

Flood Investigation Report

South Cave Flooding on 20 July 2014

CES\ 188a

December 2014



EAST RIDING
OF YORKSHIRE COUNCIL

Revision Schedule

East Riding of Yorkshire Council

Flood Investigation Report South Cave Flooding Event on 20 July 2014

Rev	Date	Details	Author	Checked and Approved By
Rev 1	24/10/14	Initial Draft	AM	
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Rev 5				
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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 the plans for clarity. The statutory public sewer record is held by Yorkshire Water Services Ltd.

Acknowledgements

East Riding of Yorkshire Council would like to thank the following for their co-operation and assistance throughout this investigation.

Environment Agency

Yorkshire Water Services Ltd

South Cave Parish Council

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Lead Local Flood Authority and Responsibilities

East Riding of Yorkshire Council, as the Lead Local Flood Authority (LLFA), has a responsibility under Section 19 of the Flood and Water Management Act 2010 to investigate significant flood incidents in its area. Section 19 states:

- (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.*
- (3) The LLFA has lead responsibility for managing the risk of flooding from surface water, groundwater and ordinary water courses.*

This report has been prepared by East Riding of Yorkshire Council in its role as LLFA in response to extensive flooding which affected properties in South Cave.

This report provides an overview of flooding that has occurred, describes the conditions which led to the flooding, considers the response to the flooding thus far and makes technical recommendations for the flood risk authorities concerned.

Relevant Flood Risk Management Authorities

The risk management authorities that have relevant flood risk management functions are:

East Riding of Yorkshire Council

East Riding of Yorkshire Council is the Lead Local Flood Authority responsible for managing flood risk from surface runoff, groundwater and ordinary watercourses, development of a Local Flood Risk Strategy, Asset Plans and Investigations under the Flood and Water Management Act 2010. East Riding of Yorkshire Council also has responsibility for some Coastal erosion risk management, and is the Highway Authority with responsibility for highway drainage under the Highways Act 1980.

Environment Agency

Responsible for managing the flood risk 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.

Yorkshire Water Services

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

In addition:

Riparian Landowners

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

- They must maintain the bed and banks of an open watercourse, and also the trees and shrubs growing on the banks.
- They must clear any debris, even if it did not originate from their land, this debris may be natural or man-made.
- They must keep any structures that they own clear of debris. These structures include culverts, trash screens, weirs and mill gates.

If they do not carry out their responsibilities, they could face legal action under the Land Drainage Act 1991. Details of a riparian landowners responsibilities can be found in 'Living on the Edge' published by the Environment Agency.

1 Executive Summary

On the 20 July an extremely intense rainfall event was experienced in parts of the East Riding, including South Cave, resulting in significant localised flooding. The main surface water drainage for the village is the South Cave Beck which flows from east to west through the village. The entire village drainage system including the Beck and the sewer network, private drains and highway drains were rapidly overwhelmed.

Areas affected included Market Place, Church Street, Annie Med Lane, West Hall Garth, Barnards Drive and Pinfold.

With overland flows and an overwhelmed drainage system some 37 properties reported flooding with 14 suffering internal flooding.

Whilst East Riding of Yorkshire Council has made every effort to secure funding, flash flooding and the capacity of the public sewerage system for which water companies / Ofwat have responsibility still remains an issue that can only be addressed through regulated investment.

The peak estimated rainfall intensity for the storm was 36mm/hr with a total estimated rainfall volume of 30mm in one hour, which is estimated to have a return period of at least 1 in 100 years. This compares to the normal average July rainfall for South Cave of 74mm per month. The report concludes that on 20 July 2014 the rainfall was of exceptional intensity and exceeded the current or historic design standards for the drainage infrastructure, and that the relevant flood risk management authorities exercised their functions in response to the flooding incident.

2 Location of Flooding

On the 20 July South Cave (the subject of a separate S19 report) and Market Weighton were both hit by intense summer storms which resulted in flash flooding.

Flooding affected the following areas in South Cave:

Middle Garth Drive	Highfield	Beverley Road
Market Place	Church Street	Beck Lane
Barnards Drive	West Hall Garth	Jobsons Close
Lloyds Close	Annie Med Lane	Pinfold
Southcote Close	St Katherines Road	Thornham Close

See Appendix 1 -.Plan of Reported Affected Areas,

Also Appendix 2 Properties and Areas Affected.

2.1 The Areas Affected

In general the areas which were affected are along the route of the South Cave Beck, these areas are also indicated on the EA flood map, (see Appendix 1 Plan of Reported Affected Areas also see Appendix 6 EA Flood Map).

The catchment area for the South Cave Beck is some 350ha (900 acres). Its topography is a steep-sided valley to the north east of the village. The base flow is spring-fed groundwater, however because the ground is generally steeply sloping it is prone to rapid run-off during heavy rain from the higher ground down into the bottom of the valley and onwards into the Beck and the village. During heavy rainfall there will also be significant flows towards the beck from surface run-off within the village itself.

2.2 The Flood Route

The South Cave Beck flows down off the Wolds along Little Wold Lane and crosses Beverley Road before running in an open channel at the side of Beverley Road with drive crossings (see photos 2 & 3). The open section adjacent to Trinity Fold had significant seasonal weed growth in the channel in July. This has now been removed by the Council on a without-prejudice basis as this is a riparian section of watercourse. There is also a Grit Trap which was full, due to the nature of the beck bed being fragmented chalk gravel. This trap is of limited value, as it re-fills very quickly. The beck overtopped its bank and water flowed down Beverley Road into Market Place.

From the Market Place the beck is culverted in a concrete box section, which the Council have attempted to survey with CCTV. As on previous occasions the survey was incomplete due to intruding service connections restricting the access for the camera. However the culvert where inspected appeared to be in reasonable structural condition and clear, apart from the service crossings. The culvert runs under the footpath along the south side of Church Street up to a short open section by the school, before entering the Westcote Farm culvert at Thornham Close. At the culvert entrance is a trash screen (see photo 8) which was found to be partially blocked with debris after the event. The Council subsequently cleared the debris and is due to replace this screen during this financial year. There was property flooding as well as highway flooding along Church Street, together with the Tennis and Bowling clubs. Water also ran down Church Hill into West End and on down Beck lane, and re-entered the beck to the rear of Barnards Drive.

Below the Westcote Farm culvert, after crossing Water Lane, the Beck is largely open through West End, with various crossings. Then at the rear of Pinfold there is a new section of culvert through a private garden. This work was consented by the Council in June 2014. At the time of the event the work was not completed, however it was not believed to have contributed to flooding upstream.

The beck is then in open section with more crossings before entering a culvert and passing under the A63, into another open section before joining with Ferry Beck, and into Mill Beck.

See Appendix 6 (The EA Flood Map) which indicates a significant area at risk of flooding immediately downstream of the A63 crossing. Therefore any scheme to reduce the flood risk within the village would need to also consider the risk downstream as well as within the village.

3 Drainage Systems in South Cave

3.1 Land Drainage – Watercourses

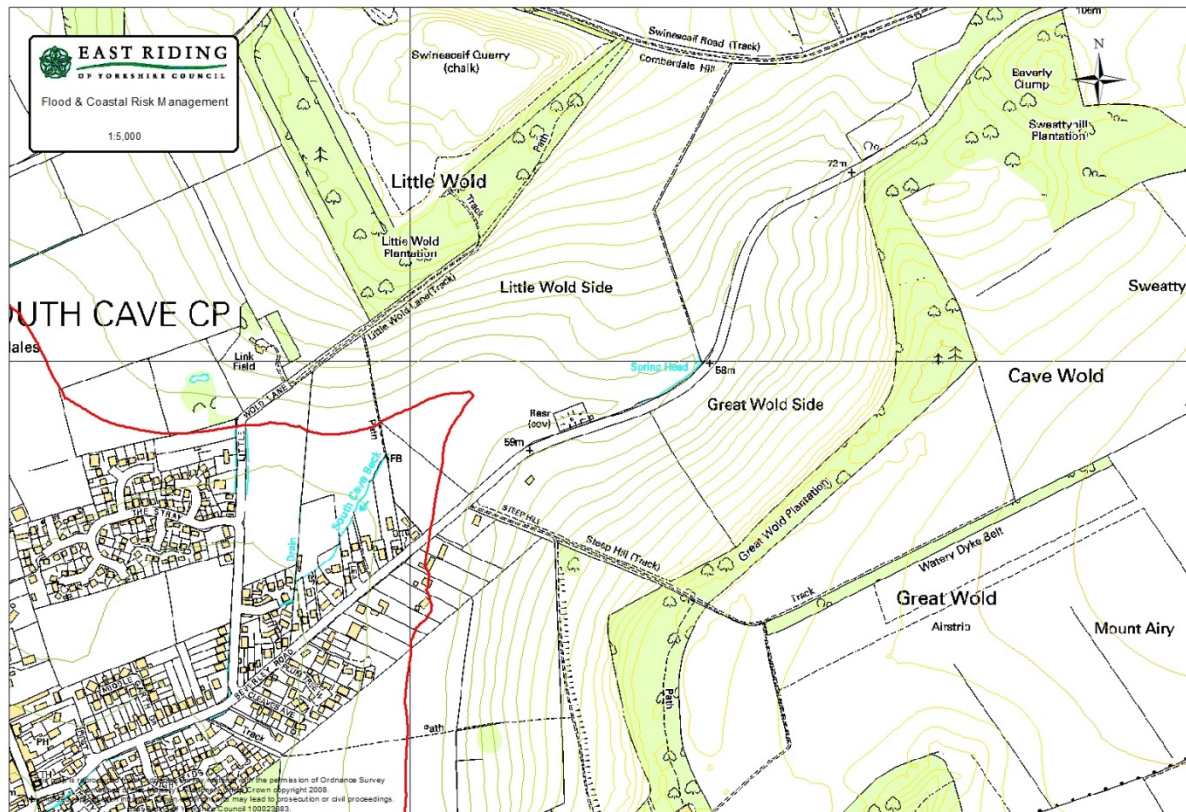


Figure 1: South Cave Beck Catchment Area

South Cave Beck (see figures 1 & 2) is a tributary of Mill Beck. The base flow is spring-fed groundwater. The main source is a spring at the foot of the chalk escarpment at Great Wold Side, (south and east of Beverley Road) but it is also fed from other localised points along the same spring line (broadly along the 50m contour, shown red in Figure 1 above) which converge in the valley to flow in a south westerly direction along Little Wold Lane.

The village lies at the bottom of the Wolds, the catchment for the Beck is a steeply sided valley which runs south east into the village. The profile and geology lead to rapid run-off during heavy rainfall and subsequent flash flooding due to overloading of the drainage in the village. There will also be significant flows from surface run-off within the village itself, from highway drainage, roof-water and hard paved areas, which will also discharge into the Beck.

The South Cave Beck flows through the village in open channel with some culverted sections, before crossing under the A63 and joining with Ferry Beck, then on to Mill Beck.



Figure 2: Watercourses in South Cave

The EA commissioned a report in 2011 the South Cave Flood Map Improvement Study for which topographic and hydrological information was collected and analysed, and an updated map produced (See Appendix 6 : The EA Flood Map).

The EA report discussed the history of flooding in the village with records dating back to 1841. The description of the events usually refers to thunder storms and flash flooding, although significant flooding occurred in 2007, which was not flash flooding.

As a part of the study a CCTV survey of the culverts through the village was attempted. However the results were incomplete due to access problems and the presence of lateral service connections passing through the culverts.

Where the Beck has been culverted, particularly along Church Street the Council uses permissive powers to maintain the culvert. However the open sections remain a riparian responsibility, and should be maintained by the adjacent land owners. The Council does have enforcement powers to ensure that essential maintenance works on watercourses are carried out.

Any proposed works which could affect the passage of water along any such watercourse require the consent of the Council as local land drainage authority, under the Land Drainage Act 1991. These works would include any proposal to culvert the watercourse, or to install a crossing or bridge of any sort, or works adjacent to the watercourse which could affect flows or access for maintenance.

Little Wold Lane Ditch is a watercourse which drains land on Little Wold Side to the north of Beverley Road. It joins with South Cave Beck before it crosses under Beverley Road.

Ferry Beck is a watercourse which drains land to the north of the village and flows through West End before crossing under the A63. There is a history of flooding issues on the Ferry Beck, the Council carried out improvement works following 2007 and no issues were reported during the 2014 event.

Water Lane Ditch originally flowed south, but when the A63 was upgraded the flow was diverted along Annie Med Lane and now discharges into the South Cave Beck in Pinfold and crosses under the A63.

3.2 Public Sewer Network

The sewers within the village are mainly combined so carry waste water and surface water. The sewers flow from the east to the west and down to Ellerker Waste Water Treatment Works. Some older developments have surface water sewers which have unrestricted discharges into the land drainage system within the village. Any more recent or proposed development would be required to restrict the discharge from the site.

During the event the public sewer system was reportedly overwhelmed by overland flows as well as from water entering the system normally; this resulted in sewage flooding from manholes.

3.3 Highway Drainage

The highway drainage within the village either discharges directly into to the South Cave Beck or into surface water sewers which also discharge into the beck. Some drainage discharges into the combined sewers which in turn flows to the waste water treatment works at Ellerker.

In many cases where the highway floods, gullies were reported to be not working, however they were apparently unable to discharge into the receiving drain or sewer as these will have been overwhelmed by the volume of rainfall. This was confirmed when witnesses reported flood water which had been standing starting to flow away down the gullies once the rain had eased and the drains began to empty, indicating that the receiving drain or sewer had been full and gullies and branch sewers had restricted discharge.

3.4 Flooding History

There is documented history of flooding in the Market Place and along Church Street dating from 1841. In 2007 large areas of the village were similarly affected and the A63 also flooded.

The main roads into the Market Place, Brough Road, Station Road (A1034) and Beverley Road all fall into the village and then into Church Street. As a result any surface runoff during heavy rainfall will naturally follow this route resulting in the flash flooding which has been experienced.

The village has developed along the natural line of the watercourse, in particular West End is a flat area on the downstream section which surrounds the Beck. Not only is the development at risk but also the maintenance of the watercourse is more difficult due to restricted access.

Note:

There were further flooding incidents, with various roads in the village affected during heavy rainfall on 8 August 2014 as ex-Hurricane Bertha caused problems in many parts of the country including the East Riding. No property flooding was reported in South Cave as a result; this event is the subject of a separate Section 19 investigation.

3.4.1 Investment in Flooding

The Council have recently made substantial funding available for flood alleviation schemes in South Cave, with further works planned.

Completed works

ERYC/FRS/113 - £0.085M for South Cave Culvert Improvements, mainly in Beck Lane but including various minor works in other parts of the village, now all complete.

Planned Works

ERYC/FRS/111 - South Cave Village Flood Alleviation Scheme. - £0.7M , planned for 2017/18 Subject to funding.

The Council have applied for £0.6M of funding from national flood defence grant, £0.1M will be made available by ERYC if the bid is successful. -

4 The Flooding Event

The weather forecast for the 20 July was for bright spells in the afternoon which could possibly generate thunderstorms later, together with the possibility of flooding. There was an Amber Flood Warning in place for the whole of the east of England with a low likelihood of localised significant disruption from surface water flooding.

4.1 Weather Data

The rainfall data available is from the EA who have rainfall gauges to measure rainfall at that the gauge location, together with the Met Office rainfall radar which is interpreted to give an estimate of the rainfall.

The peak rainfall rate was estimated to be 36mm/hr and it is also estimated that in places up to 30mm of rain fell in 1 hour (see Appendix 3 Rainfall data). The long term average rainfall would be 74mm during July at this location.

4.2 Flood Warning System – Details

The Council receive updates from the civil contingencies arm of the Met office which gives warnings of any predicted disruption due to weather conditions, i.e. ice, snow, fog, high wind and rainfall.

The National Severe Weather Warning Service issues various warnings when forecast weather conditions are expected to cause disruption. (See Appendix 4)

A warning of low risk of disruption had been issued.

4.2.1 Severe Weather Warnings

For heavy rainfall, high winds, fog, ice and snow etc.

- Yellow Warning - Be Aware
- Amber Warning - Be Prepared
- Red Warning - Take Action

The joint Met Office and Environment Agency Flood Forecasting Centre provide a flood warning service based on weather forecasts and predicted river and tide levels.

The EA routinely issue alerts and warnings for forecast flooding, with warnings graded dependent on the expected severity.

4.2.2 Flood Warnings

- Flood **Alert**, Flooding is Possible. Be Prepared.
- Flood **Warning**, Flooding is Expected. Immediate Action Required.
- **Severe Flood Warning**, Severe Flooding. Danger to Life. Usually issued in consultation with Gold Group. (A multi-agency body responsible for co-ordinating the joint response to an emergency at the local strategic level.)

4.3 Reports

The Beck runs adjacent to Beverley Road (see figure 2) and the bank is low in places and so during times of high flow, overtops its bank into the highway. This led to water flowing across the frontage of properties lower down and has subsequently caused flooding. It also leads to additional surface flows into the Market Place with water running down from three directions towards the Sheep Wash (an entrance to the culvert) and then follows the contours of the land, down Church Street where low-lying properties are also affected.

The Beck runs in a culvert largely under the southern footpath along Church Street, with additional flows entering the culvert from developments to the north of Church Street. Flooding occurred along Church Street and at the Bowling and Tennis Clubs as well as on the road in front (see photos 4, 5, 6 & 7). There is a short open section of the beck across the bottom of Bull Pasture (see Appendix 1) before entering another culverted section from Thornham Close. The screen on this culvert entrance was found to be partially obstructed with debris after the event and this will be replaced by the Council by the end of the financial year.

Water also flowed down Church Hill and along West End before flowing down Beck Lane and re-joining the beck at the rear of Barnards Drive. The Council had recently carried out some culvert improvements where the beck crosses Beck Lane.

The beck banks are very low at the head of Barnards Drive, and service connections across the beck, to a recent property also restrict the flow leading to water overflowing from the beck into Barnards Drive and West Hall Garth. Additionally Jobsons Close and Lloyds Close cul-de-sacs were also flooded. Water then flowed out onto Pinfold with flows also coming down Annie Med Lane to the junction with Pinfold before passing under the A63. With water unable to flow away quickly enough the area was flooded.

This indicates that with flooding occurring all along the length of the route of the beck through the village, the main issues would appear to be the capacity of the beck culvert and the intensity of the rainfall.

In Pinfold a section of the beck had recently been culverted in a garden area by the property owner with the consent of the Council. This work is not believed to have contributed to the flooding in the area.

5 The Effects

Market Place/Church Street was flooded and water flowed along Church Street which was closed for some time due to standing water, see photos 4,5,6 & 7. This also flooded the tennis courts and bowling green, off Church Street.

In West End, Barnards Drive, Annie Med Lane, Pinfold, WestHall Garth and Jobsons Close and Lloyds Close cul de sacs were all affected

During a period of excessive rainfall the highway gullies are often reported to be blocked, but after the rainfall subsides the water drains away down the gullies. This is due to the receiving drain or watercourse being at such a level that the gully is temporarily unable to discharge until the flow reduces.

5.1 The Response

The Humberside Fire and Rescue Service: attended the Market Place, Church Street and Barnards Drive, reporting that no action was taken as the flood water was subsiding naturally.

Yorkshire Water Services:

YWS received reports from various areas in the village and have investigated reported issues, using CCTV and sewer cleaning. No significant issues with the sewer network were identified (see Appendix 5).

The Council's Streetscene Services: following the event the highway gullies in the area were checked and two gullies in Church Street were found to be not working. Further investigation found and repaired a damaged section of pipe together with some root ingress which was removed.

Flood Risk Operation: inspections of the watercourse and some culverts have been undertaken. A defect with a piped ditch which takes some highway water across gardens in Barnards Drive has been identified and will be repaired by the Council on a no prejudice basis.

The existing trash screen at Bull Pasture, Thornham Close is to be replaced by the Council during this financial year.

6 The Recovery

As is the nature of flash floods the water drained away once the rain stopped and the system started to drain down. This left many areas together with a number of properties in need of a clean-up. The Council arranged to collect large items of flood-damaged household goods from domestic properties at no cost. This service is offered to residents in an attempt to help them return to normal life as quickly as possible following flooding.

Council staff also contacted vulnerable residents to ensure that they had access to all available services to meet their needs.

Council Flood Risk Operations Engineers attended site to inspect the watercourse and further CCTV inspection of culverts were also carried out.

7 Causes and Investigation Findings

The rainfall data obtained from various sources gives differing values for the peak rainfall intensity and the overall total amount of rainfall. What is clear is that an extremely intense rainfall event passed over Market Weighton between 18:00hours and 19:00hours, before passing over South Cave between 19:00hours and 20:00hours.

From the analysis of the rainfall data obtained the flooding was caused by the intensity and quantity of the rainfall which overwhelmed the drainage system. This led to overland flows and surcharging of the drainage system, including the sewer network, which caused flooding to many parts of the village and to properties particularly in lower areas.

The peak estimated rainfall intensity for the storm in South Cave was 36mm/hr with a total estimated rainfall volume of 30mm in 1 hour. This compares to the normal average July rainfall for South Cave of 74 mm per month. Some 37 residential properties flooded with 14 properties suffering internal flooding.

The capacity of the beck was exceeded all along its length from Beverley Road, through Market Place, Church Street through West End and into Pinfold. This is consistent with the run-off being greater than the design capacity of the culverted sections of the beck as well as the capacity of its open sections.

The flow in the Beverley Road open channel section overtopped the bank at a low point and flowed down the road. Once the flow exceeded the capacity of the culvert in Church Street from the Sheep Wash in Market Place, water flowed across the surface, following the natural contours of the ground and flooding low lying properties.

The beck also overtopped its bank in Barnards Drive at a low point causing further overland flows through the West End estate.

The heavy rain led to surface flows in many areas of the village, where the water was unable to enter the drainage system which was full to capacity.

8 Conclusions

This Section 19 investigation concludes that on this occasion the rainfall was of exceptional intensity and exceeded current or historic design standards for drainage infrastructure. The culverted sections of the South Cave Beck were overwhelmed, the public sewer system was also overwhelmed, with resultant overland flows causing flooding to highways and to 37 properties.

The peak estimated rainfall intensity for the storm in South Cave was 36mm/hr with a total estimated rainfall volume of 30mm in 1 hour. This compares to the normal average July rainfall for South Cave of 74 mm per month.

It is therefore concluded that the South Cave Beck culvert along Church Street, at Westcott Farm and under the A63 were of insufficient capacity to deal with the intensity of the rainfall. However the data obtained indicates that the rainfall was greater than the current design standards. A more detailed study of the drainage system would be required in order to identify any areas for improvement.

The LLFA is required to conclude whether each of the flood risk management authorities identified has exercised, or is proposing to exercise, their functions in response to the flood incident. Following the investigation it can be concluded that the flood risk management authorities have or are proposing to exercise their relevant functions appropriately.

9 Recommendations

The investigation has identified a number of measures that potentially should improve flood resilience and these are set out in the following recommendations:

9.1 Recommendation 1

That the Council as LLFA continue to promote and develop the proposed major scheme for South Cave Flood Alleviation, programmed to commence in 2017/18.

9.2 Recommendation 2

That the Council as LLFA identify any elements of the programmed major scheme which could possibly be implemented ahead of the scheme, which would not compromise the funding of that scheme.

9.3 Recommendation 3

That the ~Council as LLFA in partnership with the EA establish a suitable flow level monitoring regime in the beck, in order to improve flood warnings for the village.

Abbreviations and Acronyms

Abbreviations	Description
AOD	Above Ordnance Datum
Dia	Diameter
EA	Environment Agency
ERYC	East Riding of Yorkshire Council
FCRM	Flood and Coastal Risk Management (Environment and Neighbourhood Services)
GWL	Ground Water Level
HFRS	Humberside Fire and Rescue Service
HVP	High Volume Pump
LLFA	Lead Local Flood Authority
IDB	Internal Drainage Board
ABP	Associated British Ports
Km	Kilometre
Km ²	Square Kilometres
Km/h	Kilometres per hour
Ha	Hectare
FWA	Flood Warning Area
m/s	Metres per second
mm/hr	Millimetres per Hour (Rainfall)
YWS	Yorkshire Water Services

Glossary

Foul sewer

This is a pipe laid to convey waste water (foul) only away from properties and to a waste water treatment plant, and maintained by Yorkshire Water Services.

Surface Water sewer

This is a pipe laid to convey surface water only away from properties to a proper outfall, and maintained by Yorkshire Water Services.

Combined Sewer

This is a pipe laid to convey both waste water and surface water away from properties to a waste water treatment plant, and maintained by Yorkshire Water Services.

Private Drains

These are pipes laid to convey both waste water and surface water away from properties which are the responsibility of the property owners, and are not maintained by Yorkshire Water Services.

Watercourse

This can be an open channel or piped/culverted to convey surface water away from an area, this will include land drainage as well as surface water from properties and highways. Watercourses, known as ordinary watercourses or main river, are generally maintained by riparian land owners with the Environment Agency using permissive powers to maintain main river.

Yorkshire Water's investment programme is funded on a 5 year plan with the new plan due to commence in 2015. As part of this, the company will be looking to work more closely with other flood risk management authorities to reduce flood risk in partnership.

Funding is generally allocated on the basis of the severity and frequency of the flooding, and by the costs of protection; "does the scheme give good value for money?"

Flood Protection Measures

Measures taken to prevent a property from flooding, also known as flood resistance measures i.e. Demountable door guards, air-brick covers, flood doors, barriers etc.

Flood Resilience Measures

Measures taken to reduce the impact of flooding on a property and to speed up the recovery after a flood i.e. raise floor above most likely flood level, replace chipboard flooring with solid floor (dense screed), replace gypsum plaster with lime plaster, move electrical outlets above flood level etc.

Design Standards and Return Periods

Return Period

Any drainage system or flood defence should be designed to a nationally accepted standard, this standard is often expressed as a return period (in years). It is an internationally accepted methodology.

A **return period**, is the chance of an event occurring in any year.

For example, a 1 in 100 year event has a 0.01 probability or 1% chance of occurring in any one year. It does not mean that a 100 year event will happen regularly every 100 years, or only once in 100 years.

Design Standard

The standards for sewer systems used in England and Wales are designed to provide protection from flooding from a 1 in 30 year event, (with a 0.033 or 3.3% chance of occurring each year). This generally means that no sewage should escape from a sewer in a 1 in 30 year event at the time when the sewer was constructed.

The current design standard for highway drainage is the Department for Transport; Design Manual for Roads and Bridges. The design standard for new highways is that flooding should not encroach into the main carriageway as a result of 1 in 5 year event (20% chance of occurring each year).

In contrast River and Coastal Flood defences are currently designed for a 1 in 100 year event and a 1 in 200 year event respectively with an allowance for climate change, as determined by Defra.

Funding for Flood Risk Management schemes

One of the main criteria for successful applications for funding for drainage works is that the proposed scheme must be designed to provide a standard level of protection, normally defined by a set return period.

Funding is generally allocated on the basis of the severity and frequency of the flooding, and by the costs of protection; “does the scheme give good value for money?”

Future Developments and Sustainable Drainage

Any new residential or commercial development planned within the town would be required, under planning conditions, to manage surface water within the development. The discharge of surface water into the existing drainage system must be restricted to no more than the existing rate, and if possible to reduce it. This must be achieved within the development itself usually by attenuating flows during storm conditions or times of high flows and discharging at a controlled rate to prevent any increased flood risk to any other area.

Appendix 1: Plan of Reported Flooded Areas



Appendix 2: Properties and Areas Affected

Reported Property Flooding

South Cave

External

Annie Med Lane	2	
Church Street	1	
Ferry Road	1	
Jobsons Close	2	
Jobsons Road	1	
Lloyds Close	1	
Middle Garth Drive	1	
Pinfold	5	
West Hall Garth	8	
St Katherines Road	1	23

Internal

Church Street	7	
Market Place	4	
Pinfold	1	
West Hall Garth	2	14

Total **37**

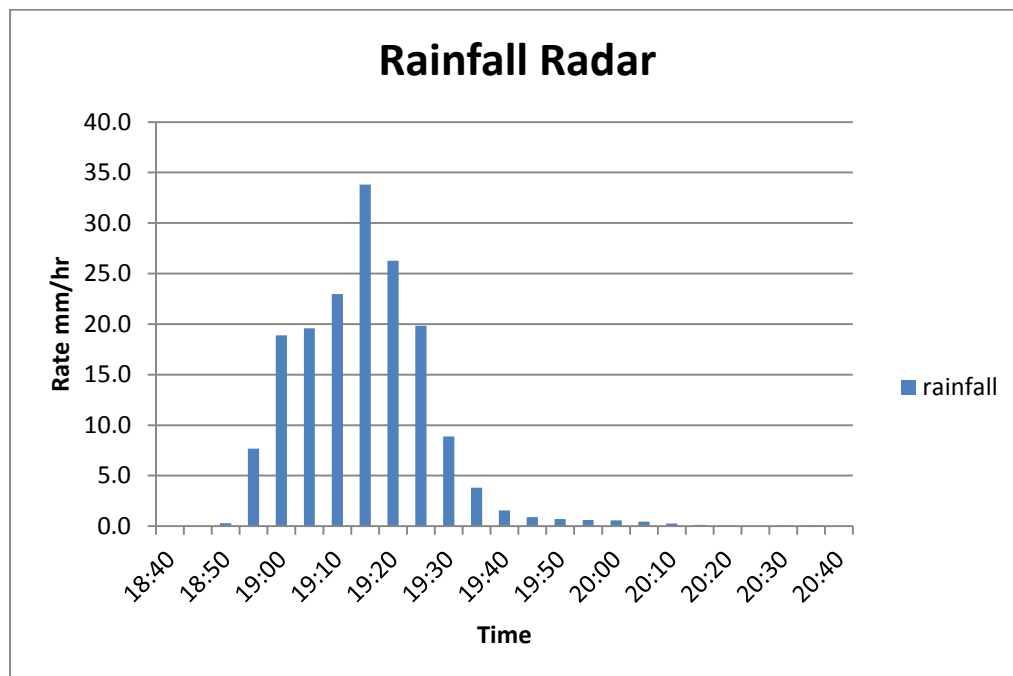
Reported Surface and Area Flooding

Middle Garth
Highfield
Beverley Road
Market Place
Church Street
Beck Lane
Barnards Drive
West Hall Garth
Jobsons Close
Lloyds Close
Annie Med Lane
Pinfold
St Katherines Road
Thornham Close
Southcote Close

Appendix 3: Rainfall Data Obtained

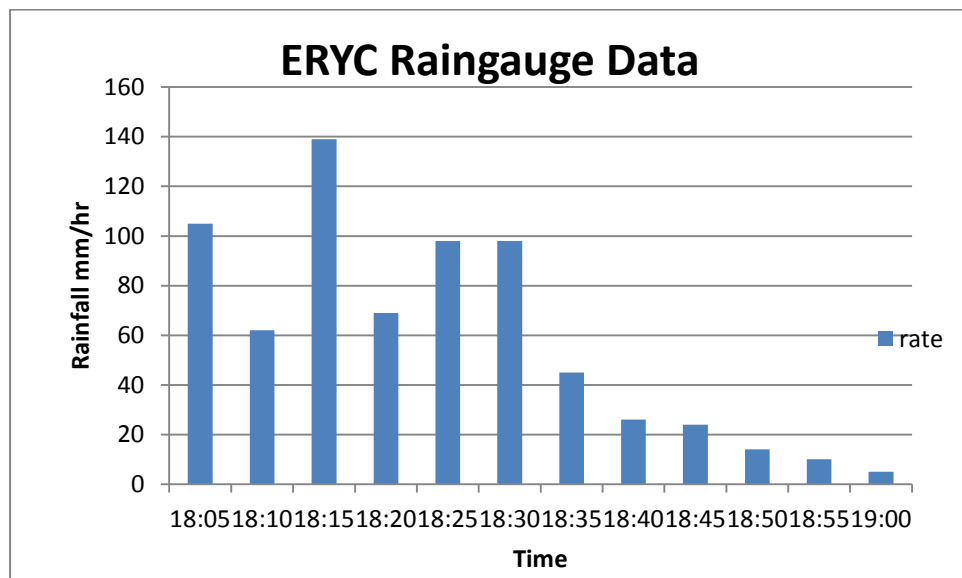
South Cave Rainfall Data:

Rainfall Radar from Met Office, estimated at the centre of the village.



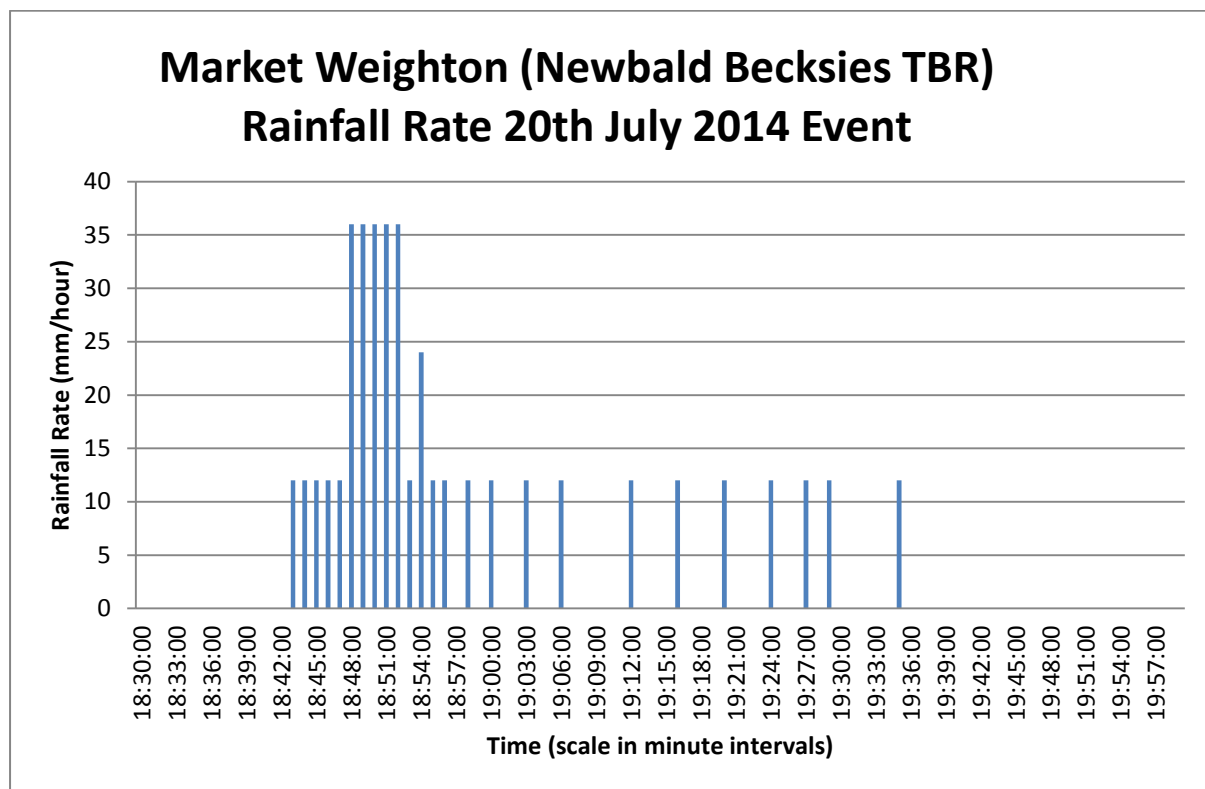
From the Met Office rainfall Radar data, Peak rate 34mm/hr

At this location total of 13.7mm fell between 19:00 and 20:00, an estimated return period of 2 years.



East Riding of Yorkshire Council Rain Gauge at Market Weighton depot, recorded a peak rate of 139mm/hr and a total of 60mm in one hour. This event was 30 minutes before the same storm hit South Cave.

EA rainfall data from the rain gauge at North Newbald



This shows the peak rainfall rate of 36mm/hr in a 5 minute period, with 7.2mm falling in one hour.



Although the rain gauge is only 5km (3 miles) to the north of South Cave the recorded rainfall was much less than the estimated rainfall from the EA’s estimate based on radar data. This is consistent with the nature of summer storms, which often result in very localised intense rainfall such as has been experienced during the summer of 2014.

It is estimated by the EA that in places up to 30mm of rain fell in 1 hour (1 in 101year return period)

Long Term Average Rainfall is 74mm in July.


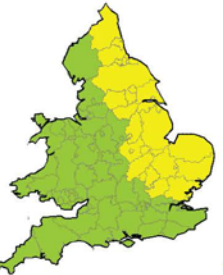

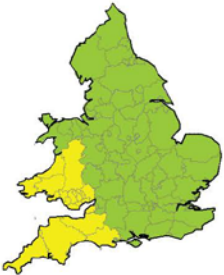
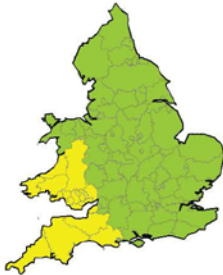
Appendix 4: Flood and Weather Warnings

FLOODFORECASTINGCENTRE

a working partnership between  

Flood Guidance Statement 19:00hrs Thursday 17 July 2014

Our assessment of daily flood risk for England and Wales, working with flood forecasting teams in the Environment Agency and Natural Resources Wales, is below.



19:00 - 23:59hrs
Thursday
17 July 2014

Friday
18 July 2014

Saturday
19 July 2014

Sunday
20 July 2014

Monday
21 July 2014

1900 BST issue: There is now a LOW overall flood risk this evening and into tomorrow morning. There is also a low likelihood of localised surface water and river flooding on Saturday and Sunday morning.

General overview of flood risk

There is now a very low likelihood of surface water and river flooding in the south-west of England and parts of Wales this evening and overnight due to an area of thunderstorms moving north.

There is also a low likelihood of significant disruption from surface water and a very low likelihood from river flooding, as torrential rainfall is possible across much of England and Wales on Saturday. Thunderstorms with heavy rain and hail may give locally significant impacts over a wide area during Saturday, and then over the east of England into Sunday morning.

Assessment of flood risk

Surface water

There is a LOW flood risk with significant disruption from surface water flooding possible across the south-west of England and parts of Wales this evening and into tomorrow, and then again across much of England and Wales on Saturday and Sunday morning.

Torrential rainfall from thunderstorms is expected to move across the south-west of England and parts of Wales this evening and into tomorrow, and then again across England and Wales during Saturday and into the east of England on Sunday morning. Tonight and tomorrow morning there is a very low likelihood of significant impacts and on Saturday and Sunday there is a low likelihood of significant disruption, leading to an overall LOW surface water flood risk. Where seen, impacts could include significant disruption to travel on roads and rail with fast, and perhaps deep, flowing water leading to a number of roads closures. Surface water flooding of properties and parts of communities, particularly in urban areas is possible, as is the disruption to key sites such as utility and transport infrastructure.

Further isolated showers are possible later on Friday and on Sunday across England and Wales. These showers may lead to localised minor disruption from surface water flooding, however the likelihood of disruption in any one county is currently low and therefore the overall flood risk remains VERY LOW for these.

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Flood Guidance Statement Issued 10:30 20 July

Rivers

Heavy rainfall and thunderstorms are expected to develop across the east and north of England through this afternoon (Sunday), bringing a very low likelihood of localised significant river flooding impacts, particularly in fast responding river catchments and rivers in urban areas, giving a LOW overall river flood risk. Larger river catchments are unlikely to see significant flooding impacts owing to the localised nature of the heavy rain.

Where the heavy rain occurs, impacts may include significant disruption to travel on roads and rail networks with fast, and perhaps deep, flowing water leading to a number of roads closures.

Elsewhere and at other times the overall river flood risk is VERY LOW.

Coastal / tidal

The coastal / tidal flood risk is VERY LOW for the next five days.

Groundwater

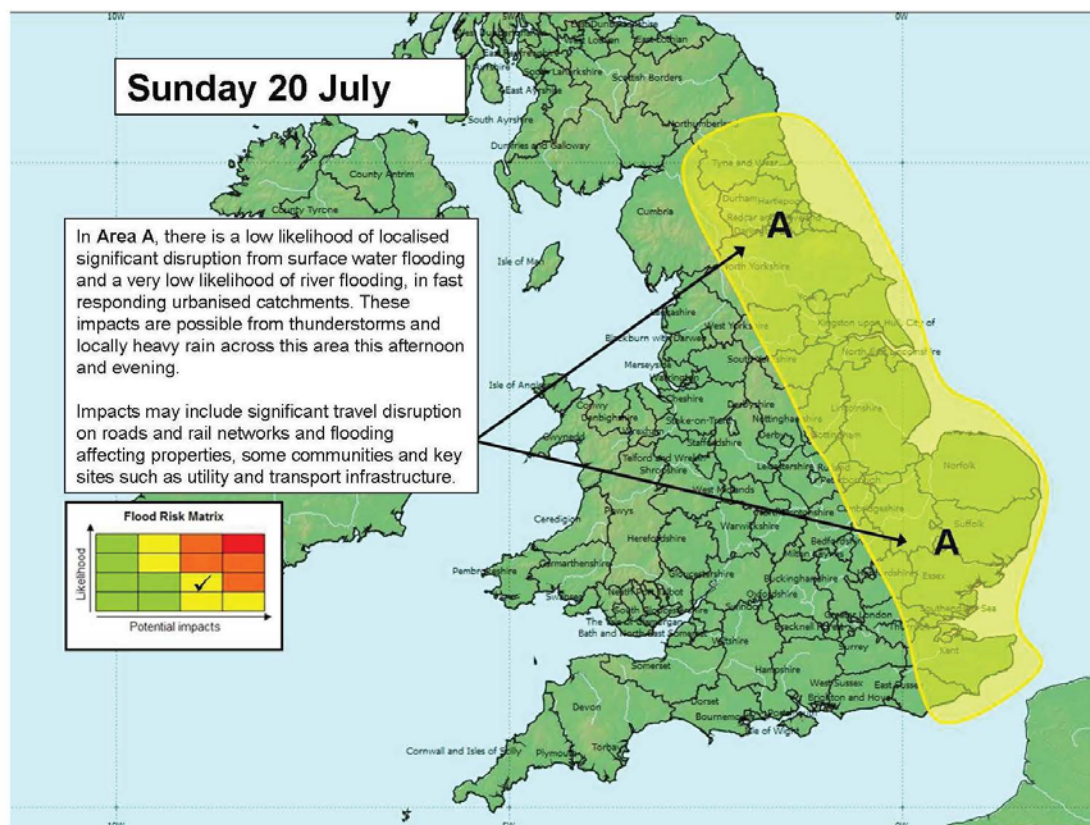
The groundwater flood risk is VERY LOW for the next five days.

Warnings and Alerts in force in England and Wales at 10:30hrs

Flood (click here)	
Severe Flood Warnings	0
Flood Warnings	0
Flood Alerts	38

Severe Weather (click here)	
Warnings	Yes
Alerts	No

Specific areas of concern



Next statement due: 10:30hrs Monday 21 July 2014

Advice issued by the Civil Contingencies Office at the Met Office on 19 July

Areas of rain, locally heavy, continue to wend their way northwards across the country this morning. My sense at this stage in proceedings is that with the rain across Yorkshire and the Humber more of a steady nature, we've so far got off reasonably well. However, we're not out of the woods yet, as I will explain below.

The forecast sequence for the rest of today is for further patchy rain to transfer northwards across Yorkshire and the Humber, but with a tendency towards something of a drier, brighter spell this afternoon. Whilst these initial areas of rain will not cause any issues the concern is that within any sustained brighter periods, the rising temperatures and high humidity will trigger some 'locally-generated' storms (initiated either directly within the region or drawn northwards from the Midlands) later this afternoon and into this evening and it is these that could produce the locally very high rainfall rates and frequent lightning activity with consequent disruption to transport and possibly power supplies. Hence we need to keep a watching brief on the rainfall radar, especially if we do get into a brighter interlude and the sun raises the temperature sufficiently to initiate the afore-mentioned locally produced storms.

This morning's Flood Guidance Statement was issued early this morning (0700) and retains all of Yorkshire and the Humber on Amber (medium) flood risk. In tandem with this the existing Amber Warning for rain will be re-issued shortly for the remainder of today (medium likelihood of some significant impacts) again containing all of the region within its borders. Please refer to the FGS for a full description of the flood risk across the region.

Overnight tonight activity should steadily wane with many parts dry by tomorrow morning. Through tomorrow, after a dry, bright morning, a scattering of heavy and locally thundery showers will develop by the afternoon, mainly across the eastern half of the region (approx east of the A1). Yesterday's Yellow Alert (low likelihood of significant impacts) for these remains in force.

On the plus side it's back to more settled, warm weather for the first half of next week.

No further updates are planned in relation to the current event but I would again emphasise the wisdom of continued radar monitoring, especially later this afternoon/evening.

Flood Warning issued by the EA at 22:53 on 20 July

Important Information.

A Flood Warning has been issued by the Environment Agency for the North Cave Beck at North Cave. Flooding is expected for Properties on Denmark Rise, Mill Lane, Church Street, Blanshards Lane, Townend Lane and Newport Road are at risk of flooding.

Immediate action required.

Flooding is expected to affect up to 82 properties in this area. The flood warning for North Cave Beck at North Cave has been issued due to recent heavy rainfall over a short period of time. The current river level is 0.5m and we are also aware of some surface water flooding. We are sending operatives to monitor the situation. We are not expecting any further significant rainfall, however due to the thundery nature of the weather, we will continue to monitor the situation.

Appendix 5: Yorkshire Water Services Response

South Cave S14 Information Request

Areas Reporting Problems and works undertaken:

Pinfold- EXT flooding- Foul and SW checked with CCTV- No issues found

Southcote Close- EXT flooding to garage- Foul T2011 checked- No issues found

Church Street- INT flooding- Located blockage on T2011- All cleared

Middle Garth Drive- EXT flooding- Investigation found non YW, runs into soak away

St Katherines Road- EXT flooding- Flooding in garden caused by beck- No YW issues found

Market Place- EXT flooding to garden. T2011 assets check, no issues found. Vactor attended for street clean up

Southcote Close- EXT flooding to garden. SW line checked and runs to soakaway, no issues

Annie Med Lane- EXT flooding reported. Foul and SW checked, no issues found. Customer confirmed SW flow

Thornham Close- EXT flooding on field reported. CCTV of SW line found silt issues, now removed . Culvert screen found to be blocked

Any estimates of Rainfall figures, and return periods for the event on 20 July

Rainfall radar shows an average of 1 in 7.5 year return period with high's of 1 in 14

Details of the reported affected areas and properties in South Cave and North Cave

Please see attached customer contacts detailing location/order & works (above)

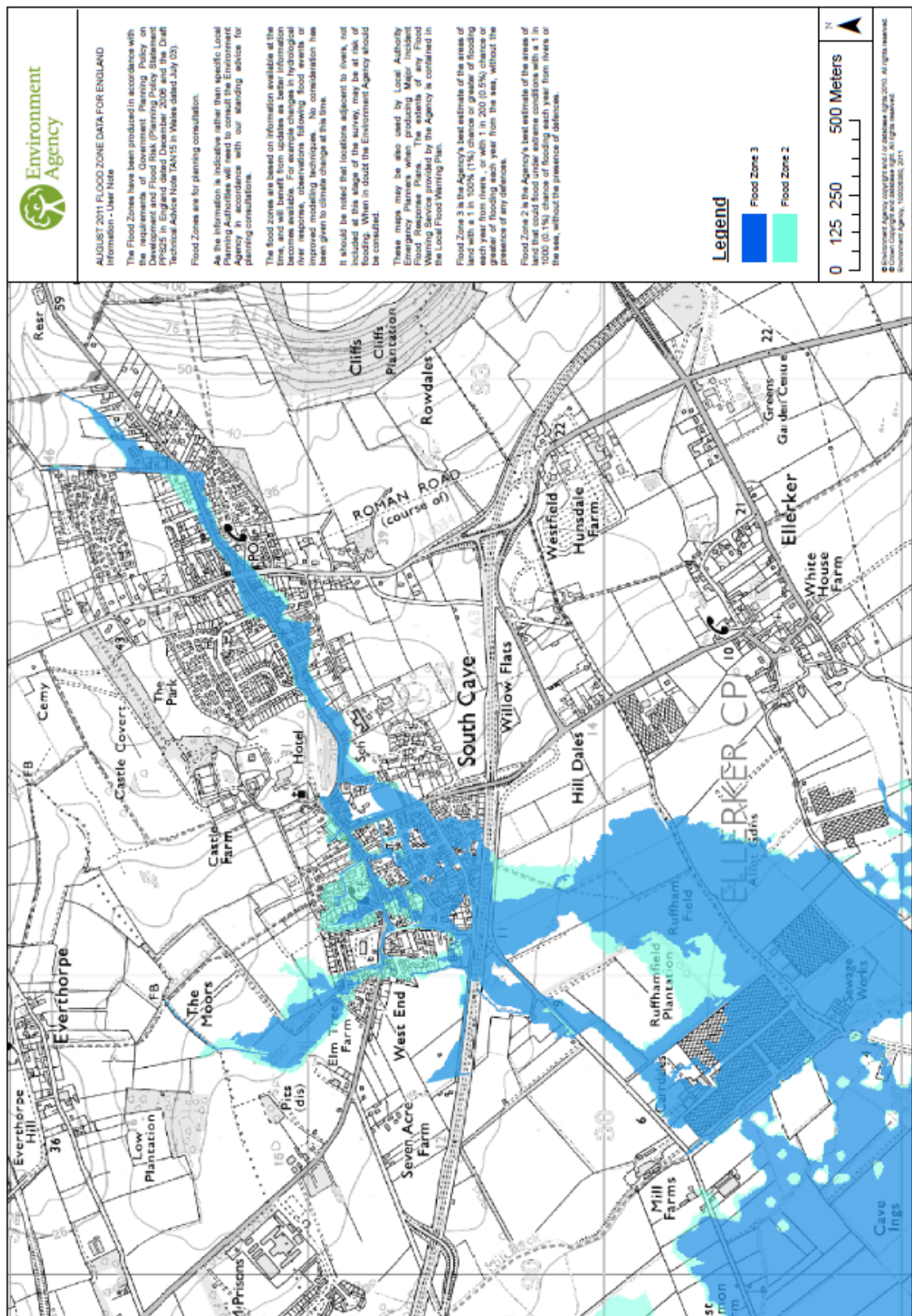
Any faults or significant defects found? ie blockages, pump failures etc?

Field located east of Thornham Close SW sewer, large amounts of silt were found during CCTV investigation, this has now been removed. The inlet to the culvert (non YW) was also found to be blocked.

Any level or flow data available for the network

None?

Appendix 6: The EA Flood Map



Appendix 7: Photographs



Photo 1: Highfield off Beverley Road, showing the intensity of the rainfall



Photo 2: South Cave Beck at Trinity Fold, Beverley Road, (weeds now removed.)

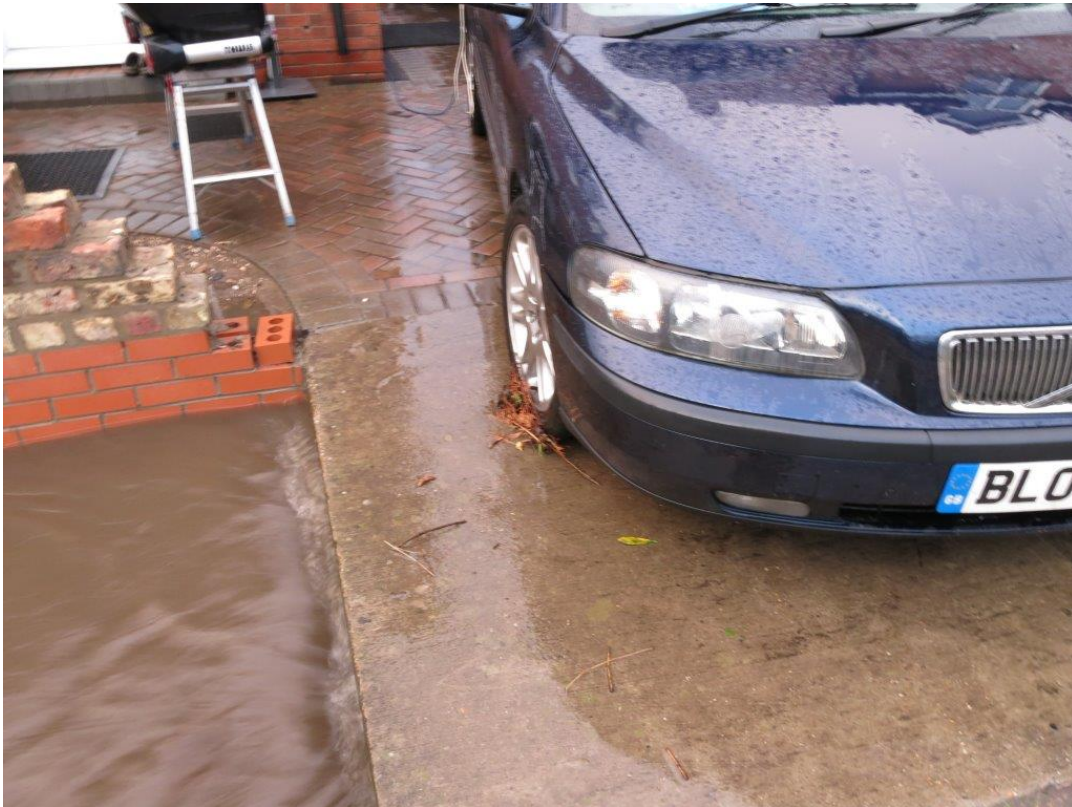


Photo 3: South Cave Beck at Trinity Fold showing evidence of overtopping of the drive crossing



Photo 4: Bowling green and tennis courts, Church Street



Photo 5: Church Street, road flooded and open section of the Beck



Photo 6: Church Street, road flooded and open section of the Beck



Photo 7: Church Street, draining down slowly



Photo 8: Thornham Close, Bull Pasture Screen (which ERYC are replacing)



Photo 9: Beck Lane looking upstream towards West End



Photo 10: Beck Lane looking downstream, (walkway on the left under water)



Photo 11: Barnards Drive, Beck overflowing into the road



Photo 12: Annie Med Lane



Photo 13: Taken from 10 Annie Med lane



Photo 14: The Garden at 10 Annie Med Lane



Photo 15: The Beck at Pinfold, showing new culvert outlet

Appendix 8: Flood Resilience Information for Property Owners

People who have been flooded before have found the following guides helpful:

The Environment Agency's flood advice can be accessed here:

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

Two Environment Agency documents that might be particularly useful are: Protecting your home:

<http://cdn.environment-agency.gov.uk/geho1009brdl-e-e.pdf>

and Temporary and Demountable Defences:

<http://evidence.environment-agency.gov.uk/FCERM/en/FluvialDesignGuide/Chapter9.aspx?pagenum=10>

Homeowners guide to flood resilience:

<http://www.knowyourfloodrisk.co.uk/pdf/protection-guide.pdf>

The National Flood Forum. Ready for flooding:

<http://nationalfloodforum.org.uk/wp-content/uploads/Ready-for-flooding.pdf>

The British Insurance Brokers Association (www.biba.org.uk). Guide on getting insurance for high risk flood areas:

<http://www.biba.org.uk/UploadedFiles/600floodguide.pdf>

The Royal Institute of Chartered Surveyors. A clear guide to flooding for property owners:

http://www.rics.org/Global/Downloads/A_clear_guide_to_Flooding_for_property_owners.pdf

The Association of British Insurers. A guide to resistant and resilient repair after a flood:

http://www.abi.org.uk/Publications/ABI_Publications_A_guide_to_resistant_and_resilient_repair_after_a_flood_670.aspx

More information is available on the ERYC Website, on the A to Z, F - 8 Flooding, Flooding and Flood Preparation.

Appendix 9: Useful Links and Contact Details:

Lead Local Flood Authority

East Riding of Yorkshire Council
County Hall
BEVERLEY
East Riding of Yorkshire
HU17 9BA

(01482) 887700

www.eastriding.gov.uk

fcerm@eastriding.gov.uk

Statutory Sewerage Undertaker

Yorkshire Water Services Ltd
Western House
Halifax Road
BRADFORD
BD6 2SZ

(08451) 242424

www.yorkshirewater.co.uk

Environment Agency

Dales Area Office
Coverdale House
Amy Johnson Way
Clifton Moor
YORK
YO30 4UZ

General Enquiries:
0870 850 6506
(Mon-Fri, 8am -6pm)

www.environment-agency.gov.uk

Incident Hotline:
0800 807060
(24hrs)

