

Flood Investigation Report

Goole Floods, 3 August 2011

CES\D200\LDES\1100
January 2012



EAST RIDING
OF YORKSHIRE COUNCIL

Revision Schedule

East Riding of Yorkshire Council Flood Investigation Report

10 January 2012

CES\D200\GO\1100\001

Rev	Date	Details	Author	Checked and Approved By
/	01/12/11	Draft	NA	
A	12/12/11	To CMT	NA	
B	20/12/11	Minor Amendments	NA	
C	05/1/12	Minor Amendments	NA	
D	06/1/12	Minor Amendment	NA	AM
E	10/1/12	Minor Amendment	NA	MF

Copyright Notice

Maps in this report are reproduced from Ordnance Survey material with the permission of Ordnance Survey on behalf of Her Majesty's Stationery Office Crown copyright 2008. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings. East Riding of Yorkshire Council 100023383.

Records of the public sewer system included are a facsimile of the statutory record provided by Yorkshire Water Services. For the purposes of this report minor sewers and other non relevant data have been omitted from plans for clarity. The statutory public sewer record is held by Yorkshire Water Services Ltd.

Acknowledgment

The council would like to thank members of the Goole community, Yorkshire Water Services Ltd, The Environment Agency and the Goole and Airmyn Internal Drainage Board for their assistance in this investigation.

Table of Contents

1. Executive Summary	1
2. Introduction	3
2.1. <i>The Pitt Review and Flood & Water Management Act</i>	3
2.2. <i>LLFA Investigation</i>	3
2.3. <i>Section 19</i>	3
2.4. <i>Section 14</i>	4
3. Site Location	5
4. Rainfall Analysis	6
4.1. <i>Eyewitness accounts</i>	6
4.2. <i>Environment Agency Data</i>	6
4.3. <i>Met Office Data</i>	6
4.4. <i>Anecdotal Rainfall Data</i>	7
4.5. <i>Rainfall Interpretation</i>	7
5. Goole Drainage and Flood Defences	9
5.1. <i>Topography</i>	9
5.2. <i>Tidal Data</i>	9
5.3. <i>Environment Agency</i>	9
6. Modern Urban Goole Drainage System Overview	10
6.1. <i>Summary of Goole Drainage System</i>	10
6.2. <i>The Public Sewerage System</i>	11
6.2.1. <i>Pumping Stations & Waste Water Treatment Plants</i>	11
6.2.2. <i>Carr Lane Pump Station</i>	11
6.2.3. <i>Carr Lane Foul Pumps</i>	13
6.2.4. <i>Carr Lane Storm Pumps</i>	13
6.2.5. <i>Lock Hill Pump Station</i>	14
6.2.6. <i>Lock Hill Foul Pumps</i>	14
6.2.7. <i>Lock Hill Storm Pumps</i>	15
6.2.8. <i>Sandhall Detention Tank</i>	15
6.2.9. <i>Other Pumping Stations</i>	15
6.2.10. <i>Goole Waste Water Treatment Works</i>	16
6.3. <i>Goole & Airmyn Internal Drainage Board</i>	17
6.3.1. <i>Southfield Pump Station</i>	18
6.3.2. <i>Hook Clough Pump Station</i>	18
6.3.3. <i>Downes Ground Pump Station</i>	18
6.3.4. <i>New Potter Grange</i>	19
6.3.5. <i>Orchard Cottage</i>	19

6.4. Surface Water Gullies	19
6.5. Riparian Watercourses	20
7. August 2011 Flooding	21
7.1. Emergency Response on Site	21
7.2. Investigation into extent and cause of flooding	21
8. Conclusions	26
9. Recommendations	27
9.1. Communication and Incident Response	27
9.2. Remedial and Improvement Works	27
9.3. Other Recommendations	28
10. Roles and Responsibilities	29
10.1. Lead Local Flood Authority	29
10.2. Environment Agency	29
10.3. Water and Sewerage Company	29
10.4. Highways Authority	29
10.5. Riparian Landowners	29
10.6. Residents	29
11. Abbreviations and Acronyms	31
12. Contact Details	32
13. Website Addresses	33
Appendix A	35
Strategic Public Sewer and Pumping Station Locations	37
Appendix B	39
Timeline – August 3 2011	40
Appendix C	43
Gulley Defects 2011	44
Appendix D	51
Postal survey questionnaire	52
Appendix E	55
Flood Density Maps	57
 Figure 1 - Location Plan	 5
Figure 2 - Goole & Airmyn IDB Boundary and Pumping Stations	18
Figure 3 - Extent of Postal Survey	22
 Table 1 - Reported Rainfall Intensity	 7
Table 2 - Rainfall Return Period Estimates	8
Table 3 – Gully Defects – 2011	20
Table 4 – Flood Survey Responses	22
Table 5 – Origin of Flood Water	23

1. Executive Summary

Following the widespread flooding of 2007 the government commissioned Sir Michael Pitt to prepare a report into the flooding, a consequence of this was the bringing into law of the Flood & Water Management Act (2010) (FWMA). This Act contains many new responsibilities and associated legal powers to assist in their implementation.

The upper tier authority in each county has been tasked with leading the coordination of flood risk management within their areas. In order to assist in this a new role of Lead Local Flood Authority (LLFA) has been defined within the Act. Section 19 of the FWMA gives the LLFA the power to carry out an investigation where it considers it necessary or appropriate. It also provides powers to request information from bodies and people in the course of carrying out any investigations.

On August 3rd 2011 Goole was subjected to a relatively short, but very intense summer storm. The short duration of this storm, coupled with it being located over the urban area of Goole meant that the rural runoff into the surrounding ditches and dykes would not have had a significant impact on the flooding.

Due to the lack of accurate rainfall recording apparatus within the affected area it has not been possible to accurately determine the volume of rainfall, or design intensity. It is estimated that at least 30mm of rain fell in a 45 minute period. This equates to a storm with a return period of 1 in 45 years or a 2.2% chance of occurring in any one year period. Anecdotal evidence suggests that the actual rainfall and corresponding return period were possibly in the region of 64mm and 1 in 950 years or 0.11% respectively.

Historically Goole drained via a combined sewer system that stored the foul and surface water within oversized sewers when the river water levels were above the outfall level prior to discharging at low tide. These sewers are still in use as part of the urban drainage system.

The current drainage system in Goole relies on a series of pump stations to ensure that the dry weather flows (flow in sewers caused by events other than rainfall) are collected at the Carr Lane terminal pump station and then pumped to the local waste water treatment plant for treatment prior to discharge into the River Ouse. The increased inflow due to rainfall/storm water activates a series of storm pumps that discharges the increased flow directly to the River Ouse at Lock Hill and Carr Lane.

It has not been possible to source accurate, calibrated rainfall data for the flood event. However, it has been determined that the storm intensity on August 3rd was significantly in excess of the design standards for sewers, gullies, pump stations and other associated drainage infrastructure. This in itself means it is likely that there would have been substantial and widespread surface water flooding irrespective of the condition and operation of the urban drainage system. Any effect of the flooding related to the reduced pump capacity at Carr

Lane pumping station would need to be tested by means of a verified hydraulic model as this is not quantifiable from the information available.

There is no single solution that would prevent a repeat of the 3 August 2011 flooding as the cause was not attributable to a single event. While the storm was of short duration it was exceptionally intense and was greatly in excess of the standards to which sewers, gullies, highway drains and drains are either historically or currently designed.

In summary, the storm that occurred on August 3rd was without doubt of exceptional intensity and exceeded current or historic design standards for drainage infrastructure. It is recommended that in order to identify the causes of widespread flooding and address local flooding hot spots that have been highlighted in survey responses, that an integrated drainage model of the Goole catchment is created. This will be a joint project between several flood risk authorities.

Where appropriate, discussions with people that have local understanding of small scale flooding issues, targeted remedial measures should be considered for inclusion within the programme of works of the relevant authority.

There would have been flooding irrespective of the condition or state of operation of the urban drainage network. However, there are works and procedures that should be considered. These have been listed in this report's recommendations.

Nigel Leighton
Director of Environment and Neighbourhood Services
Tel: 01482 395000
Email: nigel.leighton@eastriding.gov.uk

Contact officer:

Andrew McLachlan
Assistant Principal Engineer
Tel: 01482 395656
Email: andrew.mclachlan@eastriding.gov.uk

2. Introduction

This report has been prepared, by East Riding of Yorkshire Council in its role as the Lead Local Flood Authority in response to the serious flooding that occurred in Goole on August 3rd 2011.

2.1. *The Pitt Review and Flood & Water Management Act*

Following the widespread flooding of June & July 2007 the government appointed Sir Michael Pitt to conduct an investigation into the response and recovery from this event. The final report was published in June 2008. As a result of this review the Flood and Water Management Act (2010) passed into law. This Act redefines, and clarifies the roles of the numerous bodies that have a part to play in the identification and managing of flood risk. It also designates the unitary or upper tier authority for an area as the Lead Local Flood Authority (LLFA). Within the East Riding of Yorkshire this is East Riding of Yorkshire Council.

One of the duties placed on the LLFA is to, where it considers appropriate, investigate and report on incidences of flooding.

2.2. *LLFA Investigation*

East Riding of Yorkshire Council is the Lead Local Flood Authority in the district of East Riding of Yorkshire; it has a responsibility to record and report flood incidents within its administrative area under Section 19 of the FWMA. In order to assist in the preparation of the report Section 14 of the same Act confers the power to request information from parties that it considers relevant to the investigation. The relevant sections of the Act are outlined below.

2.3. *Section 19*

- 1) On becoming aware of a flood in its area, a lead local flood authority must, to the extent that it considers it necessary or appropriate, investigate:
 - (a) Which risk management authorities have relevant flood risk management functions, and
 - (b) Whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in response to the flood.
- 2) Where an authority carries out an investigation under subsection (1) it must:
 - (a) Publish the results of its investigation, and
 - (b) Notify any relevant risk management authorities.

It was deemed necessary to conduct an investigation into the flood incident on 3 August 2011 as there was significant internal and external flooding at multiple locations in Goole.

2.4. Section 14

Section 14 of the FWMA grants the lead local flood authority power to request information in connection with its functions as a flood and coastal risk management function. These powers have been exercised.

3. Site Location

Goole is a port town, located in the south western part of the East Riding of Yorkshire, towards the edge of the Humberhead Levels flood plain which is at the confluence of the Rivers Ouse and Don (Dutch River).

The wider Goole area, including Hook, Airmyn, Rawcliffe and Rawcliffe Bridge, is bounded by the River Ouse to the east, the River Aire to the north, the rivers Went and Don to the south and to the west by higher ground near Snaith, Cowick and Pollington.

This area contains some 9096 residential properties, 770 non-residential properties including a number of industrial sites, and almost 4,000 hectares of agricultural land. The town of Goole has a population of approximately 18,000.

Ground levels typically range between 2m and 4m AOD (Above Ordnance Datum).

In earlier times the area was described as “a waste of fen, marsh and bog”. The Dutch civil engineer Cornelius Vermuyden diverted the River Don northwards to the River Ouse in 1626-1629 to drain the marshland of Hatfield Chase at the behest of King Charles I. This also made the Lower Don navigable for small barges so that coal from the South Yorkshire coalfields could be transported to Goole at the new mouth of the River Don, also known as the Dutch River for transfer to seagoing vessels.



Figure I- Location Plan

4. Rainfall Analysis

4.1. Eyewitness accounts

Eyewitness accounts from residents of Goole indicate that rainfall started at approximately 1630hrs (all times are British Summer Time) and was at its most intense between 1630hrs and 1730hrs at which time it reduced in intensity over the next two hours until it had generally stopped at approximately 1930hrs. Some local, isolated low intensity/duration storms continued intermittently through until 4th August.

Residents at several separate locations across Goole reported that the flood waters started to drop rapidly between 2000hrs and 2030hrs.

It should be noted that some residents reported water suddenly emptying down gullies and water levels dropping rapidly, rather like somebody switched a pump on. This phenomenon is often seen when widespread flooding occurs, it is related to the rate at which water in a flood area drains away, relative to its volume. Whilst water is above the surface, the volume is considerable and therefore it takes longer to drain through a given outfall, once the water level begins to drop below kerbs and verges the total volume of the water rapidly decreases causing the water level to drop more rapidly giving the appearance that a pump has been turned on.

4.2. Environment Agency Data

The Environment Agency operates a network of rain gauges across the UK. Some of these gauges are read on a daily basis by volunteers, these sites will record a total daily rainfall but a further breakdown giving detailed rainfall at short intervals is not obtainable with these gauges.

There are also Tipping Bucket Rain Gauges (TBR) that record the rainfall in 15 minute increments; this allows the intensity of the storm as well as the depth of water falling to be recorded. The closest TBR to Goole is sited at Broomfleet Weighton Lock, approximately 13km east of Goole.

Data from the station at Broomfleet Weighton shows that 12.8mm of rain fell between 1800hrs and 1930hrs on August 3rd 2011, of which 11.4mm occurred between 1800hrs and 1830hrs. This data shows that while the rainfall was concentrated, the calculated return period of the storm was 1 in 3 (33.3% probability in any given year) years between 1700hrs and 1730hrs.

Rainfall radar data supplied by the Met Office show that the storms reduced in intensity as they moved eastwards from Goole to Broomfleet.

4.3. Met Office Data

The Met Office produces radar rainfall data showing cloud activity. While this does not give an accurate level of rainfall on the ground, especially in higher intensity storms, it can be used to observe the general patterns and changes

in intensity of a storm. These images show that a high intensity storm cell developed over Goole between 1645hrs and 1800hrs that reduced in intensity as it moved east towards Broomfleet.

Inspection of the data in the vicinity of Broomfleet show estimated rainfall intensities of 20 to 30mm/Hr, or 5-7.5mm per 15 minutes, which correlates with the data recorded at the Broomfleet TBR.

On this basis, the radar images for Goole show an estimated rainfall intensity of 32 to greater than 64mm/Hr between 1645hrs and 1730hrs. This equates to 8mm to greater than 16mm per 15 minutes. Whilst radar readings tend to overestimate the actual rainfall intensity especially when recording high intensity storms it is our opinion that the rainfall in the Goole area exceeded 10mm per 15 minutes for at least 45 minutes, and could have exceeded 16mm per 15 minutes over the same time period.

4.4. Anecdotal Rainfall Data

Data has been provided by a variety of private individuals and companies. This is summarised below;

Town	Distance (Km)	Reported Rainfall Intensity (mm/Hr)
Goole	N/A	Between 32 and 64
York	32	18.75
Selby	14	0.0
West Cowick	10	24
Dempster	6	32
Howden	5	26
Eastrington	8	36
Newport	13	19.6

Table 1 - Reported Rainfall Intensity

While this is not subdivided into fifteen minute intervals or measured by calibrated instruments, and therefore should not be relied on to provide a detailed analysis of the rainfall that occurred on 3rd August 2011, it does indicate that the area of peak rainfall was relatively concentrated and centred in the vicinity of Goole. This corroborates the Met Office radar data referred to in section 4.3.

4.5. Rainfall Interpretation

Given the lack of accurate, verifiable data within Goole, it is likely that the range of rainfall intensity falls between 32mm/hour at the lowest estimated intensity, to in excess of 64mm an hour from the Met Office Radar, that as previously noted is not a direct measure of rainfall although eye witness accounts, video and anecdotal evidence would suggest that the true figure is at the upper end of this range.

The probability of these storms occurring in any given year are summarised in Table 2.

Rainfall Intensity	Return Period (Years)	Annual Probability
32mm/Hr	45	2.2%
48mm/Hr	270	0.37%
64mm/Hr	950	0.11%

Table 2 - Rainfall Return Period Estimates

From the limited, verifiable, data available it is our estimate that the rainfall intensity at Goole exceeded 10mm per 15 minute for a period of 45 minutes between 1645hrs and 1730hrs on 3rd August 2011.

Eye witness reports and anecdotal evidence would suggest that the actual level of rainfall was significantly greater than this. In summary, the storm had a return period of at least 1 in 45 and it is our considered opinion that it was significantly greater than that figure.

5. Goole Drainage and Flood Defences

5.1. Topography

Goole and the surrounding area generally has a ground level of 2m to 4m AOD. This is significantly lower than the Mean High Water Springs (MHWS) level of 4.3m AOD, and the estimated 100-year water level of 5.8m AOD for the River Ouse. The flood defences sited on the adjacent main rivers are therefore critical in preventing regular fluvial flooding from the River Ouse & Don.

5.2. Tidal Data

The River Ouse is tidal from Naburn Lock, sited to the south of York, to its point of confluence with the Trent where it becomes the River Humber. On the 3rd August, the low tides at Goole occurred at 0622hrs and 1906hrs with levels of 0.5m AOD and 0.0m AOD respectively. The high tides occurred at 1011hrs and 2253hrs with water levels of 6.2m AOD and 5.5m AOD.

The storms were at their most intense between 1645hrs and 1730hrs. At this time the tide would have been falling towards its low level of 0.5m AOD which, on 3 August 2011, occurred at 1906. If the storm had occurred at high tide the rate of discharge would have been reduced as the pumps would have been operating against the water pressure of the River Ouse.

5.3. Environment Agency

All of Goole to the north of Dutch River falls within Flood Zone 3 as defined by the Environment Agency. This means that, without defences, the area is subject to river flooding with an annual probability of 1 in 100 (1%) from rivers and 1 in 200 (0.5%) from the sea.

The Environment Agency operates and maintains artificial defences such as earth banks and other hard structures sited adjacent to the Ouse, Aire and Don to significantly reduce flood risk from these rivers. These structures are designed to protect Goole from tidal flooding to a 1 in 200 year (0.5% chance per year) flood event.

The condition of these defences is regularly monitored and assessed by the Environment Agency.

The nature of the flooding on August 3rd was pluvial (overland) rather than fluvial (from watercourses) therefore the Environment Agency defences had no impact on the extent or cause of the flooding and will not be considered further in this report.

6. Modern Urban Goole Drainage System Overview

Goole is drained via a combination of highway gullies, private building drainage, public sewers, IDB & riparian watercourses, and pumping stations that are owned and operated by Yorkshire Water or the Goole & Airmyn IDB.

6.1. Summary of Goole Drainage System

The original, piped drainage system, within Goole consisted of a gravity combined sewer system that carried both foul and surface water. This system discharged into the River Ouse when the tide level in the river was sufficiently low.

When the level of the Ouse rose due to tidal action foul sewage and rainfall would be retained within the sewers under the town until the water level dropped and the sewers would empty under gravity. This necessitated the constructing of larger pipes to provide the required storage when there was no outfall than would have been required if there was an unrestricted outfall permanently available. These oversized sewers form part of the modern day urban drainage system.

More recently, parts of the sewerage system have been designed to drain rainfall (surface water) and sewage (foul water) into separate systems. These are generally the more modern estates and in most cases eventually discharge into the historic drainage system.

In order to allow foul and surface water to discharge into the Ouse irrespective of tide level a series of pumping stations were constructed in the mid to late 20th century.

When originally constructed the Carr Lane pumping station discharged foul and storm flows directly into the adjacent river. Following the introduction of the European Directive relating to the treatment of waste water a Waste Water Treatment Works (WWTW) was constructed to treat the sewerage prior to discharge into the rivers. Under normal conditions dry weather flows (DWF), which is defined as the background flow in sewers caused by events other than rainfall, are pumped from Carr Lane to the Goole WWTW for treatment before being pumped back to the original outfall into the River Ouse. During times of storm additional pumps operate to discharge the storm water directly into the river. A plan showing the major sewers and pumping stations within Goole is shown in Appendix A.

Newer developments are constructed with separate sewerage systems for foul and surface water although these will generally discharge into the historic combined drainage system. More recently it has been a requirement to restrict the rate of surface water Current design standards (Sewers For Adoption 6th Edition) stipulate that sewers should have sufficient capacity to carry such volume of water/sewerage that there is no surface flooding on a storm with a 3.33% chance of occurring in any given year (1:30 Return period).

6.2. The Public Sewerage System

As the statutory sewerage undertaker for Goole, Yorkshire Water is responsible for the operation and maintenance of the public sewerage system. This includes public sewers, pumping stations, rising mains, attenuation systems, sewage treatment plants and other ancillary apparatus such as treatment works.

6.2.1. Pumping Stations & Waste Water Treatment Plants

In total there are twelve pumping stations and a single waste water treatment plant. The operations of these pumping stations are outlined below.

Most pump stations consist of multiple pumps that when operated in parallel will provide the design capacity. These will start in sequence as the water level in the station rises. The first pump to start is known as the Duty Pump. Any subsequent pumps are commonly labelled Assist pumps.

It is common practice to have an additional pump on standby that can be called into operation in the event of a failure in one of the duty/assist pumps. The configuration of these pump stations is commonly referred to as Duty/Standby for twin pump stations, or Duty/Assist/Standby for pump chambers with three pumps. In stations with four or more pumps the additional pumps are normally classified as “Assist” pumps.

In order to ensure that all the pumps in a station operate regularly the pump acting as the duty pump will change on a rota basis each time the pump is required to start. Once a pump is operating in a duty role it will continue to operate until the water level in the station has dropped sufficiently to turn off all the operating pumps. When a pump runs for an extended time a warning alarm is automatically sent to Yorkshire Water’s Regional Control Centre.

Yorkshire Water have provided detailed information extracted from the telemetry systems at all the stations where it is fitted. Data from the relevant telemetry channels for Carr Lane and Lock Hill is summarised in Appendix B.

6.2.2. Carr Lane Pump Station

Carr Lane is a terminal pumping station, it receives flows directly, or indirectly from all the other Yorkshire Water pump stations in Goole. The station underwent an electrical and mechanical maintenance program in June 2011.

Prior to entering the pump chambers, all incoming flow is passed through screens in order to remove solids. There is a bypass system installed so that the flow to the full flow to treatment (FFT) pump

chambers will not be restricted in the event of a screen failure. Due to this bypass system the sewers will not surcharge due to the screens becoming blocked.

There are four FFT pumps (FFT 1, 2, 3 & 4) that operate in duty/assist/assist/standby configuration with a capacity of up to 360l/s via a 600 diameter rising main to the Waste Water Treatment Works located on the A614, Boothferry Road, adjacent to the M62 motorway. In normal operational circumstances the peak rate of discharge is limited to 327l/s.

Two of the FFT pumps at this station are driven by variable speed motors; this allows the rate of pumping to be adjusted to suit the incoming foul (Dry Weather) flows in order to provide a steady supply of foul sewerage to the WWTW. The remaining two FFT pumps are driven by fixed speed motors.

The Storm Well contains four fixed speed storm water pumps (SP 1, 2, 3 & 4), that operate in duty/assist/assist/standby configuration. The total design capacity of the storm pump system is 3.27m³/s.

Yorkshire Water have stated that there is no data available relating to the efficiency or pumping rate of the individual foul or storm pumps, although the foul rate of pumping can be derived from the volume of sewerage received at Goole WWTW that is recorded. This data has been provided. In keeping with common practice, the pumping rate of the storm pumps is not recorded.

During storm events the flow from the town drainage system increases. As the rate of inflow increases the FFT pumps will start in sequence, and therefore through flow volume of pumping until the maximum rate is reached. At this point, if the rate of inflow to the pump station is greater than the FFT pump capacity the water level in the pump wells will continue to increase until it reaches a sufficient level to overspill into the storm chambers at which point the storm pumps will operate as determined by the water level within the storm well and discharge storm water directly into the River Ouse.

The foul and storm pumps will not start immediately when the rainfall begins as there is a lag time, known as the time of concentration, between the rainfall landing on the ground and reaching the pump chambers. This period can be significant in large urban systems, and even greater in rural areas,

Yorkshire Water have stated that the only electrical isolation in effect at Carr Lane was to a single storm pump that was recorded as drawing excessive current after being returned from refurbishment. A second storm pump had been removed from site for repair.

A single FFT pump was unavailable during the storm due to an airlock, this would not stop the pump motor operating, but there would be

no flow through the pump. This pump would have been a standby pump that would have operated during a failure of any of the remaining three duty/assist pumps.

The FFT and Storm pump that were unavailable on the 3rd of August had repair works scheduled, or were undergoing maintenance prior to the storm.

Telemetry data showing the operation of Carr Lane pump station on 3 August 2011 is summarised in Appendix B.

6.2.3. Carr Lane Foul Pumps

On 3 August prior to the storm, pump FFT1 was operating from 0000hrs to 0429hrs then from 0434hrs to 0606hrs. At this point FFT1 is recorded as being stopped, and FFT3 started at 0611hrs and ran through until 1709hrs. FFT Pumps 1 and 4 started operating at 1648hrs and 1651hrs respectively. FFT2 has been confirmed by Yorkshire Water as being unavailable for use.

Eye witness accounts report the rainfall starting at approximately 1630hrs. This pattern of operation would be consistent with a station designed to operate in duty/assist/assist/standby configuration as additional pumps started as the water level in the foul chamber rose.

FFT1 ceased operating at 1701hrs, with FFT3 and FFT4 stopping at 1708hrs. Yorkshire Water have stated that this was due to the ultrasonic level sensors being unable to determine the water level in the wet well and the pumps entering a failsafe mode to prevent damage to the pumps and the risk of an electrical fire at the pump station in the event the foul chamber was empty and the pumps were running dry.

FFT1, 3 and 4 were restarted at 1813hrs, 1753hrs and 1811hrs respectively, from this point the three pumps ran continuously until approximately 2245hrs.

During and immediately after the storm the FFT pumps 1, 3 and 4 were unavailable for 72, 45 and 63 minutes respectively, which at an average peak rate of 120l/s per pump equates to a lost pumping volume of approximately 1,296m³ the significance of this would need confirming via the use of a verified hydraulic model.

6.2.4. Carr Lane Storm Pumps

As outlined in section 6.2.2 the storm pumps only operate when the inflow into Carr Lane exceeds the outflow rate of the foul pumps and the excess sewerage overflows into the storm chamber.

Yorkshire Water has confirmed that a single storm pump (SP2) was unavailable on August 3rd due to it having been removed for

maintenance. A second storm pump (SP3) was unavailable due to having been electrically isolated until 1923hrs on the 3rd August.

SPI and SP4 started to operate at 1654hrs and 1653hrs respectively. This is consistent with a rapid inflow of sewerage after the start of the intense rainfall that has been widely reported as starting at approximately 1630hrs. These two pumps ran uninterrupted until 2245hrs at which time the water level in the storm chamber will have dropped down to the pump stop levels. Although eye witness statements generally place the start of the storm event at 1630hrs, there will be a time lag, known as the time of concentration, between the start of the storm and the operation of the storm pumps. This is due to the time taken for rainfall to enter the sewer system and travel through the network and into the foul pump chamber. It then has to reach a level to weir into the storm chambers and reach the preset pump start level for each of the pumps.

The second assist pump, SP3, was not available until 1923hrs, approximately 150 minutes after SPI and SP4 started operating.

6.2.5. Lock Hill Pump Station

Lock Hill is sited on East Parade, adjacent to the River Ouse. It receives sewerage from the southern areas of Goole including Vermuyden Terrace, Old Goole 1 & 2 and Swinefleet Road SPS. It comprises two dry weather flow (DWF) pumps that operate in a duty/standby configuration with a design peak capacity of 89l/s. These discharge via a 450mm diameter rising main into a gravity combined sewer system adjacent to the railway line in the vicinity of Coniston Road, which in turn discharges into the Carr Lane pumping station.

All incoming flows enter through a combined sewer overflow (CSO). In storm conditions the excess inflow will surcharge and weir into the storm pump chambers. There are two pump chambers each containing two storm pumps. The storm pumps discharge directly into the River Ouse. The storm pumps operate in Duty/Assist/Assist/Assist configuration. The design capacity of the storm pumps has not been provided by Yorkshire Water.

Telemetry data showing the operation of Carr Lane pump station on 3 August 2011 is summarised in Appendix B.

6.2.6. Lock Hill Foul Pumps

Yorkshire Water have stated that the start/stop times for DWF pumps (DWF 1 and 2) are not recorded under the current telemetry configuration, however there are reports generated in event of a pump failure or when any pump has been running for an extended period of time. It has been stated that both foul pumps and all the storm pumps were operational during, and after the storm event.

6.2.7. Lock Hill Storm Pumps

The telemetry data for SPI-4 shows the pumps starting in sequence between 1648hrs and 1656hrs. This is consistent with a rapid rise in water level in the storm chambers. The pumps operated without interruption until 1900hrs at which point they switched off at intervals of approximately 50 minutes, which again is consistent with the water level in the storm chambers dropping below the preset pump stop levels as the rate of water flowing into the chamber reduced to less than that of the outgoing pump capacity.

Yorkshire Water has stated that while maintenance of the pumps is in accordance with industry guidelines, in common with Carr Lane and the wider industry, they do not have records of the current operational capacity of the storm pump system at Lock Hill.

Telemetry data showing the operation of Lock Lane pump station on 3 August 2011 is summarised in Appendix B.

6.2.8. Sandhall Detention Tank

Recently a surface water storage tank has been built in the vicinity of Millennium Way & Maple Drive. This is designed to store excess surface water prior to pumping it back into the main sewer system at a controlled rate. This will reduce the instances of flooding as an additional volume of storage is now available underground.

The properties on adjacent to Millennium Way and Maple drive are significantly lower than the highway, and site investigations show that the threshold levels of some properties are only 300mm above the sewer soffit level.

In this situation the sewers will only require a slight surcharging before back-flowing into the property drainage network and causing significant flooding. This is exacerbated by the properties being built in a low spot that prevents flood water flowing along a preferable channel such as the public highway.

We are satisfied that the Sandhall Detention Tank is built to the appropriate design standards and has reduced the incidences of flooding in accordance to that which it was designed to do.

6.2.9. Other Pumping Stations

In addition to the pumping stations described above, Yorkshire Water operates pump stations at Vermuyden Terrace, Rawcliffe Road, Old Goole, New Potter Grange Road, Rawcliffe Industrial Estate and West Park Side.

With the exception of Vermuyden Terrace, where it has been confirmed that the standby pump was unavailable due to scheduled maintenance, there were no operational issues reported at the above pump stations.

There is no telemetry data available for the Sandhall, Rawcliffe Industrial Estate or West Park Side pump stations.

Rawcliffe Road and New Potter Grange telemetry shows no errors, interruptions to service or pump failures on, or around the time of the flooding. The Vermuyden Terrace and New Potter Grange Road telemetry systems triggered an alarm when the pumps were running recorded as operating continuously for more than twelve hours.

6.2.10. Goole Waste Water Treatment Works

The waste water treatment plant that serves Goole is sited at the north west of the town, between the M62 and A614, Boothferry Road.

It receives pumped sewerage from Carr Lane, the treated sewerage is pumped into the River Ouse. The incoming sewerage is screened at the inlet to the treatment plant in order to remove any large solids or debris that may have been discharged in to the sewer system and passed through the screens or bypass system at Carr Lane.

It is theoretically possible that in the event of a sudden increase in flow that debris that had settled in the sewer system can be flushed through into the FFT chamber at Carr Lane, this may cause blinding of the inlet screens at the waste water treatment works. If the WWTW inlet screens do blind, a bypass facility is present that will ensure that the flows to the treatment works are not restricted.

The only alarms that could inhibit the pumps at Carr Lane are the “high level in distribution chamber” and “final effluent pump station high level”, neither of these were triggered on August 3rd. The only alarm activated was the CASS distribution chamber failed alarm. This was due to the FFT pumps at Carr Lane being set to override the automatic start/stop levels as determined by the ultrasonic level detectors and pumping in excess of the consented flows into the WWTW. These are water quality alarms and would have had no effect on flooding.

Yorkshire Water have stated that at no point immediately prior to or after the event were flows to the treatment works restricted to protect the treatment assets.

6.3. Goole & Airmyn Internal Drainage Board

The Goole & Airmyn Internal Drainage Board (IDB) was formed in 1962 and covers an area of approximately 1842Ha of which 800Ha is classed as agricultural. Within its boundary it is responsible for the maintenance of 24Km of watercourses and the operation of five surface water pumping stations. The extents of the IDB and the location of their pump stations are shown in Figure 2.

The pump stations operated by Goole & Airmyn IDB undergo periodic maintenance procedures, and they are all visited daily by the Board's pump attendant.

The maintained watercourses are normally flailed in September and de-silting works are carried out where required at the same time. The annual flailing works were carried out in September 2010 and the 2011 works have been completed subsequent to the flooding. The scheduled desilting works are due to finish by mid-December. Areas where the banks have slipped into the Board's watercourses are maintained and remedial measures carried out when the Board becomes aware that such measures are required. There were no re-grading or remedial works required in the year prior to the August flood event.

All of the IDB pumping stations operate in a duty/assist or duty/assist/assist mode, with the duty pump rotating between pumps in order to equalise wear. There are water level sensors within the pump stations that will switch the pump(s) on at predetermined water levels. If the rate of inflow is greater than the capacity of the duty pump the water level within the pump station will continue to rise. Once a predetermined level is reached additional pumps will operate until the maximum capacity of the station is reached.

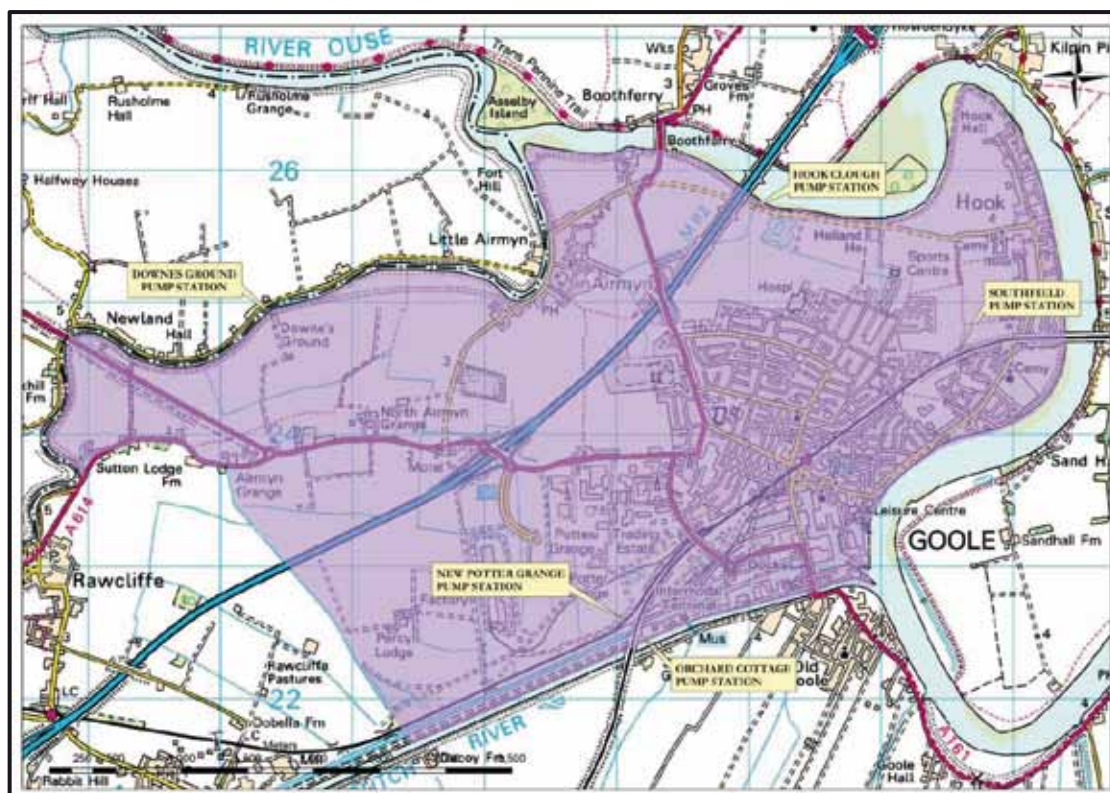


Figure 2 - Goole & Airmyn IDB Boundary and Pumping Stations

A brief description of the pumping stations and their operational status at the time of the flooding are listed below.

6.3.1. Southfield Pump Station

Southfield Pump station is located in the east of Goole, adjacent to the Railway Line, it was constructed in 1997 and comprises 2 No submersible pumps, each rated at $0.026\text{m}^3/\text{s}$ that receive water from riparian watercourses and discharge it into a watercourse that eventually discharges into Hook Clough.

6.3.2. Hook Clough Pump Station

Hook Clough is sited to the north of Goole, in the vicinity of the M62 Bridge over the River Ouse. Discharge into the River Ouse is via a gravity system when the water level allows or a pumped outfall when the outfalls are drowned.

It was constructed between 1972 and 1974 and comprises 2 No. vertical lift pumps rated at $0.51\text{m}^3/\text{s}$

6.3.3. Downes Ground Pump Station

Downes Ground is located on the River Aire, between Little Airmyn and Newland, it was constructed in around 1955. At this time there were two vertical lift pumps that operated at $0.45\text{m}^3/\text{s}$ against a head of 3.7m. The station was extended in 1972 by the addition of a third pump capable of discharging $0.45\text{m}^3/\text{s}$ against a 5.1m head. When the

water level in the receiving watercourse allows the system drains by gravity, with the pumps only operating when the outfall is restricted.

6.3.4. New Potter Grange

New Potter Grange is located on the south west of Goole, adjacent to the Dutch River. It receives water from riparian watercourses and lifts it into a watercourse that feeds into the adjacent Orchard Cottage Pump Station. New Potter Grange was constructed between 1972 and 1974 and comprises 2No. Archimedes screws with a capacity to lift $0.425\text{m}^3/\text{s}$ through approximately 2.0m.

6.3.5. Orchard Cottage

This pumping station receives flows from IDB maintained watercourses, including an element that is pumped from the adjacent New Potter Grange. The original construction took place in about 1972 with an additional pump installed in 2005. There are two vertical lift pumps each capable of delivering $0.285\text{m}^3/\text{s}$ of water. The pump installed in 2005 has a capacity of $0.290\text{m}^3/\text{s}$ giving a total peak capacity for the pump station of $0.860\text{m}^3/\text{s}$.

The IDB reported that there were no operational problems at any of its maintained pump stations during, or after the storms.

6.4. Surface Water Gullies

The urban area of Goole contains approximately 4,700 gullies that are the responsibility of East Riding of Yorkshire Council in its role as the highway authority. These gullies discharge into a variety of receiving systems such as private sewers, water courses, designated highway drain, although the vast majority discharge into the public sewer system.

Gullies, like the remainder of the drainage systems are designed to drain rainfall effectively up to a given intensity. Given the extended period over which Goole has developed there will be no consistent design standard for the highway gullies. However they are not the only means by which water can enter the sewer system. Some properties will have roof drainage that connects directly to the sewers, and there are watercourses that receive flow from, and discharge flow to the sewers.

With the exception of gullies that discharge into highway drains the limit of responsibility of the highway authority is the downstream end of the pipe that connects the gully pot to the receiving watercourse or sewer. When the gully connects to a designated highway drain the limit of responsibility is the point of connection of the highway drain to its receiving watercourse. These are cleaned on an annual basis, with the most recent programme completed in March 2011.

Of the 4700 gullies, 184 were inaccessible due to parked vehicles or other obstructions, and another 25 had defects. These are summarised in Table 3.

	Number of Gullies	Percentage of Gullies
Gullies Cleaned	4491	95.55
Obscured by vehicles	184	3.91
Stuck lid	6	0.13
Broken lid	7	0.15
Blocked outfall	11	0.23
Dig out Required	1	0.02

Table 3 – Gully Defects – 2011

The gully fault log is attached as Appendix C.

In addition to the highway gullies there are numerous, unrecorded gullies that are the responsibility of private companies and landowners, the points of outfall from these are generally not known, or recorded. Maintenance of these systems is carried out on an ad hoc basis by the responsible party.

6.5. Riparian Watercourses

Watercourses that are not maintained by the Environment Agency or Internal Drainage Boards are categorised as riparian watercourses. The responsibility for maintenance of these falls to the landowner adjacent to the watercourse.

A major riparian watercourse serving Goole is Hook Drain, this watercourse discharges into the North Street trunk sewer. It has been culverted along its entire length and now forms part of the urban drainage system. Several public sewers, lateral drains and minor watercourses discharge into Hook Drain. Although it is classed as a riparian watercourse it was surveyed by CCTV and cleaned along its entire length by East Riding of Yorkshire Council in 2009. This is a third party owned and maintained asset, East Riding engineers have carried out visual inspections at various points since the CCTV and cleaning works. These inspections have not raised any significant cause for concern as to the condition of the watercourse.

7. August 2011 Flooding

Immediately following the severe rainfall, initial reports gathered from sources such as local media, reports to the MP or Elected Members indicated that approximately thirty properties were subjected to internal flooding. Geospatial analysis of the reported locations showed they were widely spread throughout Goole. In order to obtain an accurate record of affected properties further liaison with the emergency services, other council departments and residents of Goole was undertaken.

7.1. Emergency Response on Site

During the storm event there were representatives of East Riding of Yorkshire Council, Humberside Fire & Rescue, and Humberside Police on site in Goole. While Yorkshire Water had communications between their operators and the Network Engineers or Control Centres there was no direct interface with the other services present.

Although it was recognised that the operational response of Streetscene Services was timely and proportionate, having systems in place to bring the councils drainage engineers into the loop earlier may have been beneficial. This would have allowed for a greater technical understanding of the situation on the ground albeit with limited benefit in this case due to the intensity of the storm.

7.2. Investigation into extent and cause of flooding.

In order to understand the nature of the flooding, and to determine an accurate record of the extent of the floods, data was gathered from multiple sources including;

- Request for information in the local press and ERYC website in the days following the flooding
- Eyewitness accounts
- Information requests to Yorkshire Water Services Ltd.
 - Pump Station Telemetry
 - CCTV Sewer Surveys
 - Work management system records
 - Customer contacts relating to the Goole drainage systems.
- Information requests to the Goole & Airmyn Internal Drainage Board
 - Pump capacities and design standards
 - Inspection routine
 - Watercourse maintenance schedule
- Information from the Environment Agency
 - Weather Station Data
 - Rainfall Intensity Radar Data
 - Information relating to Main River flood defences
- Liaison with other departments within East Riding of Yorkshire Council
 - Housing
 - Streetscene Services

- A postal survey was sent to properties within the boundary shown in Figure 3. A copy of the survey is shown in Appendix D.

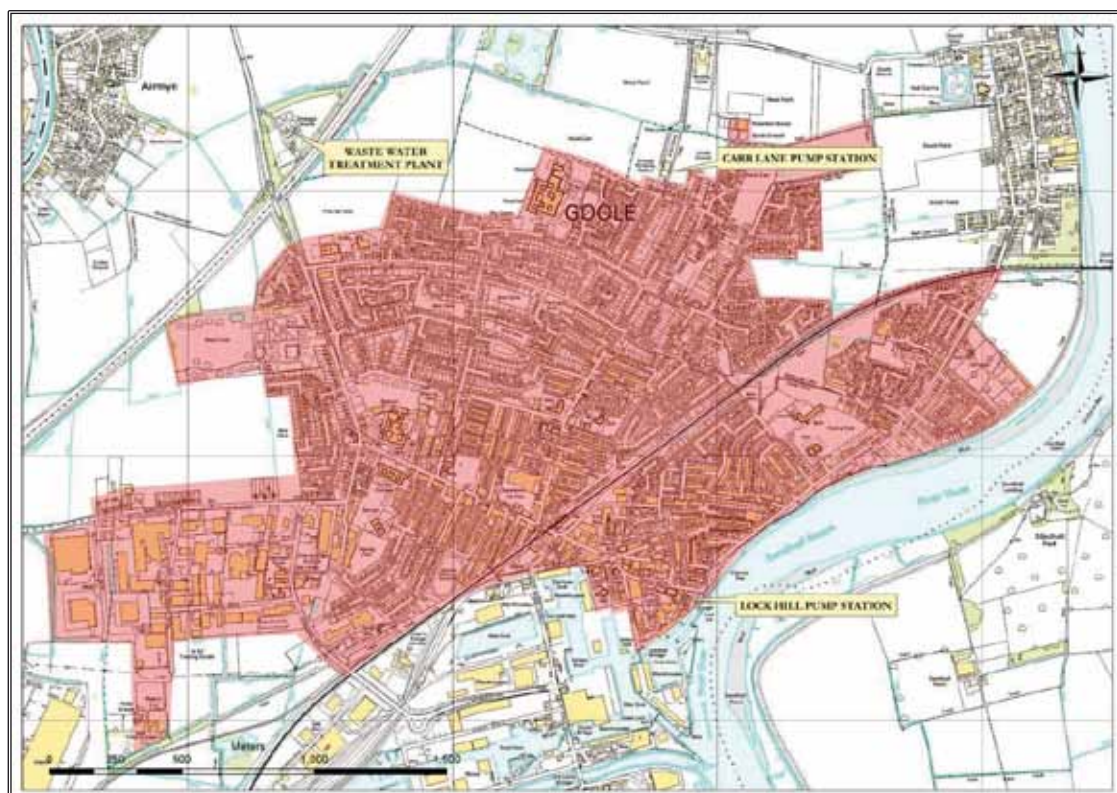


Figure 3 - Extent of Postal Survey

In total approximately 8300 surveys were delivered during the week commencing 22 August 2011 with 2467 completed returned by 28 September 2011, a response rate of 29.7%. Seventy three surveys were returned as undeliverable.

When a property suffered flooding within the building structure it will, in virtually all cases also have been subject to external flooding, and flooding of the adjacent highway, the notable exception to this being Millennium Way and Maple Drive where the properties are significantly below the adjacent highway level.

The confirmed incidences of flooding from returned surveys are shown in Table 4.

Property Type	Total
Internal including Outbuildings	631
Internal including Outbuildings reported, but no address details supplied.	112
External yard/garden areas but not internal to property.	915
Adjacent carriageway or footpath.	1720

Table 4 – Flood Survey Responses

In order to increase the coverage of the survey respondents were asked to list properties that suffered from internal flooding in addition to their own.

The responses were logged in a database and the type of flooding each property suffered was recorded. When a property was reported multiple times any additional reports beyond the first were discarded from the count of data. These additional responses showed that a total of 631 properties were subject to internal flooding. It should be noted that some responses stated general areas or streets of properties that had been subject to internal flooding; however, insufficient information was provided to allow accurate locations to be recorded. One hundred and twelve respondents reported internal flooding but did not provide contact details or an address at which the flooding occurred.

Given the response rate, and 112 respondents that reported internal flooding but did not provide sufficient data too accurately record the flood location it is likely that there was a greater incidence of flooding than listed in Table 4.

The primary source of data used to determine the number and location of properties that were subject to flooding was the postal survey carried out in August & September 2011. This indicates that in excess of 600 properties suffered from internal flooding. An additional 915 properties had surface or foul water within their property boundary, but not within the property.

There are clusters that show significant numbers of internally flooded properties. The major clusters are located on or near Jackson Street, Jacksonville, Elise Street, Byron Street, Milton Street, Marlborough Avenue, Kingsway, Centenary Road, Millennium Way, Maple Drive, Attlee Drive and Parklands. However there are confirmed incidences of flooding within property boundaries spread across all of Goole. Plans showing clusters of properties affected by flooding are included in Appendix E.

Eye witnesses and survey respondents have indicated that there was not a single source of flood water. These results are summarised in Table 5

Rainfall Source	Number of respondents	% of respondents
Drains in the Highway	610	57.9
Drains around property	462	43.8
Out of nearby watercourses and ditches	33	3.1
Overland Flow	260	24.7
Other	171	16.2
Unknown	137	13.0

Table 5 – Origin of Flood Water

The above table shows that while most of the flooding originated, as would be expected, by flowing out of drains within the highway there were other sources of flood water.

As outlined previously in this report the majority of Goole's historic drainage system comprises oversized conduits that were designed to store foul and storm water prior to discharging by gravity into the River Ouse when the water level was low enough.

More modern developments have separate foul and surface systems that jointly discharge into watercourses or the historic combined system. These modern developments will generally have a restricted rate of outfall in order to prevent overloading of the historic system. In conjunction with this restriction the surface water system will comprise of oversized pipes in that are designed to store excess storm water and release it slowly into the remainder of the sewer system.

The overall effect of these two systems will be to provide a substantial volume of storage within the sewer systems that would have mitigated, to a degree, the volume of flood water, the precise level of mitigation will require a verified hydraulic model to be commissioned.

When the rate of inflow into the sewer system exceeds the rate of discharge the sewers will start to fill and surcharge. If the sewers fill to a sufficient depth, water will flow out of manholes and gullies. This was witnessed by residents.

As the estimated storm intensity exceeded drainage design standards by a significant margin, it is unsurprising that there was surface flooding. In order to determine the effect of the unavailability of the assist storm pump at Carr Lane a verified hydraulic model will be required.

The standby pump that would operate in event of failure of one of the duty/assist pumps was unavailable for the full duration, and immediately after the storm as it had been removed for pre-planned maintenance.

The combination of these two pumps being unavailable meant that the pump capacity of the station was reduced between 1654 when the two remaining pumps started and 1923 when the previously electrically isolated pump was bought back into operation by Yorkshire Water engineers. As the efficiency of the storm pumps or the volume of water they pumped during the storm is unknown, the effect this had on the volume of flood water is also unknown.

Unlike steep sided catchments, where flood water is generally restricted to a narrow area adjacent to the watercourses, flood water in Goole will spread rapidly over a large area to a correspondingly shallow depth. Thus a greater number of properties would be affected by an equivalent volume of water in a steep sided catchment.

Any effect of the reduction in capacity of the storm pump station at Carr Lane needs to be understood, although given the flat nature of the catchment it is unlikely that there would be a significant reduction in the number of flooded properties but this needs to be determined with a hydraulic model.

A significant number of respondents stated that the flood waters came from drains around their property. This would indicate that as the public sewer filled, and then became surcharged water back-flowed along the property drains before emerging from the gullies.

In the vicinity of Millennium Way the affected properties are significantly lower than the highway and only a slight surcharge of the sewer systems would be required before flooding occurred. A potential solution to flooding in areas such as this would be to provide an increased volume of underground storage in the sewer network that can be released into the existing sewer system at a controlled rate. This would be in addition to the Sandall Lane Detention Tank System that provides a level of protection in accordance with industry standards for public sewers.

A small proportion of respondents observed water flooding out of open ditches; these should be identified and an assessment of their condition undertaken. Where required the responsible party should carry out remedial works. As the flooded area falls wholly within the boundary of the Goole & Airmyn IDB they would have responsibility for identifying and enforcing any remedial actions required under the provisions of the Land Drainage Act.

Additional comments and observations noted in the survey responses made reference to areas that are reported to flood regularly, even in minor, but unmeasured storms. Such reports would appear to indicate a local issue with the drainage systems. Where identified these locations should be thoroughly investigated and if a defect is identified the responsible body should program in remedial works on a priority basis.

If necessary, the IDB for the area should consider adopting additional strategic watercourses that they consider critical to the effective drainage of the area.

Appendix E contains plans showing the relative frequency and clustering of properties and highways affected by flooding.

8. Conclusions

The rainfall that caused the August flooding was without doubt exceptional, and could quite reasonably have had the commonly used phrase “once in a lifetime” applied to it.

Although we have been unable to definitively determine the intensity or the associated statistical return periods it is our considered opinion, from the available data, that in excess of 32mm, and probably in excess of 64mm of rain fell between 1630hrs and 1730hrs on 3rd August. In statistical terms such storms would have a return period of 1 in 45 (2.2%) or 1 in 950 (0.11%) respectively.

Even the lower estimate rainfall estimate is in excess of the design standards applied to drainage systems; therefore it is likely that even if the drainage system was “as new” and operated to 100% capacity, there would have been significant areas of flooding.

The full pumping capacity of the Carr Lane facility was unavailable until approximately 1930hrs. Any effect on flooding related to reduced pump capacity would need to be tested by means of a verified hydraulic model as this is not quantifiable from the information available.

As a result of the resident survey East Riding of Yorkshire Council have become aware of areas where localised flooding occurs on a regular basis due to significantly less intense storms. While these, in the normal course of events do not affect properties internally, they are an inconvenience to some residents. They should be investigated and appropriate remedial measures undertaken by the relevant bodies.

Given the complexity of the Goole sewer system, the limited verifiable rainfall data available and degree of interaction between systems it is not possible to definitively state a single cause of the flooding. From the limited rainfall data available it would be reasonable to draw the conclusion that the storm vastly exceeded the various design standards for all sections of the network and in order to fully understand the events and enable the production of a targeted programme of strategic remedial works, a fully verified integrated catchment model should be created. This will be a significant task that will require input and co-operation between multiple flood risk management agencies.

In summary, the storm that occurred on August 3rd was of exceptional intensity and exceeded current or historic design standards for all sections of drainage infrastructure.

It is likely that substantial and widespread flooding would have occurred irrespective of the condition or state of operation of the drainage network. However, there are works and procedures that can be undertaken or implemented that may mitigate and reduce the effects of future storms.

9. Recommendations

9.1. Communication and Incident Response

- 9.1.1. All emergency and flood risk management bodies to have a presence on site in similar events in order to assist in the rapid and effective co-ordination of responses, resources and mitigation/protection works.
- 9.1.2. Further to the urgent and well received operational response given by the council, during future occurrences there is a need to ensure that technical officers from the drainage department are contacted when it is apparent a flood event may occur, or when flooding is occurring.

9.2. Remedial and Improvement Works

- 9.2.1. Yorkshire Water to alter pump control/water level detection systems, where possible, within critical pump stations to ensure that the pumps do not enter a failsafe mode and switch off when the level detection systems are unable to detect the water level.
- 9.2.2. Yorkshire Water to improve telemetry systems at the pump station at Lock Hill to record pump start/stop times and other data they consider relevant on all pumps.

Yorkshire Water to install telemetry at Sandhall Detention Tank, Rawcliffe Industrial Estate and West Park Side pump stations.

- 9.2.3. East Riding of Yorkshire Council to install a rain gauge within Goole in order to record accurate rainfall data.
- 9.2.4. East Riding of Yorkshire Council or other bodies to install rain gauges in the vicinity of Goole to provide early warnings of intense rainfall to emergency responders and organisations with an interest in flood alleviation.
- 9.2.5. Yorkshire Water and East Riding of Yorkshire Council to investigate the construction of an additional surface water sewer/attenuation system and associated lifting pump at Millennium Way and surrounding area, that will provide protection to a greater level than the recently installed Sandhall Detention Tank. It should be noted that neither East Riding of Yorkshire Council nor Yorkshire Water Services Ltd are funded to provide this level of works.
- 9.2.6. Yorkshire Water and the Goole and Airmyn Internal Drainage Board to carry out tests on all pumps at terminal pump stations in order to determine the current operational efficiency for each pump. Remedial works to pumps to be implemented as appropriate.

- 9.2.7. Where any pump of a multi-pump station in the area is removed or off line for an extended period for any reason a replacement should be installed. Terminal pump stations such as Carr Lane should have a dedicated spare available for immediate installation in the event of an installed pump being removed for an extended period of time.

9.3. Other Recommendations

- 9.3.1. Environment Agency, East Riding of Yorkshire Council, Yorkshire Water and the Goole & Airmyn IDB to develop an integrated drainage/catchment model for Goole to identify flooding hotspots and assist in targeted development of remedial schemes.
- 9.3.2. East Riding of Yorkshire Council to investigate reports of regular localised flooding in minor rainfall events that have been reported in the resident survey responses and prioritise remedial measures, or increased maintenance where applicable. Where appropriate other flood risk management authorities to be informed of results and program remedial works as appropriate.
- 9.3.3. East Riding of Yorkshire Council in their role as LLFA to discuss with Yorkshire Water the possible designation of Lock Hill and Carr Lane Pump Stations and associated outfalls as critical assets under the provisions of the Flood & Water Management Act (2010).
- 9.3.4. Goole and Airmyn IDB & East Riding of Yorkshire Council to investigate, on a annual basis, critical riparian watercourses for condition and act use their powers under the Land Drainage Act (1991) and Flood & Water Management Act (2010).
- 9.3.5. Goole and Airmyn Internal Drainage Board to consider adopting and maintaining additional “critical” watercourses as determined by results of inspections carried out due to recommendation 9.3.4.
- 9.3.6. East Riding of Yorkshire Council to investigate the potential for property level flood protection measures at appropriate locations and bid for Defra funding to implement the recommended proposals.

10. Roles and Responsibilities

10.1. Lead Local Flood Authority

Flooding from surface runoff, groundwater and ordinary watercourses, development of a Local Flood Risk Strategy, Asset Plans and Investigations.

10.2. Environment Agency

Flooding from main rivers, the sea and reservoirs including coastal erosion risk management, permissive powers to maintain Main Rivers, Strategic Overview over all forms of flooding and development of a National Flood Risk Strategy.

10.3. Water and Sewerage Company

Yorkshire Water Services is the statutory sewerage undertaker for the Yorkshire region with a duty to effectually drain sewers pursuant to the Water Industry Act (1991).

10.4. Highways Authority

Provide, maintain and manage highway drainage under the provisions of the Highways Act 1980.

10.5. Riparian Landowners

Riparian landowners are those who own land adjoining a watercourse, they have certain rights and responsibilities, including the following:

- i. They must maintain the bed and banks of the watercourse, and also the trees and shrubs growing on the banks.
- ii. They must clear any debris, even if it did not originate from their land, this debris may be natural or man-made.
- iii. They must keep any structures that they own clear of debris. These structures include culverts, trash screens, weirs and mill gates.
- iv. if they do not carry out their responsibilities, they could face legal action under the 1991 Land Drainage Act.
- v. Further details of a riparian landowners responsibilities can be found in “Living on the Edge” published by the Environment Agency.

10.6. Residents

Residents are encouraged to understand the flood risk in their local area and have a flood plan to steer their response in times of flooding. Actions such as placement of sandbags, moving valuable items to a safe place and semi / permanent measures such as installation of floodgates, airbrick covers etc further encouraged to reduce the consequences of flooding at a property level.

It is recommended that residents sign up to appropriate warnings for their area and keep contact details up to date and act upon all warnings appropriately. When flooding does occur residents are encouraged to document as much information as possible to aid the investigations of all operating authorities and to provide information to their loss adjusters and insurers.

II. Abbreviations and Acronyms

AOD	Above Ordnance Datum
BST	British Summer Time (GMT+1)
CASS	Cyclic Activated Sewage System
DWF	Dry Weather Flow
EA	Environment Agency
ERYC	East Riding of Yorkshire Council
FFT	Full Flow to Treatment
FIR	Flood Investigation Report
FWMA	Flood and Water Management Act 2010
GMT	Greenwich Mean Time
IBD	Internal Drainage Board
LDA	Land Drainage Act 1991
LLFA	Lead Local Flood Authority
l/s	Litres Per Second
m ³ /s	Cubic meters Per Second
MHWS	Mean High Water Springs
SuDS	Sustainable Drainage Systems
TBRG	Tipping Bucket Rain Gauge
WWTW	Waste Water Treatment Works
WRA	Water Resources Act 1991
YW	Yorkshire Water

12. Contact Details

Lead Local Flood Authority

East Riding of Yorkshire Council
County Hall
Cross Street
Beverley
East Yorkshire
HU17 9BA

01482 887700

www.eastriding.gov.uk

land.drainage@eastriding.gov.uk

Statutory Sewerage Undertaker

Yorkshire Water Services Ltd
Western House,
Halifax Road
Bradford
BD6 2SZ

0845 1 242424

www.yorkshirewater.co.uk

Environment Agency

General Enquiries 08708 506506 (Mon-Fri, 8am - 6pm)
Incident Hotline 0800 807060 (24hrs)

www.environment-agency.gov.uk

Goole and Airmyn Internal Drainage Board

Goole & Airmyn IDB
Lower Aire & Don Consortia of Drainage Boards
Halcyon House
Landing Lane
Newport
Brough
HU15 2RU

01430 441765

<http://www.loweraire-idbs.org.uk/board.php?boardid=3>

loweraire@googlemail.com

13. Website Addresses

Flood & Water Management Act 2010:

<http://www.legislation.gov.uk/ukpga/2010/29/contents>

Land Drainage Act 1991:

<http://www.legislation.gov.uk/ukpga/1991/59/contents>

Water Resources Act 1991:

<http://www.legislation.gov.uk/ukpga/1991/57/contents>

Highways Act 1980:

<http://www.legislation.gov.uk/ukpga/1980/66/contents>

EA - 'Living on the Edge' a guide to the rights and responsibilities of riverside occupation:

<http://www.environment-agency.gov.uk/homeandleisure/floods/31626.aspx>

EA - River and Coastal Maintenance Programmes:

<http://www.environment-agency.gov.uk/homeandleisure/floods/109548.aspx>

EA - Prepare your Property for Flooding:

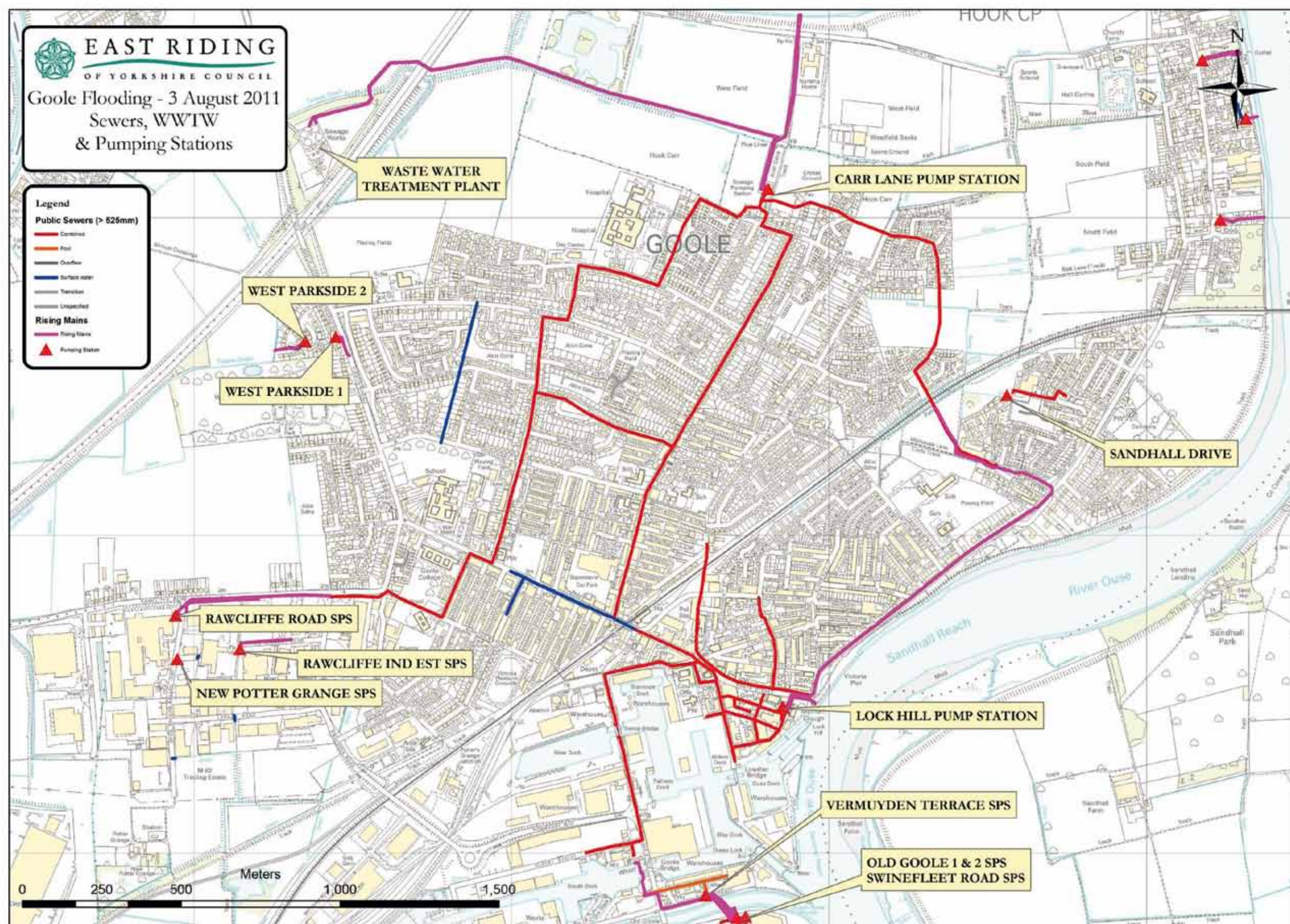
How to reduce flood damage

Flood protection products and services

<http://www.environment-agency.gov.uk/homeandleisure/floods/31644.aspx>

Appendix A

Strategic Public Sewer and Pumping Station Locations



Appendix B

Timeline – August 3 2011

- Operator Actions on 3rd August 2011
- Pump Operation Derived from Supplied Yorkshire Water Telemetry Data

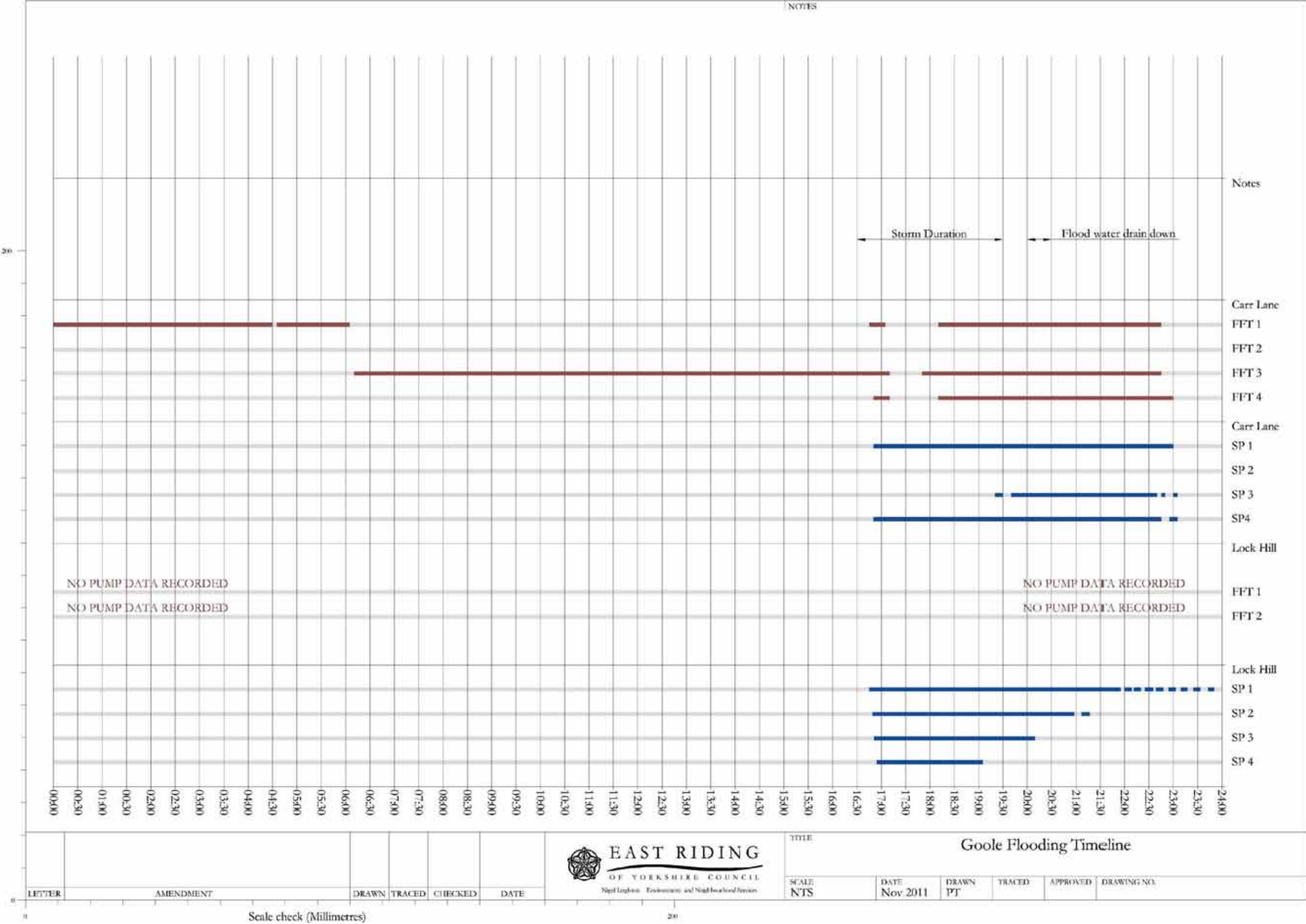
*Copy of Table supplied by Yorkshire Water,

Goole Flood Incident 3rd August 2011 – Operator Response Timeline

The table below is a timeline of the Yorkshire Water operator's activity on 3rd August 2011 in response to the extreme rainfall event and significant flooding in Goole

*Please note all times are approximate

Time	Activity
17:00	Operator receives call from YW control centre, high volume of customer contacts reporting flooding being received in DN14 area, Control arrange for a stand by operator to attend.
17:10	Operator departs to travel to Goole
17:45	Operator receives call from YW Network Performance Engineer and informs him that he is en-route to Goole Carr Lane SPS and that he has witnessed significant flooding
18:00	Operator arrives onsite at Goole Carr Lane, 2 FFT pumps running and 2 Storm pumps running, Operator puts all 3 FFT pumps onto manual control and runs all 3. Operator informs Network Performance Engineer of the situation
18:10	Network Performance Engineer requests that a electrician attend to release 3 rd Storm pump as it was electrically isolated and carry out necessary actions to allow the pump to be run,
18:30	Electrician arrives onsite to start work on getting 3 rd Storm Pump operational
19:30	3 rd Storm pump operational and running. At this point there are 3 FFT pumps running in hand and 3 Storm Pumps running in auto
20:55	Operator receives "pump ceased alarm" from Lock Hill SPS
21:10	Operator visits Lock Hill SPS and finds all pumps running and site as normal, no problems found. (Investigations later find that this alarm means that the pumps have not stopped running for duration)
21:15	Operator leaves site to visit pumping station in Reedness as has received an alarm
23.10	Operator returns to Goole Carr Lane SPS, 3 FFT pumps running in hand and 3 Storm pumps running in auto
00:05	Operator tries to switch FFT pumps back into auto, pumps fail to start in automatic control and are switched back to manual control (all pumps continue to run)
00:30	Operator tries again to switch FFT pumps back into automatic running mode and from this point the pumps all run in automatic mode
02:30	Operator leaves Goole Carr Lane SPS, all operational pumps running in automatic mode and levels in the wet well are returning to normal



Appendix C

Gulley Defects 2011

Town/Village	Street/Road Name	Landmark/ Reference	Date defected	Cars	Fast Lid	Broken Lid	Blocked Outlet	Dig Out Rqd	Broken Pot
Goole	Cecil Street	side of 27 mansfield road	22/02/2011	1					
Goole	Cecil Street	o/s 8	22/02/2011	1					
Goole	Cecil Street	o/s 18	22/02/2011	1					
Goole	Marshfield Ave	o/s 47	22/02/2011	1					
Goole	Marshfield Ave	o/s 33	22/02/2011	1					
Goole	Marshfield Ave	o/s 19	22/02/2011	1					
Goole	Bournville	o/s 37	07/03/2011	1					
Goole	Bournville	o/s 46	07/03/2011	1					
Goole	Newland Road	o/s 17	07/03/2011	1					
Goole	Elsie St	o/s 49	07/03/2011	1					
Goole	Elsie St	opp 40	07/03/2011	1					
Goole	Elsie St	o/s 32	07/03/2011	1					
Goole	Elsie St	o/s 18	07/03/2011	1					
Goole	First St	on corner	08/03/2011	1					
Goole	Henry Street	o/s 30	08/03/2011	1					
Goole	Henry Street	o/s 4	08/03/2011	1					
Goole	Henry Street	o/s 4	08/03/2011	1					
Goole	Henry Street	o/s 11	08/03/2011	1					
Goole	Henry Street	o/s 19	08/03/2011	1					
Goole	Henry Street	o/s 45	08/03/2011	1					
Goole	Henry Street	o/s 69	08/03/2011	1					
Goole	Grange Road	o/s 23	08/03/2011	1					
Goole	Grange Road	o/s 47	08/03/2011	1					
Goole	Dempster Ave	o/s 50	08/03/2011	1					
Goole	Dempster Ave	o/s 6	08/03/2011	1					
Goole	Dempster Ave	o/s 11	08/03/2011	1					
Goole	Manor Road	o/s 21	08/03/2011	1					
Goole	Percy Street	o/s 120	08/03/2011		1				
Goole	Hatfield Place	o/s 14	08/03/2011	1					
Goole	Percy Street	o/s 59	08/03/2011	1					
Goole	Percy Street	o/s 45	08/03/2011	1					
Goole	Percy Street	o/s 35	08/03/2011	1					

Goole	Percy Street	o/s 5	08/03/2011	I					
Goole	Percy Street	opp 2	08/03/2011	I					
Goole	Percy Street	o/s 24	08/03/2011				I	I	
Goole	Percy Street	o/s 44	08/03/2011						
Goole	Percy Street	o/s 56	08/03/2011	I					
Goole	Percy Street	o/s 66	08/03/2011	I					
Goole	Percy Street	o/s 76	08/03/2011	I					
Goole	Percy Street	o/s 126	08/03/2011			I			
Goole	Percy Street	o/s 132	08/03/2011	I					
Goole	Percy Street	o/s 136	08/03/2011			I			
Goole	Hazel Grove	o/s 8	08/03/2011	I					
Goole	Manor Road	o/s 44	08/03/2011	I					
Goole	Manor Road	o/s 22	08/03/2011	I					
Goole	Manor Road	o/s 6	08/03/2011		I	I			
Goole	Pasture Road	o/s fireplaces	09/03/2011	I					
Goole	Pasture Road	o/s job centre	09/03/2011	I					
Goole	Pasture Road	o/s 127	09/03/2011	I					
Goole	Marlborough Av	1st on left	09/03/2011	I					
Goole	Marlborough Av	o/s 29	09/03/2011	I					
Goole	Marlborough Av	o/s 72	09/03/2011	I					
Goole	Marlborough Av	o/s 58	09/03/2011	I					
Goole	Marlborough Av	o/s 46	09/03/2011	I					
Goole	Marlborough Av	o/s 36	09/03/2011	I					
Goole	Marlborough Av	o/s 8	09/03/2011	I					
Goole	Fifth Ave	o/s 54	09/03/2011	I					
Goole	Spencer Street	o/s 19	09/03/2011	I					
Goole	Spencer Street	o/s 34	09/03/2011	I					
Goole	Byron Street	o/s 3	09/03/2011	I					
Goole	Byron Street	o/s 24	09/03/2011	I					
Goole	Bryon Street	o/s 6	09/03/2011			I			
Goole	Dunhill Road	o/s 40 -24	09/03/2011	I					
Goole	Dunhill Road	o/s 6	09/03/2011	I					
Goole	Dunhill Road	opp 5	09/03/2011	I					
Goole	Dunhill Road	o/s 2 to end	09/03/2011	I					
Goole	Dunhill Road	o/s 149	09/03/2011	I					
Goole	Northcote Ave	adj l/p 14	09/03/2011		I				
Goole	Moorland Road	o/s 7	09/03/2011	I					
Goole	Derwent Road	o/s 17	09/03/2011	I					
Goole	Shipcote Road	o/s 28	09/03/2011	I					
Goole	Shipcote Road	o/s 6	09/03/2011	I					
Goole	Derwent Road	o/s 12	09/03/2011	I					
Goole	Moorland Road	adj l/p 7	09/03/2011	I					

Goole	Moorland Road	o/s 52	09/03/2011	I					
Goole	Moorland Road	o/s 60	09/03/2011	I					
Goole	Moorland Road	o/s 68	09/03/2011				I		
Goole	Moorland Road	o/s 76	09/03/2011	I					
Goole	Moorland Road	o/s 82	09/03/2011	I					
Goole	Moorland Road	o/s 81	09/03/2011	I					
Goole	Marley Street	o/s 98	09/03/2011	I					
Goole	Marley Street	o/s 66	09/03/2011	I					
Goole	Marley Street	o/s 17	09/03/2011	I					
Goole	Marley Street	o/s 51	09/03/2011	I					
Goole	Hall Road	o/s 15	09/03/2011	I					
Goole	Hall Road	o/s 19	09/03/2011	I					
Goole	Hall Road	opp l/p 2	09/03/2011	I					
Goole	Marcus Road	o/s football ground	11/03/2011				I		
Goole	Newport Street	o/s 43	11/03/2011				I		
Goole	Marcus Road	o/s Marcus View	11/03/2011	I					
Goole	Marcus Road	o/s 60	11/03/2011	I					
Goole	Marcus Road	o/s 56	11/03/2011	I					
Goole	Swinefleet Road	opp smithy snacks	11/03/2011				I		
Goole	Swinefleet Road	opp 64	11/03/2011				I		
Goole	Swinefleet Road	opp 68	11/03/2011				I		
Goole	Swinefleet Road	opp 76	11/03/2011				I		
Goole	Swinefleet Road	o/s key store	11/03/2011				I		
Goole	Swinefleet Road	o/s 91	11/03/2011	I					
Goole	Humber Street	o/s 7	11/03/2011	I					
Goole	Humber Street	o/s 21	11/03/2011	I					
Goole	Humber Street	o/s 33	11/03/2011	I					
Goole	Humber Street	o/s 10	11/03/2011	I					
Goole	Church close	o/s 5	11/03/2011	I					
Goole	Church close	o/s 45	11/03/2011	I					
Goole	Swinefleet Road	o/s 99	11/03/2011	I					
Goole	Swinefleet Road	o/s 111	11/03/2011	I					
Goole	Swinefleet Road	o/s 100	11/03/2011	I					
Goole	Swinefleet Road	o/s 72	11/03/2011						
Goole	Swinefleet Road	o/s 68	11/03/2011	I					
Goole	Swinefleet Road	o/s 68	11/03/2011	I					
Goole	Swinefleet Road	o/s 10	11/03/2011	I					
Goole	Swinefleet Road	o/s 6	11/03/2011	I					
Goole	Swinefleet Road	o/s 2	11/03/2011	I					
Goole	Swinefleet Road	o/s hot stn	11/03/2011	I					
Goole	Swinefleet Road	o/s smithys hot snacks	11/03/2011	I					
Goole	Swinefleet Road	o/s 18	11/03/2011	I					

Goole	Swinefleet Road	o/s 13	11/03/2011	1					
Goole	Carter Street	o/s 16	14/03/2011			1			
Goole	Boothferry Road	o/s Layburn Tools	14/03/2011	1					
Goole	Riversdale Drive	o/s 7	14/03/2011	1					
Goole	Millennium way	play area	15/03/2011	1					
Goole	Millennium way	o/s 15	15/03/2011	1					
Goole	Sawedhall Drive	o/s 7	15/03/2011	1					
Goole	Voice Road	o/s f/h I	16/03/2011	1					
Goole	New Porter Grane Road	o/s NK I	16/03/2011	1					
Goole	Larpan Road	o/s NK I	16/03/2011	1					
Goole	Larpan Road	o/s Kenira	16/03/2011	1					
Goole	Larpan Road	o/s Kenira	16/03/2011	1					
Goole	Larpan Road	opp MKM	16/03/2011	1					
Goole	Seavy St		17/03/2011	3					
Goole	Kent Road	o/s 30	17/03/2011	1					
Goole	Kent Road	o/s 73	17/03/2011	1					
Goole	Kent Road	o/s 64	17/03/2011	1					
Goole	Kent Road	o/s 54	17/03/2011	1					
Goole	Chestnut Ave	o/s 7	17/03/2011	1					
Goole	Barthomethew Ave	opp old poplars ave	17/03/2011	1					
Goole	Kingsway	o/s 85	17/03/2011	1					
Goole	Kingsway	o/s 47	17/03/2011	1					
Goole	Kingsway	o/s 35	17/03/2011	1					
Goole	Kingsway	o/s 27	17/03/2011	1					
Goole	Kingsway	o/s 15	17/03/2011	1					
Goole	Kingsway	o/s 8	17/03/2011	1					
Goole	Fountainne Street	before I	17/03/2011	1					
Goole	Fountainne Street	o/s 39	17/03/2011	1					
Goole	Fountainne Street	opp 36	17/03/2011	1					
Goole	Fountainne Street	o/s 49	17/03/2011	1					
Goole	Fountainne Street	o/s 57	17/03/2011	1					
Goole	Fountainne Street	o/s 61	17/03/2011	1					
Goole	Limetree Ave	o/s 74	17/03/2011		1				
Goole	Limetree Gardens	o/s 4	17/03/2011	1					
Goole	Limetree Ave	o/s 90	17/03/2011	1					
Goole	Limetree Ave	o/s 104	17/03/2011	1					
Goole	Limetree Ave	opp 165	17/03/2011	1					
Goole	Limetree Ave	Charity Shop	17/03/2011			1			
Goole	Limetree Ave	o/s 163	17/03/2011				1		
Goole	Limetree Ave	o/s 149	17/03/2011	1					
Goole	Limetree Ave	o/s 145	17/03/2011		1				
Goole	Limetree Ave	o/s 119	17/03/2011	1					

Goole	Limetree Ave	o/s 109	17/03/2011	I					
Goole	Limetree Ave	o/s 101	17/03/2011	I					
Goole	Limetree Ave	o/s 91	17/03/2011	I					
Goole	Limetree Ave	o/s 23	17/03/2011	I					
Goole	Fountayne Street	o/s 36	17/03/2011	I					
Goole	Fountayne Street	o/s 26	17/03/2011	I					
Goole	Fountayne Street	o/s 16	17/03/2011	I					
Goole	Hook Road	o/s 9	18/03/2011	I					
Goole	Aire Street	opp l/p 2	18/03/2011	I					
Goole	Aire Street	opp 50	18/03/2011	I					
Goole	Aire Street	opp 46	18/03/2011	I					
Goole	Aire Street	o/s 37	18/03/2011	I					
Goole	Aire Street	o/s 27	18/03/2011	I					
Goole	Aire Street	o/s taste china	18/03/2011	I					
Goole	Adam Street	nr l/p 2	18/03/2011		I	I			
Goole	Aire Street	o/s 50	18/03/2011	I					
Goole	Hook Road	o/s church	18/03/2011	I					
Goole	Hook Road	o/s 57	21/03/2011	I					
Goole	Hook Road	o/s 60a	21/03/2011	I					
Goole	Hook Road	o/s 77	21/03/2011	I					
Goole	Hook Road	o/s 237	21/03/2011				I		
Goole	Marshfield Ave	o/s 7	22/03/2011	I					
Goole	Marshfield Ave	side of 45	22/03/2011	I					
Goole	Marshfield Ave	o/s 8	22/03/2011	I					
Goole	Marshfield Ave	o/s 34	22/03/2011	I					
Goole	Marshfield Ave	o/s 48	22/03/2011	I					
Goole	Marshfield Ave	o/s 52	22/03/2011	I					
Goole	Marshfield Ave	o/s 74	22/03/2011	I					
Goole	Marshfield Ave	o/s 82	22/03/2011	I					
Goole	Marshfield Ave	o/s 92	22/03/2011	I					
Goole	Queensway	before 2	22/03/2011	I					
Goole	Queensway	o/s 22	22/03/2011	I					
Goole	Queensway	o/s 48	22/03/2011	I					
Goole	Queensway	o/s 45	22/03/2011	I					
Goole	Queensway	o/s 33	22/03/2011	I					
Goole	Queensway	o/s 1	22/03/2011	I					
Goole	Chiltern Road	o/s 73	23/03/2011	I					
Goole	Chiltern Road	o/s 68	23/03/2011	I					
Goole	Chiltern Road	o/s 60	23/03/2011	I					
Goole	Chiltern Road	o/s 48	23/03/2011	I					
Goole	Malvern Road	o/s 45	23/03/2011	I					
Goole	Pentland Ave	o/s 17	23/03/2011	I					

Goole	Malvern Road	o/s 75	23/03/2011	1					
Goole	Malvern Road	o/s 99	23/03/2011	1					
Goole	Malvern Road	o/s 109	23/03/2011	1					
Goole	Malvern Road	o/s 80	23/03/2011	1					
Goole	Malvern Road	o/s 68	23/03/2011	1					
Goole	Forth Ave	o/s 14	28/03/2011	1					
				184	6	7	11	1	0

Appendix D

Postal survey questionnaire



EAST RIDING
OF YORKSHIRE COUNCIL

Goole Flooding Survey

East Riding of Yorkshire Council have commenced a formal investigation into the causes of flooding in Goole on 3 August 2011. The council would encourage anybody with information about flooding to make contact, preferably through email but also through telephone and in writing. Any information will help the council establish the nature and extent of the flooding. The location, time and depth of flooding would be most useful. Digital photographs of flooding with the location in the filename would also be welcome.

PLEASE RESPOND AS SOON AS POSSIBLE.

Q1 Did the road outside your property flood?

☐ Yes ☐ No

Q2 Did your property flood?

☐ Yes (Go to Q3) ☐ No (Go to Q5)

Q3 Which part of your property did the flooding affect? (please tick all that apply)

☐ Garden ☐ Inside the building (including garages)

☐ Under floor

Q4 Where did the water come from? (please tick all that apply)

☐ Drains in the road ☐ Flowed overland and into property

☐ Drains around the property ☐ Other (please state)

☐ Out of nearby watercourses and ditches ☐ Don't know

Other:

Q5 Are you aware of any other properties on your street that had water within the building or under the floor?

☐ Yes ☐ No

Q5a If so, please list them:

Q6 Any other comments?

Q7

If you would be happy for East Riding of Yorkshire Council to contact you for further information regarding the flooding please leave your details below?

Postcode:

Address:

Telephone number:

Email address:

If you have any further information or can supply photographs or video footage, please telephone the land drainage team on 01482 395656 (24hr answerphone) or email on land.drainage@eastriding.gov.uk

Please note that any information which you provide in this survey will be used by East Riding of Yorkshire Council in accordance with the Data Protection Act 1998.

Data provided will be used for preparation of report under the Flood & Water Management Act 2010 and will not be passed to any other parties. General areas of flooding may be identified in the published report.

East Riding of Yorkshire Council will, on request, provide this document in Braille, audio or large print format. If English is not your first language and you would like a translation of this document into any other language, please telephone (01482) 393939.

Jesteśmy tutaj aby Państwu pomóc. Naszym celem jest udostępnienie każdemu naszych usług. Jeśli potrzebują Państwo pomocy tłumacza prosimy dzwonić pod ten numer 0121 377 2880.

This survey can be completed on line, please go to
<http://www.eastriding.gov.uk/corp-survey/snapform/Goole/floodingsurvey.htm>.

Please return your completed questionnaire in the enclosed freepost envelope, or send it for free to:

The Research Group (Ref GFS)
 East Riding of Yorkshire Council
 FREEPOST NEA 8623
 Beverley
 East Riding of Yorkshire
 HU17 9BR

Appendix E

Flood Density Maps

- Internal Flooding – Internal, or under floor of structures within property limit
- Property Flooding - Flood Water within property limits, Internal or External to structures
- All Flooding – Flooding of properties or highway reported

