and Q2 reports submitted.</td>
</tr>
<tr>
<td>Winter Preparations</td>
<td>Preparation as Section 4.2 and monthly/ weekly forecasting.</td>
</tr>
<tr>
<td>Preparation and making suitable arrangements for emergency discharges if required</td>
<td>Arrangements discussed with EA during Winter weekly calls.</td>
</tr>
<tr>
<td>Developments</td>
<td>Respond to planning applications as required</td>
</tr>
<tr>
<td><strong>Flood Mitigation</strong></td>
<td></td>
</tr>
<tr>
<td>Forecasting</td>
<td>Wet weather monitoring of groundwater levels and sewer levels/flows relative to trigger levels</td>
</tr>
<tr>
<td>EA communications</td>
<td>Monitoring groundwater levels and communicate with EA</td>
</tr>
<tr>
<td>Stakeholder Engagement</td>
<td>Communications with stakeholders and the public as appropriate.</td>
</tr>
</tbody>
</table>
Multi-agency activities

Infiltration Reduction

- Misconnections - HCC (for highways) and Test Valley Borough Council (for domestic connections) to investigate and pursue as required.
- Groundwater Flooding Strategy - HCC with input by other agencies as appropriate

Activities being carried out by SW that will reduce infiltration into sewers are given in Table 1 below. This table also includes timescales and expected outcomes. In the RPS, the EA notes that it is not seeking the complete elimination of groundwater surcharging, but requires improvements to be made in line with “best technical knowledge not entailing excessive cost” (BTKNEEC).

7.2 IRP Updates

The IRP records SW's commitment to continue to strive to reduce the need to over-pump. As required by the RPS, SW will report progress quarterly to the EA and will update the IRP annually (RPS Section 2.3 vi). The approved IRP will be published on SW's website.
APPENDIX A

Survey Findings and Rehabilitation Scope Plans

[Refer to Figure 2 in Section 3.1 for an explanation of the plans in this appendix which show the extent of completed survey, sources of significant infiltration and completed repairs.]
APPENDIX B

Typical Overpumping Arrangements
**Typical overpumping arrangement**

The figure below shows a typical overpumping arrangement and contains links to further details on the equipment used. For Goodworth Clatford this equipment would be located within the existing pumping station compounds.

- **Pump drawing excess flows from sewer and discharging into a settlement tank.** See Figure B3
- **Settlement tanks.** See Figures B4 to B6
- **Pump hose drawing excess flows from sewer.** See Figure B2
- **Hose discharges to watercourse via filtration sacks.** See Figure B7
FIGURE B1
SCHEMATIC OF TYPICAL OVER-PUMPING ARRANGEMENT
Figure B2 – Pump lifts flow through a barrel filter from a level in the sewer which captures liquid flows rather than solids

Figure B3 – Pump extracts flows from the sewer and discharges to a settlement tank
Figure B4 - Diagram of a large settlement tank showing the direction of flow beneath and above baffle plates which results in suspended fine solids dropping to the bottom of the tank. The dimensions shown (2.44m x 1.83m x 1.52m = 8ft x 6ft x 5ft) are

Figure B5 - Photograph of a small settlement tank usually fed by 75mm (3 inch) or 100mm (4 inch) hoses. The dimensions of the tank are 1.0m wide x 1.5m long x 1.4m high
Figure B6 – Photograph of a typical settlement tank showing the hose at the entry point to the tank and the baffle plates. The blue foam shown can be added to the tank to capture solids at the entry point for flows supplied by 75mm and 100mm pumpsets only.

Figure B7 – Discharge of treated flow to the watercourse through a filtration sack which is replaced regularly.
APPENDIX C

Emergency Discharges in the Winter of 2013-14

See notes in Section 4.5 regarding the potential need to modify / augment over-pumping sites to deal with future flood events. Over-pumping sites will be selected to provide the most effective arrangements to maintain services, whilst minimising environmental effects. Where practical, sites that have been used previously are expected to be re-used (when necessary), but the use of different locations cannot be ruled out, if hydraulic conditions dictate.
Goodworth Clatford, Hampshire - Overpumping and Tankering Sites in the Winter of 2013-14 (Plan 1 of 3)

Manholes particularly vulnerable to spillages include those in the vicinity of the WPS.
Goodworth Clatford, Hampshire - Overpumping and Tankering Sites in the Winter of 2013-14 (Plan 2 of 3)

Manholes particularly vulnerable to spillages include those in the vicinity of the WPS

Pump A (UNUSED)
(436255, 142313)
at Royal Oak WPS
3 inch pump from wet well to small settlement tank in WPS to discharge to water course via filtration sacks

NB. In 2013/14, an overpump was set up at Royal Oak WPS, but was unused as overpumping was carried out at Goodworth Clatford Station WPS

Tanker Point at Royal Oak WPS

Longstock Road

Watercourse

Advisory signs to be placed downstream of discharge point
Goodworth Clatford, Hampshire - Overpumping and Tankering Sites in the Winter of 2013-14 (Plan 3 of 3)

Manholes particularly vulnerable to spillages include those in the vicinity of the WPS

Advisory signs: at pump station, at, and downstream of, discharge point

Pump B
(436105, 142587)
Goodworth Clatford Station
3 inch pump from wet well to small settlement tank in WPS to discharge to water course via filtration sacks

Watercourse

Small settlement tank located at Goodworth Clatford Station WPS

Timing for Deployment of Tankers and Overpumps in the Winter of 2013-14
<table>
<thead>
<tr>
<th>Location</th>
<th>Tankering</th>
<th>Overpumping</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Start Date</td>
<td>Stop Date</td>
</tr>
<tr>
<td>Goodworth Clatford, Hampshire</td>
<td>12/02/14</td>
<td>15/05/14</td>
</tr>
</tbody>
</table>

There was no over-pumping or tankering in 2014/15.
APPENDIX D

Emergency Discharge Proposal
Emergency Discharge Proposal

Despite the significant investments being made by SW to reduce infiltration into sewers, and multi-agency actions to be taken, due to circumstances outside SW’s control, there may continue to be occasions when emergency discharges will be required. Further analysis will be conducted after completion of the current rehabilitation programme to access the circumstances when overpumping and tankering would be expected to be required, locations and expected flow rates.

At present, our proposal for emergency discharges will be as follows:

<table>
<thead>
<tr>
<th>Ref</th>
<th>Item</th>
<th>Action</th>
<th>When Required</th>
<th>Locations</th>
<th>Expected Flow Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tankering</td>
<td>Deploy tankers to reduce flows at strategic locations in the sewerage system.</td>
<td>When hydraulic capacity of the sewers and pumping stations are exceeded due to additional flows from groundwater. Monitor rising groundwater level in cellars.</td>
<td>Collect flow from the same manholes used in the winter of 2013-14, as identified in the plans in Appendix C. Discharge flow to Fullerton WTW.</td>
<td>Low</td>
</tr>
<tr>
<td>2a</td>
<td>Overpumping: Pumps</td>
<td>Install pumps to reduce flows at strategic locations in the sewerage system.</td>
<td>In cases of exceptional high flows in the sewers, and when tankering is insufficient, in order to protect residents from imminent public health dangers of sewage flooding in properties or restricted toilet use (RTU). Monitor levels in manholes.</td>
<td>Overpump, probably at the same locations used in the winter of 2013-14, as identified in the plans in Appendix C, but as noted in Appendix C, the use of other sites cannot be ruled out.</td>
<td>Flow rate depends on head/pipe material/distance etc. 3 inch dia. pump = 10-20 l/s (typical rate)</td>
</tr>
</tbody>
</table>
In addition to the overpumping and tankering, there may on occasions be some spillage from manholes in the vicinity of the operations. By timely set up of equipment and appropriate maintenance, SW will endeavour to minimise, and ideally to completely avoid such spillages. However, on occasions, some spillages will be inevitable.

During times of high infiltration, it is possible that there could be a spillage from any manhole in Goodworth Clatford. Manholes that are known to be particularly vulnerable to spillages are highlighted in Appendix C and include:

- Manholes in the vicinity of wastewater pumping stations at Goodworth Clatford South and Goodworth Clatford Station
APPENDIX E

Signage
Typical Advisory Sign - Reference Number and Village Name to be Amended

VILLAGE NAME

EMERGENCY OVERPUMPING

Please note over-pumping of dilute screened sewage to the TBC
is being undertaken to protect customers from flooding and lack of drainage.

It is advised to keep children & pets from the watercourse in the vicinity of this discharge. If you have contact with the water please ensure you wash your hands before eating or drinking.

If you have any concerns please contact:

Southern Water 0845 278 0845 Quoting Ref: TBC

Southern Water