
Thames Water

We are responsible for removing and treating wastewater which includes the foul, and in some areas the combined sewers that exist in some of the older large urbanised areas, such as London⁵. We also manage and maintain surface water sewers where they exist, these will typically discharge to a watercourse or river. In some cases, the cause of sewer flooding may not fall under our responsibility. In these circumstances, we will explain what we can do to help and continue supporting the relevant authorities or third parties to reduce the impact for customers.

Environment Agency

The Environment Agency is responsible for main rivers and part of its remit includes monitoring and informing the levels of ground and river water. The Environment Agency also investigates pollution incidents and monitors the quality of the water in rivers.

Lead Local Flood Authority and District Council

Gloucestershire County Council is the lead local flood authority and has the

responsibility under the Flood & Water Management Act for managing the local flood risk from groundwater and surface water runoff e.g. local watercourses and culverts⁶. They work with landowners to maintain privately owned ditches, drainage and watercourses, keeping them clear of blockages. They are also responsible for managing the risk of groundwater flooding, both inside and outside of properties. Water from these local authority gullies and drains and privately owned ditches can also impact Thames Water's sewers, therefore, we work with all responsible stakeholders to resolve the excess flow. Cotswold District Council is the local Planning Authority responsible for approving new development, but equally may have responsibility for ensuring maintenance of watercourses; particularly on council-owned land.

Highway Authority

Gloucestershire County Council is the Highway Authority and is responsible for highway maintenance and highway drainage, and for clearing roadside gullies. Highways England is responsible for the drainage of motorways and certain trunk roads.

Customers

Customers own, and are responsible for, the maintenance of private drains within the curtilage of their property, which did not transfer to Thames Water ownership in October 2011⁷.

Riparian Owners

Riparian Owners are landowners who own land with watercourses or land adjacent to watercourse (ie road side ditches). The responsibility for the operation and maintenance of ditches, local watercourses and general land drainage lies mostly with riparian owners.

Land Owners

Land owners include farmers and both residential and commercial customers, but includes trusts etc. They are responsible for ensuring the adequate drainage of their land, such that it is not a nuisance to others.

⁵ Thames Water is responsible for the collection and treatment of commercial and domestic sewage. Typically this will be the foul sewerage. Domestic or commercial roof and paved drainage will often go to a soakaway or directly to a water course/river, which if so is not the responsibility of Thames Water.

⁶ Some local watercourses and/or culverts are termed as 'Riparian' meaning that a land owner, possibly adjoining or owning the land containing the watercourse/culvert is responsible for the maintenance and free-flowing of the watercourse/culvert.

⁷ See <http://www.thameswater.co.uk/help-and-advice/8654.htm> for more information.

2 Catchment description

2.1 Geology and topography

The Fairford sewerage catchment incorporates the towns of Fairford and the villages of Coln St Aldwyns, Eastleach Turville, Fyfield, Hatherop, Netherpton, and Quenington. It is located in Gloucestershire, approximately 14km north of Swindon.

Fairford is situated on the River Coln at the boundary where the bedrock limestone of the Cotswold escarpment meets the gravel beds of the Upper Thames Valley. Some areas have a thick bed of permeable gravel over impermeable clay, which can contribute to considerable

variations in ground water levels between dry summer and wet winter conditions, sometimes with ground water flooding in wet seasons. Fairford also has several lakes that have been formed by gravel extraction. The flow routes into the lakes are fed by ground and surface water, and occasionally river overflow. The catchment drains to the south east where a series of interlinked lakes act as Fairford's flood reservoir. The Court Brook, a minor watercourse, runs close to the River Coln. It is usually dry except in wet seasons when it collects overflow from the river, which is then channelled into the lakes. The

catchment is situated in an area that is prone to significant seasonal fluctuations in groundwater levels, with the added likelihood of rainfall induced infiltration⁸ owing to its permeable soils.

Appendix B includes maps showing the geology and fluvial, pluvial and groundwater flood risk areas in the catchment.

According to the Environment Agency the current ecological status of the River Coln and River Leach as 'Poor' and 'Moderate'⁹ respectively.

2.2 Sewage treatment works

The Fairford sewage treatment works is located to the south of the town serving the town of Fairford and the surrounding Villages of Quenington, Coln St Andrews, Hatherop, Fyfield and Eastleach Turville. It supports a combined population of circa 4,315 and treats a daily flow of up to 3,264m³/day. The works receives all flows via two pumping stations to a high-level inlet works. The flows then gravitate through screens into a balancing tank, and then to primary settlement tanks and further treatment, before discharging into the River Coln.

The sewage treatment works includes storm tanks to handle excess flows above the flow to full treatment during peak periods and storms, which discharge back to the inlet for treatment. During more extreme events these tanks can discharge to the River Coln when they are full, if the flows cannot be returned to the inlet, allowing the storm flow to be screened and mixed with the treated effluent before discharge. The size of the storm tanks was increased in 2006 as part of a project to address flooding in the catchment.

The works has had no recent requirements for any major capital investments, however, this is currently being reviewed with regards to the amount of development proposed within the area, and an assessment study is to be undertaken to understand the phasing of the proposed new development and the operational implications for the sewage works.

⁸ Rainfall Induced Infiltration is the term given to sewer infiltration that occurs as a result of rainfall percolating into the ground impacting the sewer on route to recharging the groundwater table.

⁹ Environment Agency website, interactive map, Basin Management Plans.

2.3 Foul sewers

The catchment is served by a separate foul water gravity sewerage system which feeds Fairford sewage treatment works via eight sewage pumping stations, two of which (Horcott and Moor Farm), pump directly to the sewage treatment works. The sewer records indicate the sewer to be a separate system intended for foul waste only, rather than a combined system designed to cater for both foul and surface water. A schematic diagram of the catchment is detailed in Figure 4 below.

Foul sewers in Fairford date from the early 1950s when Cirencester Rural District Council constructed the main drainage system. The outlying villages were drained to Fairford at a later date, and Eastleach Turville was only connected to the foul sewerage network in the late 1980s. The villages of Quenington, Coln St Andrews, Hatherop, Fyfield and Eastleach Turville all have their own gravity sewer networks and are in turn pumped to the sewerage system in Fairford. The network has been extended locally as required, to accommodate new developments and a flood relief scheme was undertaken in 2006 to address foul water flooding that had been experienced within the network. This included the diversion of flows to reduce the impact on the sewers in the south eastern part of the town, an increase to the pumped flows to the

works and the provision of storage; both in the network and at the sewage treatment works.

Sewer design criteria ensures the appropriate sizing and laying of pipes at an appropriate gradient to maintain a satisfactory self-cleansing characteristic. The capacity of sewers is typically set to cater for six times Dry Weather Flow (DWF) with a 10% allowance is included for infiltration¹⁰. In terms of design capacity, a 225mm diameter sewer laid at a gradient of 1 in 225 will have sufficient capacity to cater for the foul sewage from around 1,200 houses, which based on average occupancy rates equates to 2,500 people. Problems in sewers with diameters smaller than 300mm tend to be as a result of blockages in the pipes. However, occasionally surface water can be misconnected into the foul sewerage network – problems then arise when it rains heavily.

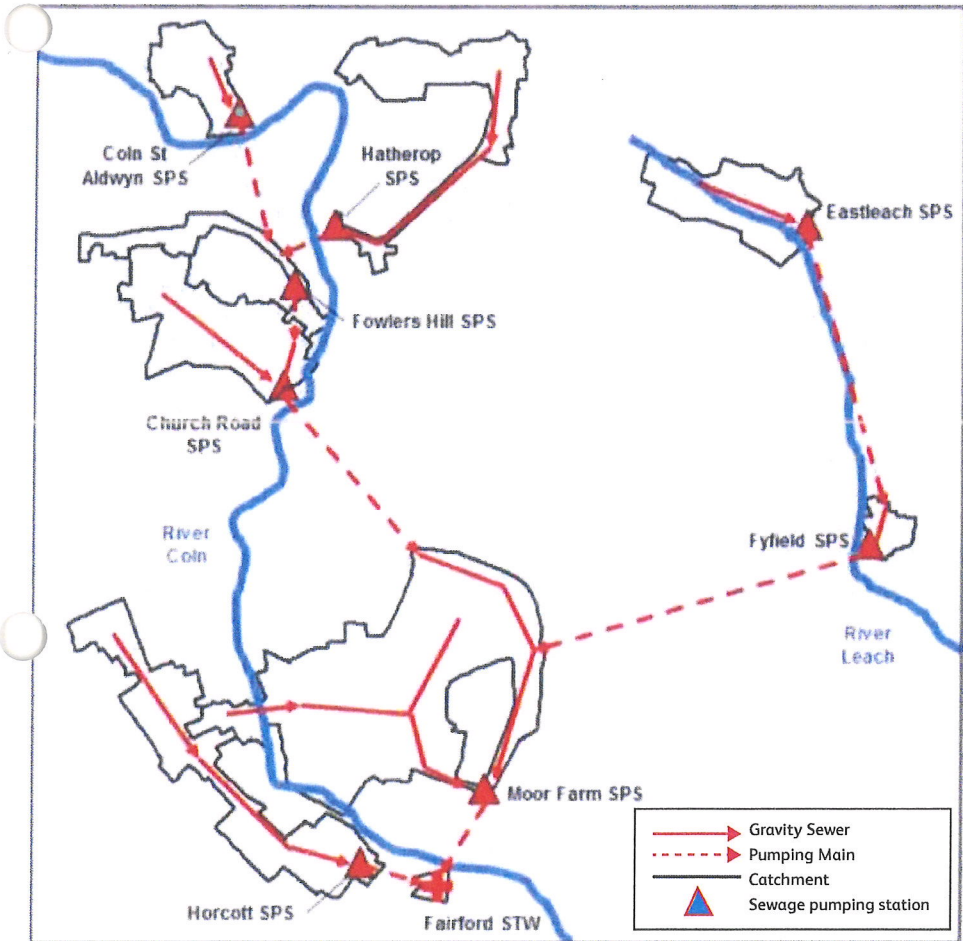
In Fairford the foul sewers range from 150mm to 375mm in diameter and serve approximately 2,000 properties. The flows to the two terminal pumping stations (Horcott and Moor Farm) arrive via three separate sewers (two 225mm diameter sewers and one 375mm diameter sewer). An assessment of the population served by each of these sewers indicates that they

are more than adequate under normal dry weather conditions to deal with foul flows, however, monitoring carried out last winter suggests that the network is responsive to rainfall, indicating that surface flows are impacting the foul sewers.

Materials used in the construction of the sewerage system are typical of the time, with clay pipework and brick and concrete manholes. The clay pipework has a very long service life, but sometimes the joint seals deteriorate over time. The 1950/60s pipes were typically laid on bedding material such as pea shingle, with the trenches likely to have been backfilled with 'as dug' excavated material. More recent drains and sewers, i.e. since the 1980s, are typically surrounded with pea shingle. This protects the pipe but can also act as a good conduit for groundwater. The layout of the town suggests that most properties are likely to have their own foul drains (as opposed to shared drains), that connect directly into the public sewer. As per Section 1.2 above, the private foul water drains within the property boundaries in Fairford are the responsibility of the property owners, where they are not shared.

¹⁰ Dry Weather Flow is the term given to the average flow rate observed over a 24 hour period and based on Sewers for Adoption, the industry standard, includes an allowance for infiltration of 10% of the calculated flow rate.

Figure 4 Fairford catchment schematic



2.4 Surface water sewers

There are very few surface water sewers in the Fairford catchment with the majority in newer developments in the north east of Fairford town. The surface water from the majority of properties is likely to drain to soakaways or to the River Coln. Soakaways can only function satisfactorily when ground conditions allow soakage and may be completely ineffective when groundwater levels are high. In some areas, we have seen examples of customers draining surface water through their foul drains when their soakaways do not work. This exacerbates capacity problems for other customers connected further downstream in the sewerage network.

The catchment is mostly rural and incorporates a network of roadside ditches and minor watercourses that are intended

to drain surface water from roads and public spaces in the area. As per Section 1.2 above, the responsibility for the operation and maintenance of these ditches, local watercourses and general land drainage is lies mostly with riparian owners. Gloucestershire County Council as lead local flood authority has overall responsibility for managing groundwater.

The Environment Agency has the duty and the authority to ensure that the River Coln is maintained appropriately. The responsibility for the maintenance lies with riparian owners.

Highway drainage typically discharges to the roadside ditches. Owing to the high local beauty of the area the ditches tend to be well maintained with clearance of vegetation and debris occurring. However,

the area does have an active groundwater table and as a result groundwater springs do occur from time to time, which can lead to localised land drainage issues.

The extent of highway drainage is unknown, but it is likely that highway run-off discharges via a mixture of piped drainage to watercourses and directly to the roadside ditches, some of which will act as soakaways. Gloucestershire County Council is responsible for the highway drainage and culverts crossing the highway.

3 Long-term outcomes

We have listened very carefully to the views of customers before developing our plan for the Asset Management Period 6 (AMP6), regulatory period. Between 2009 and 2013 we carried out over 50 separate customer research and engagement activities.

Beyond being able to maintain the current service that we provide, customers have told us that they would like to see a reduction in instances of sewer flooding and odour nuisance and an improvement in river water quality. These are areas where some customers are prepared to see, and pay for, an improvement in the current level of service.

In response to this, we have developed 4 company outcomes and 11 service outcomes for our wastewater service that we are committed to working towards over the next 5 years and beyond, further details can be found in Table 1 below and on our website¹¹.

Table 1 Wastewater outcomes

Company outcome	Wastewater service outcome	Why is this service outcome chosen
We will provide a safe and reliable wastewater service that complies with all necessary standards and is available when our customers require it.	Asset health: maintaining our assets to ensure we can provide a safe and reliable service in the long-term.	We must ensure an appropriate balance between reducing costs today and not compromising our future service.
	Properties and public areas protected from flooding.	Flooding is one of the worst service failures for customers.
	Resilient sewage treatment service that minimises the impact of extreme events on river water quality.	We need to be able to provide service against a variety of pressures such as climate change and population growth.
Our customers and stakeholders can trust us, we are easy to do business with and we care.	Do the basics excellently by getting things right first time.	This service outcome ensures our wholesale activity is completely aligned to our objective to improve our Service Incentive Mechanism (SIM) scoring.
We will provide the level of customer service our customers require, in the most economic and efficient manner, to ensure that bills are no more than necessary.	Reduced dependence on energy from the grid.	Reducing dependence on energy from the grid is one of a range of measures across our entire plan to keep costs down to an affordable level for customers.
We will limit our impact on the environment and achieve a socially responsible, sustainable business for future generations, including reducing levels of leakage.	Minimising our carbon footprint.	There is an expectation from society that we will play our part in reducing carbon emissions.

¹¹ See http://www.thameswater.co.uk/tw/common/downloads/about%20us%20-%20corporate%20responsibility/AMP6_-_Outcomes_Reporting_Policy.pdf for more information.

Company outcome	Wastewater service outcome	Why is this service outcome chosen
	River water quality meets customers' expectations and regulatory requirements.	We must meet environmental regulations, and river quality is a visible indicator to citizens of our environmental stewardship.
	Satisfactory sludge disposal.	Sludge is a resource that we should manage effectively to keep bills down.
	Corporate responsibility.	We will act as a responsible company, meeting expectations from wider society.
	Reduced odour from wastewater operations.	Odour is a problem for some of our customers.
	Compliance with new environmental regulations.	We must meet environmental regulations, and river quality is a visible indicator to citizens of our environmental stewardship.

Below we provide more information about our asset health, properties and public areas protected from flooding and river water quality service outcomes, as these are relevant to the Fairford drainage strategy.

3.1 Asset health

Our Asset health performance commitment encompasses a composite range of measures against which we will manage the health of our sewerage network. This commitment underpins our outcome of a safe and reliable wastewater

service. It includes sewer collapses, blockages, unconsented category 1 to 3 pollution incidents and properties internally flooded due to operational problems (such as blockages, collapses or equipment failures).

3.2 Properties and public areas protected from flooding

There are two performance commitments that underpin the delivery of this service outcome:

1. We commit to protecting properties from flooding due to rainfall. We estimate that our plan for 2015-20 will result in over 2,100 properties being alleviated from internal flooding, external flooding and also from restricted toilet use (for example when

groundwater levels are high following prolonged periods of wet weather). Our customer research indicates that our sewer flooding programme will deliver £20m of benefit to customers every year by 2020.

2. We commit to reducing the risk of sewer flooding and pollution from combined sewers (i.e. those that convey both foul and surface water) by slowing down surface water run-off and re-

routing the flow through sustainable drainage measures such as water butts, permeable paving, rain gardens and green roofs. We aim to retrofit over 20 hectares of sustainable drainage measures by 2020. We may also apply this commitment to areas where the network was designed to take foul flow only, but investigation shows that a substantial amount of surface water is in the foul sewer.

3.3 River water quality meets customers' expectations and regulatory requirements

We have a performance commitment to reduce the number of pollution incidents as a result of discharges from our sewerage network and treatment works. Pollution can occur as a result of blockages, collapses or failure of our

equipment and also following heavy rainfall when our sewers have insufficient capacity to cope with the flow. All pollution incidents are reported to the Environment Agency's National Incident Recording System (NIRS).

4 Current issues

4.1 Recent wet weather events

The foul sewerage system in Fairford has become overwhelmed for weeks at a time in recent years, following prolonged and heavy rainfall. This has been associated with significant sewer flooding. Based on site reconnaissance that we have carried out we believe that the system has surcharged due to a combination of groundwater infiltration to public sewers and private drainage, surface water runoff from saturated fields, surface water inundation from highways and public spaces, surface water misconnections and river water overflowing from the River Coln.

We are confident that this is a comprehensive list of factors that have caused flooding. During recent events, the following incidents have been observed with respect to the sewerage network:

- surcharging sewers causing spills out of many public manholes
- external foul flooding in a number of locations
- properties suffering internal sewer flooding and restricted toilet use, resulting in the use of portable toilets
- failures at Moor Farm sewage pumping station, requiring temporary pumps to be installed and tankers to be used.

During these events, other sources of flooding have also been observed:

- highway drainage overwhelmed causing highway flooding
- the River Coln overwhelmed causing fluvial flooding of properties
- land drainage issues with water running off fields and onto the highway.

Figure 5 below, compares the daily treated flow volume at Fairford sewage treatment works with groundwater levels in the Environment Agency's Fairford borehole - RBHL.2092. The graph suggests that there is a correlation between flows reaching the Fairford sewage treatment works and groundwater levels.

A short-term flow monitoring assessment undertaken last winter also indicates that rainfall has an impact on the sewers, and hence the sewage treatment works. Whilst the sewer records show the sewerage network to be a separate system intended for foul waste only, rather than a combined system designed to cater for foul and surface water, it is clear from this data that flows also increase at times of lower ground water; suggesting the impact of surface water connectivity in some parts of the network.