

Water and sewerage services during the summer 2007 floods

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About this report

This report summarises how the regulated water and sewerage companies in England and Wales performed during the 2007 floods in delivering water and sewerage services. It also assesses the performance of the companies' emergency response, how the companies are learning lessons and emerging issues for our regulatory policy.

The information is drawn from information provided by the four most affected companies – Anglian Water, Severn Trent Water, Thames Water and Yorkshire Water.

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1. Introduction and main findings

Ofwat's role as the economic regulator of the water and sewerage sector is to protect consumers, promote value and safeguard the future. We have reviewed water and sewerage companies' role and performance in managing the 2007 flood events. This report sets out our findings.

We recognise the impact of the 2007 flood events and the human suffering that resulted for communities and individuals, both directly through flooding of homes and properties, and indirectly through the impact on vital services, particularly those provided by water and sewerage undertakers.

The report focuses on issues relevant to our role as industry regulator for water and sewerage services. It is based on information provided by the four water and sewerage companies most affected by the heavy rainfall in June and July 2007 – Yorkshire Water, Severn Trent Water, Anglian Water and Thames Water.

Our investigation has explored:

- the impact on service to water and sewerage consumers;
- how companies and their assets performed in managing these events; and
- possible implications for future planning and regulatory policy.

We will be feeding our findings into the Government's flooding "lessons learned" review led by Sir Michael Pitt. We have not addressed issues where others are better placed to do so. This includes companies' emergency response plans and compliance with Civil Contingencies duties, where the Cabinet Office Civil Contingencies Secretariat is responsible for improving preparedness for and response to emergencies, and the industry's "mutual aid" arrangements, where Water UK take the lead. The Consumer Council for Water has already published research into consumers' views into the loss of supply at Mythe water treatment works (WTW).¹

Headline issues

The exceptional rainfall events of this summer led to the flooding of many water and sewerage assets. Two incidents with major impacts on consumers took place, where water and sewerage services were compromised by flooding:

¹ Consumer Council for Water: '[Response to Loss of Supply](#)', September 2007.

- Flooding of Severn Trent's Mythe WTW led directly to the loss of piped potable water supply to 350,000 consumers in the Gloucester area from 22 July for up to 16 days.
- Widespread flooding took place in Hull in June as the drainage system was overwhelmed with rainwater flowing overground. This has raised significant issues relating to the dependency of the city on its pumped drainage system, major elements of which are owned and managed by Yorkshire Water.

These incidents resulted in widespread suffering and inconvenience for affected communities.

However, in many other areas impacts on the water and sewerage service provided to consumers were effectively contained, despite many water and sewerage assets being affected, impaired or overcome by flooding resulting from the exceptional rainfall. In particular, the scale of disruption to sewage treatment works (STWs) and sewage pumping stations (SPS) was significant and required companies to work hard to recover these assets quickly. In general, outside Hull and Gloucestershire, impacts on the service delivered to consumers by water and sewerage companies were limited.

The two key exceptions of Mythe and Hull, have highlighted that we need a better analysis of the exposure of key sites or assets to flooding risks. In considering risk it is important to assess both the likelihood and consequences of flooding events.

The risk from flooding must also be considered in the context of the many other risks to services that water and sewerage companies provided. The industry has developed, with our approval, risk based and economic methods of analysis to prioritise and justify investment to maintain and improve services. This includes both cost benefit analysis and risk based approaches to long term asset management, such as those embodied in the common framework. We expect these approaches to be applied to issues that have arisen from the summer events.

The affected companies have processes in place to learn lessons from the floods.

Recommended actions

- As part of their long-term asset management planning, we will challenge companies to demonstrate understanding of flood risks to service.
- We will work with the industry and other relevant stakeholders to develop a consistent and coherent framework for assessing flooding risk and identifying cost beneficial measures to improve resilience of critical assets. We will expect

companies to be able to demonstrate that they have identified the right set of measures to improve resilience, along with the timeframe for taking action. We will develop guidance during 2008, to ensure that it informs business plans for the 2009 price review.

- We will review the issues raised by the Hull Independent Review Body (IRB) report, including the changes made to Hull's drainage arrangements in recent years and their operation during the floods. When we have concluded this review, we will take any actions required to ensure that consumers are protected. In particular we will ensure that Yorkshire Water takes actions required to provide the right level of protection for consumers.
- In assessing PR09 investment choices we will challenge companies to demonstrate a clear understanding of consumers' priorities in terms of investments to reduce risk to service, as well as a clear cost benefit case.
- We will use the climate change scenarios to be published by the UK Climate Impacts Programme in 2008 to identify key priorities for adaptation by the water industry in England and Wales and guide judgements made within the PR09 process.
- We recommend that the provisions made for the emergency supply of water under the SEMD and the guidance for the implementation of the emergency supply should be reviewed by Defra in the light of experience at Mythe.
- We recommend that Water UK should review the industry's "mutual aid" arrangements with input from all stakeholders. Water UK should also bring water companies together to examine lessons on emergency planning.
- We recommend that Defra amend the legal right to connect to public sewers with a view to promoting integrated urban drainage solutions.

The remainder of this report is structured as follows.

- **Chapter 2** sets out some background information on the floods and water and sewerage service standards.
- The performance of the companies' water supply service, sewerage service and emergency response is considered in **chapters 3, 4 and 5**.
- **Chapter 6** summarises what companies are doing to learn the lessons from the floods.
- **Chapter 7** sets out some emerging issues that will need further consideration.

2. Background

The floods

The flooding events of this summer followed exceptional rainfall, with some areas experiencing two months' rain in just 12 hours. May was the second wettest month for 72 years⁶ and the ground in many areas was close to saturation when in June there were two exceptional rainfall events on 15-16 and 24-25 June.⁷ These resulted in flooding in east, west and south Yorkshire, east Lincolnshire, north Nottinghamshire, Worcestershire, parts of Warwickshire, and Gloucestershire.

More exceptional rainfall, again widespread, heavy and prolonged, followed on 20 July (an area of about 3,500 km² experienced more than 100 mm of rain⁸) and Gloucestershire and parts of West London and the Thames Valley were particularly badly flooded. In both months, the monthly rainfall in the affected areas exceeded a return period⁹ of 1 in 100 years, while the rainfall events themselves would be expected, on average, no more than once in two hundred years.¹⁰

River flows in many areas set new “all time” or summer records and in the worst affected areas (for example in the river Severn between Upton and Gloucester, upper river Thames and river Don in South Yorkshire) river levels were similar or higher than the extreme 1947 floods.⁸ The flood levels also rose very rapidly as a result of the intense rainfall and the already saturated ground. This lessened the time available to react to flood warnings.

The widespread flooding came from a combination of overland flows and overflowing sewers, drains, watercourses and rivers. In some areas, for example the Don Valley in South Yorkshire and the lower Avon and Severn, there was more flooding from overflowing watercourses. In other areas, flooding occurred from rainwater flowing overground. This was a particular problem in Hull where the drainage system was overwhelmed by the volume of rainwater.

The Environment Agency has reported that in total about 48,500 households and 6,900 businesses were flooded during the summer.¹¹

⁶ Centre for Ecology and Hydrology, [Hydrological Summary for the UK: May 2007](#).

⁷ Centre for Ecology and Hydrology, [Hydrological Summary for the UK: June 2007](#).

⁸ Centre for Ecology and Hydrology, [Hydrological Summary for the UK: July 2007](#).

⁹ Rainfall events are categorised in terms of an estimated “return period”, expressed as “one in so many years”. The longer the return period, the more severe the event.

¹⁰ www.metoffice.gov.uk/climate/uk

¹¹ Environment Agency data ‘[2007 summer floods](#)’ website.

Service standards

Water and sewerage companies in England and Wales operate under general and statutory duties, as set out in, among others, the Water Industry Act 1991. These general duties are augmented by a range of requirements imposed by their licences. The combination of the statutory duties and the licence requirements sets the broad outline of water and sewerage companies' functions. In terms of risk from flooding, sewerage companies have a duty to ensure that their areas are effectually drained, which we enforce. However, the concept of 'effectual drainage' is not expressed in the form of an absolute standard.¹²

More detailed service standards that the companies must comply with include:

- drinking water quality as defined in legislation, which the Drinking Water Inspectorate (DWI) assesses¹³;
- sewage effluent consent standards as defined in legislation, which the Environment Agency assesses¹⁴;
- the guaranteed standards scheme (GSS)¹⁵, which sets out certain minimum standards of service for individual customers. Where a company fails to meet any standard it must pay a specified payment to the affected customer or customers; and
- regulatory targets/expectations, which we set through the price review process¹⁶.

In relation to drainage, or flooding from sewers each company is required to monitor the number of properties that are "at risk" from flooding (through Ofwat's DG5 register), and the number of sewer flooding incidents that occur. Companies are also required to prevent increases in the risk from sewer flooding (usually expressed as the number of properties at risk of flooding during a return period, for example, once in ten years).

The price limits we set every five years finance each company to maintain, among other things, water and sewerage infrastructure, meet growth or changes in demand and, where agreed, reduce the likelihood of specific service failures, for example properties being flooded with sewage because of overloaded or damaged sewers. At present, between 2005-10, we are expecting sewerage companies to reduce the number of properties at risk through a targeted investment programme of £1.2 billion.

¹² House of Lords, *Marcic (Respondent) v Thames Water Utilities Limited (Appellants)*, 2003, UKHL 66.

¹³ www.dwi.gov.uk. Companies are required by law to supply water that is fit for human consumption and drinking water must be wholesome.

¹⁴ www.environment-agency.gov.uk. Reference.

¹⁵ The Water Supply and Sewerage Services (Customer Service Standards) Regulations 1989. The most recent amendments are Statutory Instrument 2005 No.2035.

¹⁶ We monitor some levels of service (DG indicators); others may be a function of company policy supported by business plans that are acceptable to us.

For the next price review in 2009, we have asked each company to develop long term strategic direction statements setting out how they expect to deliver service over a 25 year planning horizon. We also expect companies to prepare specific plans for cost-beneficial investments to reduce sewer flooding risks during the 2010-15 period.

By assessing companies' business plans, we make sure that consumers pay no more than necessary for the service they receive. We set outputs as part of the price review and monitor whether each company achieves these outputs. Where a company fails to meet the required output, we require it to take action to put it right.

Standards during exceptional events

There are special arrangements for performance standards when exceptional events, such as the very heavy rainfall in the summer and the subsequent flooding, affect services. The GSS Regulations include provisions for exceptional and severe weather, which exempts the company from making the GSS payment. However, there is no definition of exceptional or severe weather within the legislation. The extent and severity of flooding this summer was such that we considered that the exceptional weather (Regulation 7B – sewer flooding) and severe weather (Regulation 7 – interruptions to supply) exemptions could apply.

For STW compliance, there is provision within both the Water Resources Act 1991 and the Urban Wastewater Treatment Directive for the Environment Agency to exclude STW discharge samples from consent compliance if the operation of the STW was adversely affected by unusual weather.

3. The performance of the water supply service

Summary

Six WTWs operated by five of the water and sewerage companies were seriously affected by flooding. However, only the closure of one – Mythe WTW operated by Severn Trent and supplying water to Gloucester, Cheltenham and Tewkesbury – resulted in significant interruption of supply to consumers. This was a major water supply emergency and resulted in up to 350,000 consumers losing drinking water supplies for up to 16 days. In addition, on four different occasions during June and July, Severn Trent was unable to immediately repair burst water mains because flooding had made the affected areas inaccessible. This resulted in supply interruptions to 90 properties of more than 6 hours, and a further 22 properties of more than 12 hours.

The scale of the emergency was the result of both the extent of the floods and because Mythe WTW is the single source of supply for consumers in Gloucester, Cheltenham and Tewkesbury. This situation has raised questions about the dependency of large populations on a single critical asset. Companies need to examine this issue closely, together with regulators and stakeholders.

Where there is a threat to either drinking water quality or supply, the company has a requirement to notify DWI. DWI is investigating the Mythe incident, and will publish its conclusions and make recommendations regarding the actions required to comply with the Water Supply (Water Quality) Regulations 2000 as amended on 22 December 2007.

The Mythe WTW flooding emergency

Mythe WTW is in Tewkesbury. It is operated by Severn Trent and serves more than 350,000 consumers. It was flooded and shutdown on 22 July and remained out of service until 28 July. Non-potable supplies were restored on a phased basis with potable supplies fully restored on 7 August.

Until midnight on 21 July the Environment Agency's flood level predictions for Mythe indicated that the works would not be flooded. However, Severn Trent instigated its Flood Emergency Response Plan during 21 July, placing sandbags at key buildings and importing additional pumps despite local disruption because of already flooded roads. Severn Trent monitored the river level at Mythe and remained in close contact with the Environment Agency. Severn Trent also called in the Fire Service late that

night to provide emergency pumping. At midnight on 21 July river levels were still rising and the Environment Agency confirmed that the works would flood.

The Mythe incident highlights the uncertainties involved in forecasting such an extreme event when the water levels rose quickly to record levels. During 21-22 July the flood level at Mythe Bridge gauge¹⁷, just upstream of Mythe WTW, exceeded previous record levels.

Early on 22 July, Severn Trent implemented its contingency plan to provide alternative supplies (see chapter 5). Severn Trent was able to switch 20,000 properties to Mitcheldean WTW, which was not affected. When Mythe WTW was shut down there was approximately 36 hours' worth of treated water stored in its supply zone service reservoirs. However, news of the impending supply failure broadcast by the media on 22 July led to a rise in demand, and piped water supplies in the area began to fail later that day. By 23 July, 70,000 properties were without piped water, and by 24 July this rose to 140,000 properties, or about 350,000 consumers.

Partial access to Mythe WTW was regained on 24 July allowing Severn Trent to pump out basements and make an initial damage assessment. Full access to the works was regained on 25 July. Severn Trent says that the controlled shutdown had lessened the potential damage but it still had much work to do, including drying and checking electrical plant and repairing damaged assets. During this period, severe weather warnings were again received and a semi-permanent flood barrier was installed by 29 July. This remains in place.

The re-commissioning of the Mythe supply system involved Severn Trent reinstating the basic water treatment processes in a careful and safe manner. When the works was functioning satisfactorily, treated water was put back into the supply system on 28 July. The empty system took time to refill and the health authorities required that consumers were issued with "Do not drink" notices during this period. On 3 August, Severn Trent informed consumers that water could be used as long as it was boiled before use and potable supplies were restored fully on 7 August. DWI is investigating these matters.

Other WTWs impacted by flooding

The flooding affected four other WTWs operated by the four most affected companies, but this did not result in consumers suffering a loss in supply. Additionally, one WTW operated by Dŵr Cymru was also affected, resulting in the

¹⁷ Mythe gauging station levels are from the Environment Agency. This gauge has been in regular operation since 1970.

company providing alternative supplies to approximately 7,000 consumers for one day. The details of these other WTWs impacted by flooding are below.

- Fulstow WTW (near Cleethorpes), operated by Anglian, usually serves about 8,000 consumers. It closed as a precaution on 25 June as the flood level rose and consumers' supplies were re-zoned. Anglian estimates that 2,500 properties lost their supply for two hours.¹⁸ DWI was not notified about this event.
- Homesford WTW (Derbyshire), operated by Severn Trent, has a capacity of 65 MI/d. It does not directly serve consumers but feeds into the Derwent aqueduct, which supplies Nottingham. It was shut down for one day on 26 June as the river water flooded the groundwater source and a building. No equipment was damaged and the work restarted once the river level fell. The connectivity of the water supply system meant that Severn Trent's consumers experienced no loss of supply. DWI does not consider that this was a notifiable event.
- Ewden WTW (Sheffield), operated by Yorkshire, serves about 100,000 consumers. It had to be shut down on 30 June for seven weeks because the 33 inch diameter outlet main became threatened by flood erosion in the banks of the River Don. The connectivity of the water supply system meant that no consumers lost their water supply.
- Grimsbury WTW (Banbury), operated by Thames, can serve up to 52,000 consumers. It was flooded on 21 July and is currently still out of action. However, there are other means of supplying consumers that are used on a regular basis. Thames' consumers experienced pressure fluctuations but no loss of service. DWI was notified of this event and classified it as a non-incident because there was not a risk to drinking water quality. A 1 in 50-year flood defence scheme, installed at the works by Thames in 2002 after close consultation with the Environment Agency, was unable to prevent the flooding. A comprehensive flood defence scheme for Banbury is being progressed by the Environment Agency and Cherwell District Council. This would provide a higher standard of flood protection to the WTW.
- Whitbourne WTW (Herefordshire), operated by Dŵr Cymru, serves approximately 7,000 consumers. It was evacuated because the River Teme flooded on 21 July and remained shut down for two days. Approximately 3,800 properties lost water supplies in and around the Bromyard area on 22 July. Water bowsers, tankers and bottled water supplies were deployed and 400 properties were re-zoned. A "boil" notice was issued when the WTW again became operational on 23 July, and the water supply was declared "all clear" on 28 July. The DWI has concluded its investigations and came to the view that the company managed the incident well and acted promptly to minimise the impact on consumers.

¹⁸ Our DG3 measures do not register supply interruptions of less than three hours.

²⁰ Gloucestershire County Council, '[Scrutiny inquiry into the summer emergency 2007](#)', November 2007.

4. The performance of the sewerage service

Summary

Hundreds of STWs and SPS were flooded and put out of action and sewers in many places were overwhelmed by rain and river water. However, in general, the sewerage service was maintained. Some works failed, but companies were able to deploy temporary plant and restore service quickly, and no material impacts on river quality have been reported.

The exception to this generally positive summary is the flooding in Hull after the drainage system there was overwhelmed. This is covered in more detail below. Furthermore, the scale of damage caused to sewerage service assets is large. For Yorkshire Water alone, the repair and recovery costs are likely to exceed £50 million and take 18 months to complete. These costs are part of a company's normal business risk and customers will not pay for them.

Sewage (and sludge) treatment works

More than 300 STWs were flooded with the operation of many of these severely compromised. This reflects the fact that many STWs are close to rivers and that the floods far exceeded the provisions in place for flood protection.

Flooded STWs were affected to varying degrees. For example, Yorkshire's Blackburn Meadows STW (near Meadowhall), which serves a population equivalent of more than 500,000 in Sheffield, flooded to a depth of two metres and failed. But Yorkshire's Saltend STW (Hull), which serves about 500,000 consumers, was only flooded to 0.6 metres and continued to function. In Yorkshire alone, the sewage treatment for over 2.5 million people was compromised or failed, and recovery to the required standards of treatment was only achieved by extensive deployment of temporary pumping and electrical plant. Many sites are still affected and full recovery of the normal plant and equipment will take many months.

Companies have reported that because these failures occurred during unusual weather conditions, the Environment Agency waived discharge consents until the treatment processes had been brought under control. The situation was brought under control quickly, albeit often through temporary means. The treatment processes employed in sewage treatment were able to re-start quickly once the pumps had been re-started. The companies have not reported any material impact on river quality as a result of failures caused by the flooding. This may be because the rivers were swollen and as a result provided unusually high dilution.

Sewage pumping stations

The floods far exceeded the provisions in place for flood protection at SPS. More than 300 SPS were flooded and their operation compromised. Two-thirds of these were in the Yorkshire and Thames regions. In general, companies have reported rapid recovery of SPS service either as a result of installing temporary plant or repair, and that there are no significant long-term service failures. Although investigations are not yet complete, the four companies have said that failure of SPS did not materially exacerbate flooding.

Nonetheless, companies will need to examine any impacts associated with flooding of SPS. For example the Gloucestershire County Council inquiry²⁰ reports sewer flooding in Longlevens where power failed at a SPS. We understand that Severn Trent is currently considering options to address this, one of which is to relocate the SPS.

A subset of SPS are critical to the drainage in a particular catchment, for example, Hull (see below). In these cases, failure of SPS can have a significant impact on the extent of flooding. In Hull pumping supports discharges over the tidal wall, which had not been breached. Thus, any pumping would mitigate flooding to an extent. There are other areas where reliance on pumping for drainage is similar to the Hull situation.

The sewerage system

Most sewers are open systems and are at least in part combined, receiving surface water runoff in addition to sewage. The combined sewerage system becomes easily overloaded in heavy rain, in which case polluting sewage can escape. Surface water then becomes contaminated with sewage even though the contribution of the sewer to the volume of surface water flooding is low.

The combined sewerage system is generally designed to cope with storms, and will carry rainfall from 1 in 20-year storms without undue strain as consented overflows operate to reduce the flow, discharging dilute sewage to watercourses. However, there are, in some places, combined sewerage systems that will not adequately carry more frequently occurring storms. New sewerage systems are generally designed to cope with 1 in 30-year storms. There are a small number of properties in problem locations (currently some 7,300 in England and Wales) that may flood more frequently than 1 in 10 years from overloaded sewers. However, rainfall as intense as that experienced in June and July will overwhelm nearly all sewers. In many areas, sewers and drains were overwhelmed, with Hull being particularly badly

affected due to its topography and the nature of its drainage system. A few sewers were also damaged as a result of the high flows travelling through them.

Sewerage companies believe that the sewerage system operated as expected given the exceptional circumstances. They have reported that, for the most part, rainfall was much higher than the levels sewers are expected to handle, and the resulting flooding was not materially exacerbated by any operational failures. In many cases, flooding was caused by general inundations from surface water and river flooding. The companies are carrying out their own performance reviews and these will take time to complete. We have asked companies to provide us with the outcomes of these studies.

Yorkshire reported problems with flood waters depositing large amounts of silt in some sewers, which could have contributed to delays in drainage. However, there is no clear pattern to this, with some sewers affected, while others were totally cleaned out.

Some properties will have been flooded directly from sewers, but companies have had difficulty identifying them. This is because the companies rely primarily on customer contact when flooding from sewers occurs, but in the general inundations in June and July this did not happen. Companies are currently investigating all incidents and we do not expect this work to be fully complete until they make their next annual report to us in June 2008.

Hull flooding

The June flooding in Hull has been documented in Hull City Council's Independent Review Body's (IRB) interim and final reports.²¹ More than 8,300 properties were flooded.

The city is low lying, and all drainage has to be pumped into the rivers Hull and Humber. Yorkshire operates these pumping stations, the Saltend STW and a large part of the drains and sewers serving the Hull area. Some surface water drains and watercourses in the Hull area are the responsibility of other organisations.²² This leads to a complex interaction between the various components of Hull's drainage system.

²¹ 'The June 2007 floods in Hull', Report by the Independent Review Body [24th August 2007\(interim\)](#) and [21 November 2007 \(final\)](#).

²² The local authority is responsible for some drainage, and the Environment Agency for some watercourses in the Hull area.

The rainfall on 25 June exceeded the capacity of the sewers, and overwhelmed the city's drainage system. One of the smaller pumping stations, Bransholme, failed for 12 hours on 26 June because of flooding but this pumps surface water, not sewage, into the river Hull. Yorkshire's emergency plan for this eventuality involved temporary pumps. But the allocated pumps, to be sourced through a commercial supplier, had been sent to the greater emergency at the Ulley Dam in Rotherham.²³ Yorkshire had to get the temporary pumps elsewhere which delayed the re-start of pumping. It is not clear if stopping the pumping for 12 hours had a material impact on the numbers of properties affected, but it may have extended the duration of the flooding.

Yorkshire reported to us that those parts of Hull's drainage system that are its responsibility have been maintained in line with other drainage systems in the country. Ofwat monitors the performance of sewerage companies and we publish our assessments each year in our 'Financial performance and expenditure' and 'Levels of service' reports.²⁴ No performance problems have been reported for Yorkshire. However, the exceptional rainfall in June has raised serious questions about the ability of Hull's drains and sewers to cope with such events, even if they are beyond the normal design standards. The Hull IRB final report has also raised questions about the capacity of the storm pumps at Hull.

We will review the issues raised by the Hull IRB report, including the changes made to Hull's drainage arrangements in recent years and their operation during the floods. When we have concluded this review, we will take any actions required to ensure that consumers are protected and that Yorkshire Water delivers an appropriate level of service.

It is clear that the drainage assets operated by Yorkshire Water in Hull are critical to the flood risk exposure of the city. Yorkshire Water has stated its desire to fully re-examine the system with the participation of the other stakeholders.

²³ Ulley dam, owned by Rotherham Borough Council, suffered damage on the 24-25 June and many large temporary pumps were called in to that location.

²⁴ Ofwat, 'Financial performance and expenditure' and 'Levels of service' reports, 2006-07.

5. Performance – emergency response

Companies reported communication and transport difficulties during the flooding. Accessing affected sites was difficult and prevented the companies from assessing immediately damage in a number of cases. Anglian found that access to its emergency control centre was itself threatened by floodwater so that the emergency team had to be re-located. There were also problems with customer contacts.

- Communication with consumers deprived of a piped water supply was a major problem for Severn Trent. Its internet site was overloaded on 22 July and a simplified web page had to be installed to provide advice on the incident. A dedicated call centre to deal with incident calls also needed to be set up. Severn Trent reported that the local media was the most effective way of communicating with consumers.
- Thames' customer call centre in Swindon was flooded and staff had to be moved to an alternative site. Calls were re-routed to Thames' outsourcing partner in Rotherham, but customers with general billing enquiries were unable to be dealt with for an hour on the 20 July and on the morning of 21 July.

Working interfaces with the local emergency planning authorities (such as Gold Command) in Gloucester and Hull took time to establish, but all the companies were involved with local emergency response authorities during the flooding emergencies. This included Anglian staff helping to pump water away from a block of flats in Lincoln.

All the companies are involved in post-mortem reviews of their emergency response with other stakeholders.

Power supplies – water and sewerage

Water treatment, water supply, SPS and sewage treatment are all heavily reliant on a continuous electricity supply obtained in almost all cases from the National Grid. Sometimes power is generated at STWs from bio-gas, and in cases where power supplies are considered vulnerable, stand-by generation is sometimes provided. Temporary generators were required to keep water supply pumps running in Sheffield because electricity sub-stations flooded.

When companies examine the resilience of their water and sewerage assets, the resilience of the electricity supply network on which they depend must also be taken into account. A near miss for a sub-station is likely to be a near miss for water and

sewerage services. Close liaison on this between water companies and their power supplier is vital.

Water service

The flooding in Gloucestershire resulted in a major incident being declared under Gold Command on 20 July, headed by the Chief Constable of the Gloucestershire Constabulary.²⁵ This command extends to the county boundary. When it became clear that the closure of Mythe WTW would result in extensive loss of supply, Severn Trent's emergency response came under the control of Gold Command. Severn Trent, in common with other utilities, is a "category two responder" under these emergency arrangements, and is required to contribute emergency planning information to the relevant Local Resilience Forum.

Under the Security and Emergency Measures Direction (SEMD)²⁶, water companies are required to:

"keep under review and revise such plans as it considers necessary to ensure the provisions of essential water supply...and wastewater services at all times."

As part of the provisions, should the piped water supply fail, domestic customers must receive a minimum of ten litres per head per day (l/h/d) of potable alternative water.

To achieve the SEMD requirements, Severn Trent:

- transferred as many areas of Gloucester to an alternative source of water from Mitcheldean WTW on 21 July as a precautionary measure. This action maintained supplies to some 20,000 properties throughout the incident;
- tankered water from other treatment works to provide limited support to service reservoirs in the area, prolonging the availability of a piped supply for some;
- connected 10,000 properties to Strensham WTW once the necessary valves became accessible. This supply was subject to a "do not drink" notice;
- deployed and refilled drinking water bowsers;
- procured and distributed bottled drinking water; and
- obtained help from other water companies through the industry's "mutual aid" scheme – tankers for transporting water, bowsers, other equipment and even staff were borrowed.

²⁵ Civil Contingencies Act 2004 and regulations made under the Act.

²⁶ The SEMD is a statutory document produced under the provisions of section 208 of the Water Industry Act 1991.

Severn Trent encountered particular problems with:

- vandalism – a small number of bowzers were damaged, stolen or left with the tap running;
- narrow streets – modern large tankers could not negotiate these and water had to be transferred to smaller vehicles; and
- providing information to consumers about bowser locations.

The scale of the bowser and bottled water operation was much greater and lasted longer than Defra and Welsh Assembly guidance to the companies on emergency planning²⁷ had envisaged. Throughout the first seven days, the company improved the supply of water through bowzers and bottled water to more than twice the minimum quantity required for each consumer. However, consumers used to an average daily consumption of some 138 l/h/d obviously found it difficult to adapt to the emergency supply volume.

²⁷ Defra/Welsh Assembly Government, 'Planning for Major Water and Wastewater Incidents in England and Wales', October 2006.

6. Learning lessons

All the affected companies are carrying out their own detailed reviews of the flooding. These are being carried out both internally and with the local emergency planning authorities. Companies will be sharing the outcomes of their reviews with us and also reporting to us in their annual returns next June.

Part of this work is to examine the return period of the rainfall and the flooding that occurred in particular locations, to understand why assets flooded or failed to cope with the flows that occurred.

For the water service, Severn Trent is carrying out an in-depth review of the Mythe incident. It has identified a number of issues, including the adequacy of flood defences, resilience of the water supply system in the Gloucestershire area, emergency communications with consumers and the expectations and needs of these consumers in such an emergency. Other companies will need to examine the lessons here. The findings and recommendations of DWI's investigation will be an important element of this learning by Severn Trent and the whole of the water industry. DWI is working with the Health Protection Agency nationally with a view to updating and issuing guidance for use by water companies and by health protection teams in connection with consumer warning notices and other matters relating to the provision of alternative supplies of drinking water.

All the companies will need to look into many sewerage issues. They have to be able to explain, as part of their annual report to us, why, for example, incidents of flooding from sewers might or might not be due to exceptional weather. These investigations will take time and may well highlight particular problems in the sewerage system. We will continue to liaise with companies on these as necessary. As set out above we will review the changes made by Yorkshire Water to Hull's drainage arrangements in recent years and their operation during the floods. Yorkshire has announced it is taking steps to improve storm pumping²⁸ and wants to work with the other drainage stakeholders to carry out a full review of the city's drainage.

Companies have also told us that they are looking again at the flood protection for critical assets. They will need to draw on information from the Environment Agency about flood risk.

²⁸ Announcement of £16 million investment.

7. Emerging issues

This chapter identifies some of the emerging issues from our understanding of the experience of water and sewerage companies in managing their assets and the impact on service to consumers. It is not our final view of what needs to be done as a result of the experience with the 2007 floods. We will continue to work with the industry and other stakeholders in the months ahead in identifying implications for regulatory policy and planning for the future.

Understanding flood risks and resilience

Water and sewerage companies are expected to manage a wide range of risks affecting their ability to provide service to consumers, including the exposure of their assets to flood risks. The evidence we have seen from companies following the June and July flooding events suggests that they need to strengthen their understanding of exposure to flood risks, particularly for key critical assets or sites.

- **Action:** As part of their long-term asset management planning, we will challenge companies to demonstrate understanding of flood risks to service.

Flood risks are not the only risk to continuity of service, and companies must make sure that they can manage or mitigate all risks. It is important that companies understand flood related risks within this wider context and make sure their services are resilient by identifying the best value set of measures. The experience in the summer of 2007 suggests that the focus should be on key critical assets.

- **Action:** We will work with the industry and other relevant stakeholders to develop a consistent and coherent framework for assessing flooding risk and identifying cost beneficial measures to improve resilience of critical assets. We will expect companies to be able to demonstrate that they have identified the right set of measures to improve resilience, along with the timeframe for taking action. We will develop guidance during 2008, to ensure that it informs business plans for the 2009 price review.

Understanding resilience issues for water and sewerage services

In seeking to make sure that the right set of measures is identified to improve the resilience of water and sewerage services, we are mindful of the specific nature of resilience issues for clean water supply and wastewater disposal services.

Typically, clean water supply systems offer greater scope for interconnection, where one source of supply may be substituted by another connected supply for a temporary period. This is illustrated by the continued performance of water supply services, outside of Gloucestershire, despite being put under considerable stress during exceptional weather conditions. This included shut downs at a number of WTWs, where alternative supplies could be mobilised. The major interruption to supply caused by the shut down of Mythe WTW highlights the need for companies to focus on the risks to critical assets where a large population is dependent upon one source.

Different issues arise from the experience in relation to sewerage assets. In general, much larger numbers of sewerage service assets were affected by the flooding. However, the temporary impairment of the vast majority of these assets does not appear to have exacerbated the extent of flooding, and the recovery of service at these assets was swift. This is true even for some very large sewage treatment sites. Companies have shown that in general they were able to manage major challenges in responding to flooding at large numbers of sites.

The 2007 experience suggests that the assets that are critical in terms of service to consumers and wider impacts are those which perform a vital role in urban drainage. Companies will need to make sure that they have a clear understanding of the flood risk exposure of sewerage assets, notably major pumped drainage assets, where these are critical to maintaining effectual drainage and continuity of sewerage services.

- **Action:** We will review the issues raised by the Hull IRB report, including the changes made to Hull's drainage arrangements in recent years and their operation during the floods. When we have concluded this review, we will take any actions required to ensure that consumers are protected. In particular we will ensure that Yorkshire Water takes actions required to provide the right level of protection for consumers.

Cost benefit analysis

In analysing flood risk we will expect companies to adopt as far as practicable established principles of economic (cost beneficial) risk-based analysis. Risk to

service from flooding is a complex area that requires a clear understanding of probability and consequences, integrated with wider risk assessment so that best value interventions can be identified. This applies to the risk of sewer flooding of properties or external areas, as well as service risks relating to the flooding of water or sewerage assets.

- **Action:** In assessing PR09 investment choices we will challenge companies to demonstrate a clear understanding of consumers' priorities in terms of investments to reduce risk to service, as well as a clear cost benefit case.

Taking account of climate change

Climate change is likely to increase the likelihood of intense rainfall events in the future, and our understanding of return periods for flooding events will develop over time. Over the coming years we will expect the industry to develop a consistent and clear view of both the historic hydrological record and the way in which climate change should be included in the assessment of risk and design standards.

- **Action:** We will use the climate change scenarios to be published by the UK Climate Impacts Programme in 2008 to identify key priorities for adaptation by the water industry in England and Wales and guide judgements made within the PR09 process.

Review of emergency plans

The experience at Mythe provides a number of learning points, not least of which are the length of time a flooding incident at a WTW takes to resolve, the extent of the supply failure and the availability of replacement supplies of potable water. Severn Trent and the other water companies should address these issues and also review their own plans. There is also a case to review the emergency planning guidance²⁵ that should underlie company planning for severe supply interruptions.

- **Recommendation:** We recommend that the provisions made for the emergency supply of water under the SEMD and the guidance²⁸ for the implementation of the emergency supply should be reviewed by Defra in the light of experience at Mythe.
- **Recommendation:** We recommend that Water UK should review the industry's "mutual aid" arrangements with input from all stakeholders. Water UK should also bring water companies together to examine lessons on emergency planning.

Integrated urban drainage

There are a large number of initiatives already in place addressing many of the issues relating to the performance of the public drainage system. The 'Making Space For Water'²⁹ programme is looking at how surface water flows can be best managed. We support an approach that would keep rainwater out of sewers since building bigger sewers would be both prohibitively expensive and would not address flooding from sea, rivers or surface water flow into storm drains. This issue is not confined to one area but affects the whole of the network. There is a need to look again at the arrangements for draining rainwater from our urban areas and the responsibilities for that drainage as they affect the public sewerage system.

We will work with Defra, the Environment Agency and the water industry in developing policies to improve the arrangements for urban drainage. In particular, we will continue our work to support Defra's integrated urban drainage pilot projects across the country.

- **Recommendation:** We recommend that Defra amend the legal right to connect to public sewers with a view to promoting integrated urban drainage solutions.

²⁹ Defra, 'Making space for water'.



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