



Stockton-on-Tees
BOROUGH COUNCIL

Lead Local Flood Authority Flood Investigation Report

**Flooding Incidents in various locations in the
Borough of Stockton on Tees on 25th & 26th
September 2012**

Final Report

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Executive Summary

The summer of 2012 was the wettest ever recorded leading to saturated ground and high river levels. On the 25th and 26th September 2012 after more than 24 hours of persistent heavy rain, the Borough of Stockton on Tees experienced the worst flooding in decades.

The most severely affected were the communities along Lustrum Beck and the residents living in Norton near to Billingham Beck. The trunk road network (A19/A66) was also severely affected leading to wide spread traffic disruption. We estimate that in the region of 150 properties and businesses were affected internally but the exact number may never be known as not all residents report flooding to their properties.

Flooding occurs from various sources which are outlined in the report. The main sources of flooding from this particular weather event were fluvial and surface water flooding, with the addition of run off from water logged fields in certain areas.

Under Section 19 of the Flood and Water Management Act 2010, Stockton on Tees Borough Council as the Lead Local Flood Authority (LLFA) is required to investigate flooding incidents within its area, and this report examines six specific locations which satisfy locally agreed criteria. The locations investigated are Browns Bridge and Newtown, Hartburn, Norton and Billingham Bottoms, Orde Wingate Way businesses, Portrack Retail Park and the A66 at Long Newton.

We have examined each of the six locations where flooding was severe and asked questions of our risk management partners to help us understand what may have been the issues in these particular locations. The results from the investigations will form an action plan and we will work with our risk management partners, in reducing the risk from future events.

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1. Introduction

1.1 Lead Local Flood Authority Investigation

The Flood and Water Management Act 2010 (FWMA) gained royal assent in April 2010 and established unitary local authorities as Lead Local Flood Authorities (LLFAs). Stockton Borough Council as LLFA has the duty to investigate a flood event when considered necessary or appropriate under Section 19 of the FWMA.

Section 19 Local authorities: investigations

- (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 investigation under subsection (1) it must –
- a) publish the results of its investigation, and
 - b) notify any relevant risk management authorities.

Flood and Water Management Act (2010), S.19, c.29, London: HMSO³

The Tees Valley authorities through the Tees Valley Strategic Flood Risk Partnership agreed that an investigation for a flood event, is deemed locally significant and considered appropriate, if one or more of the following is affected by flooding:

- 5 or more residential properties;
- 2 or more businesses;
- 1 or more critical services;
- 1 or more transport links (Impassable for 10 Hours or more).

The severe event (thought to have exceeded the 1 in 100 year event) which occurred on the 25/26th September 2012, resulted in major flooding across many parts of Teesside and it has been described as the worst flooding in decades.

Stockton Borough Council as LLFA deemed it necessary to complete an investigation due to the vast amount of properties that flooded internally including some businesses and many roads closures across the Borough.

This investigation report provides a concise review of the roles and responsibilities of all risk management authorities involved, and an outline of their past or proposed actions, if any. Recommendations for a possible way forward will also be detailed.

1.2 Stockton on Tees

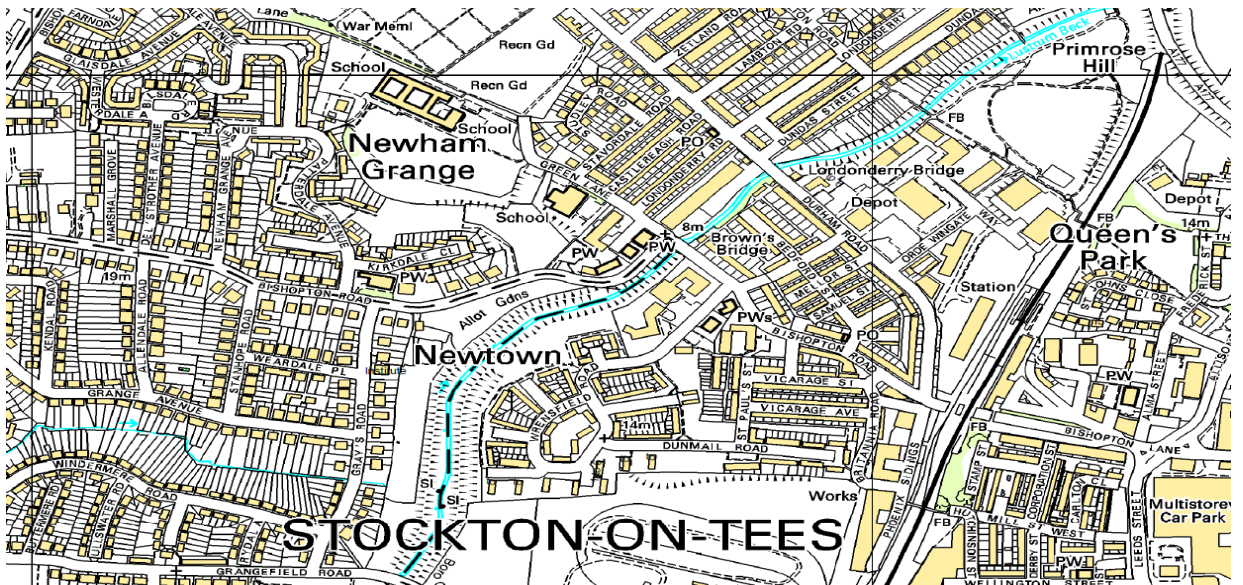
The major watercourses in the borough are the River Tees, Lustrum Beck, the River Leven, Cowbridge Beck, part of the Old River Tees, Homefleet Beck, Saltergill Beck and Billingham Beck which are all classified as Main Rivers. The main source of flooding in the borough is tidal and fluvial from the river tees and other urban watercourses. Certain areas can also be prone to surface water flooding.

The tidal flood risk is particularly extensive, placing large parts of the industrial area on the north bank of the Tees Estuary and other, more central parts of the Borough, at risk. Tide locking (prevention of fluvial flow discharging due to high tide levels) is also a contributing flood risk factor on many watercourses that flow into the tidal Tees.

1.3 Site Locations

During the incident on 25th and 26th September 2012, the worst affected areas included communities around Browns Bridge, Hartburn, Billingham Bottoms, businesses on Orde Wingate Way and Portrack Retail Park. The A66 was also closed due to flooding for a considerable time causing disruption to travel.

1.3.1 Browns Bridge



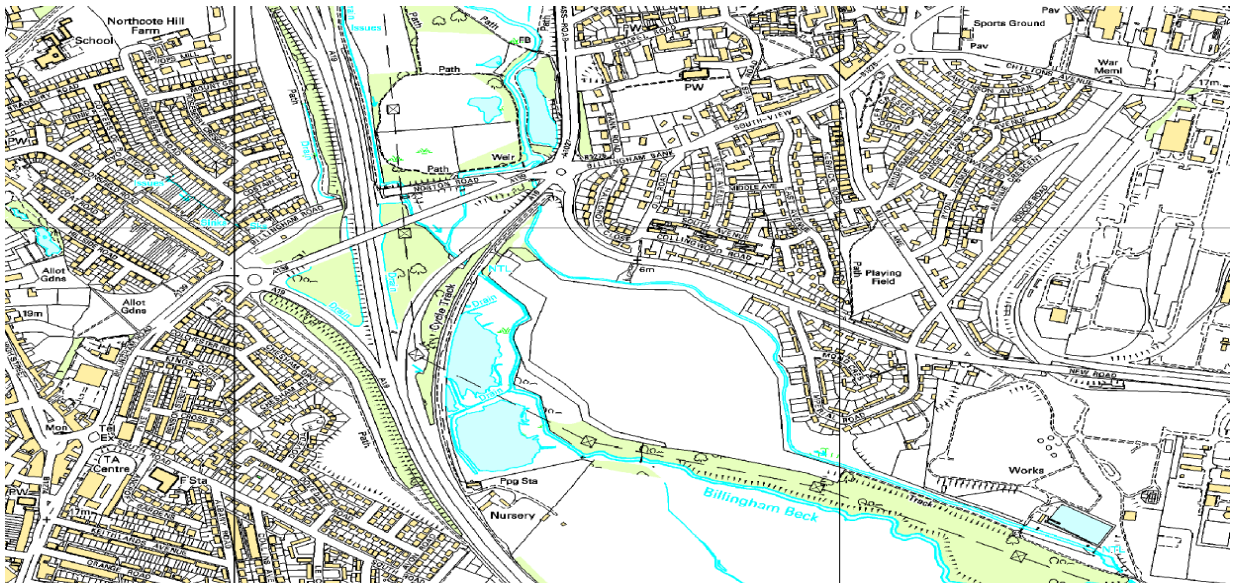
Browns Bridge is situated within the Newtown area, Stockton on Tees and is within close proximity to Stockton town centre (Grid Reference NZ4377119735). It is a predominantly residential area with Bishopston Road providing essential public transport links into Stockton town centre.

1.3.2 Hartburn



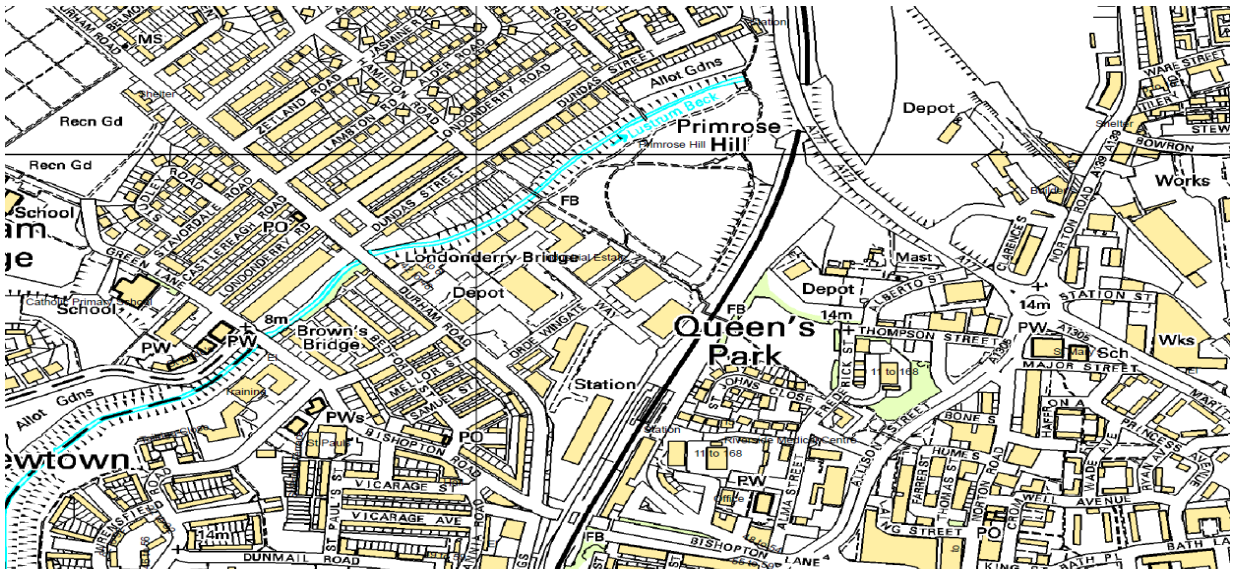
The Hartburn area lies west of Stockton town centre (Grid Reference 443019,518600). The area is predominantly residential and Lustrum Beck runs between the Hartburn and Oxbridge areas.

1.3.3 Norton and Billingham Bottoms

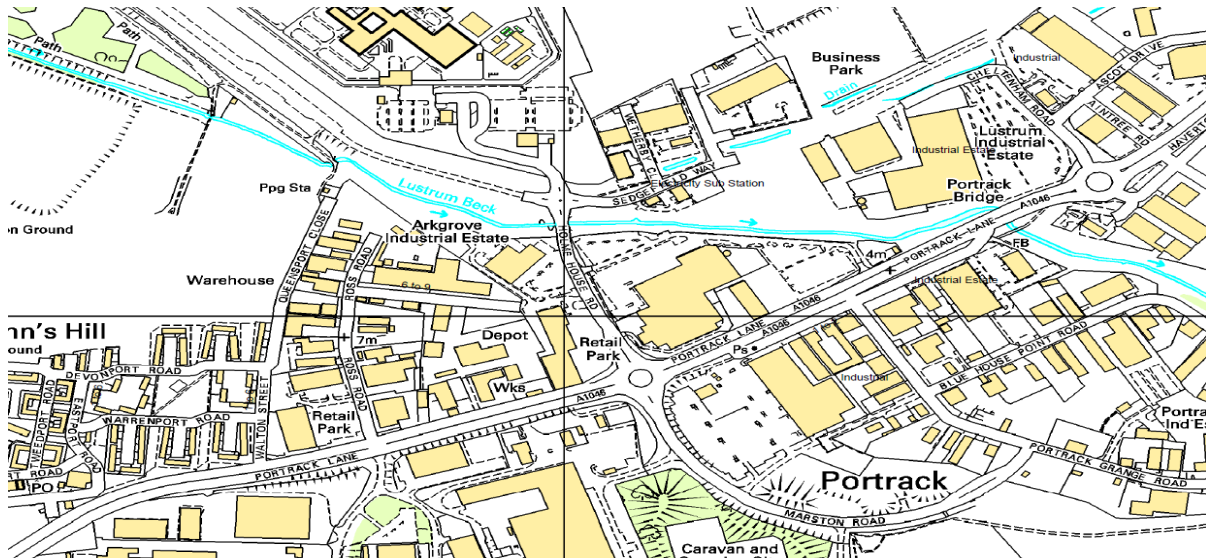


Billingham Beck is located to the north of the Borough and runs parallel to the A19 Trunk Road (Grid Reference NZ45373,22014). Billingham Beck is a tidal river, and has a wide floodplain. A large proportion of the area is agricultural land, with a residential area located to the West

1.3.4 Orde Wingate Way Businesses



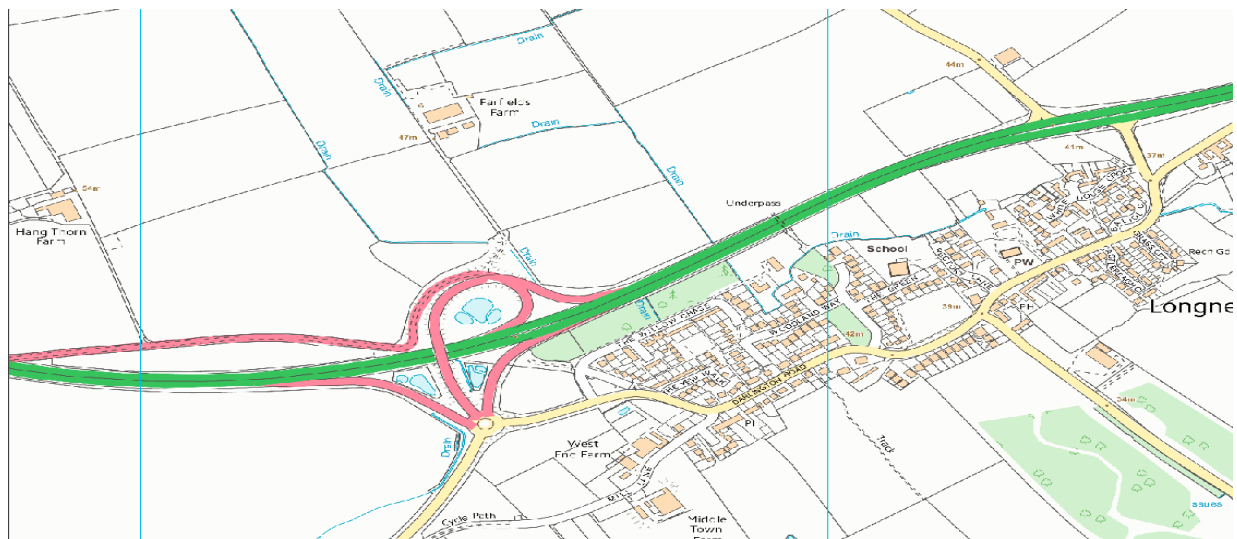
The businesses on Orde Wingate Way are located within the Primrose Hill area of Stockton on Tees. The businesses are within close proximity of Stockton town centre. Lustrum Beck runs adjacent to some of the business units.



Portrack Retail Park is predominantly industrial land comprising of many business units. Portrack Business units are located north-east of Stockton on Tees Town Centre. HM Holme House Prison is also located on Holme House Road.

1.3.6 A66 Long Newton Interchange

The A66 long Newton interchange lies west of long Newton village. The A66 trunk road provides essential links between the borough of Stockton on Tees and Darlington.



1.4 Other Flooding

This report concentrates on the areas listed above, as they are large areas meeting locally agreed criteria. It should be recognised however that a number of other areas in the Borough also suffered from flooding leading to devastation and disruption to residents.

Some of the other areas to suffer flooding include;

- Severe flooding to 3 properties at Aislaby from Nelly Burdon's Beck, 2 of the 3 properties were affected internally.
- Severe garden and highway flooding at Grays Road from the ordinary watercourse which is a tributary of Lustrum Beck, a number of properties on Grays Road and Grange Avenue were affected by external flooding however the flood water is not known to have entered the properties.
- A67 Uraly Nook Road closed due to flooding
- Port Clarence Road closed due to flooding under the rail bridge
- Flooding to Yarm High Street occurred however the high street remained open and was passable with care.
- Severe flooding to the gardens of Costain Grove, Norton.
- Severe flooding to approximately 64 gardens and allotments on Dundas Street.

2. History

2.1. History of Flooding

This section details the previous flooding history of the sites that were most severely affected during the 25th/26th September 2012 incident, provides information on any flood defence features already in place and any maintenance or monitoring systems in place.

2.1.1 Browns Bridge/Newtown

The existing flood defences within Newtown area were constructed in the 1960's and consist of 1200m of earth embankment and 100m of retaining wall.

The flood events that occurred during March 1979 and November 2000, resulted in severe flooding at Bishopton Road and Wrensfield Road, the adult Training centre, Newtown Methodist Church, Kingdom Hall and Wrensfield School. Fifteen properties along Bishopton Road, eight along Bedford Street and several properties along Duddon Walk were also flooded. During the peak of the November 2000 event the existing flood defences were approximately 100mm from overtopping. Following the November 2000 event investigations identified two flooding mechanisms, firstly the deck of Browns Bridge is below the top level of the existing flood defence by approximately 170mm which results in floodwater spilling across Bishopton Road. Secondly the floodwater backed up through the drainage system and surcharged the system at the junction of Bishopton Road and Wrensfield Road.

2.1.2 Hartburn

The events that occurred during March 1979 and November 2000, resulted in severe flooding over both the left and right banks. On the right-bank, land associated with Ropner Park was flooded; along with 124a Oxbridge Lane, Stockton Council's training nursery and Teesside Airports beacon station. The properties of 51 and 53 Hartburn Avenue were flooded up to a depth of approximately 750mm. Greens Beck exacerbated the flooding by discharging across Hartburn Avenue. The properties of 1, 3, 5 and 7 Burnside Grove and 126, 128 and 130 Oxbridge Lane were also flooded as a result of Lustrum Beck overtopping.

In 2007 flood defences involving sheet piling and low floodwalls funded from Local Levy, were constructed in the gardens of No. 45, 51 and 53 Hartburn Avenue in order to protect the houses from flooding.

There are no flood defences upstream of Darlington Road Bridge. The west end bowling club located at the confluence of the rural and urban catchments is elevated at approximately 8.4m AOD (Above Ordnance Datum) During the March 1979 and November 2000 events flooding occurred over the right bank causing flooding to the Bowling Green, changing room building and car park. There were also three properties along Darlington Road, numbers 2, 4 and 6 affected by the flooding.

2.1.3 Norton/ Billingham Bottoms

There are no constructed flood defences along Billingham Beck however the Beck is constrained by elevated banks along its course. Billingham Beck has been known to overtop its banks however it does have a wide floodplain. The areas affected by flooding are in Norton, Haverton Hill and Bishopton Bridge areas to the North of Stockton. The area is mostly agricultural including a golf course with few properties at risk of flooding.

2.1.4 Orde Wingate Way Businesses/Primrose Hill Area

The existing flood defences within Primrose Hill Area were constructed in the 1960's and consist of earth embankments along the left bank. Flooding to the allotments and residential gardens occurred during the November 2000 event. Business units on Orde Wingate Way have recently been constructed along the right-bank, with threshold levels of 6.95m AOD which is above the existing 1 in 100 year level. These units were not flooded during November 2000.

During the September 2012 event some units here were flooded, which means that the event which occurred exceeded 1 in 100 year.

2.1.5 Portrack Retail Park

The existing flood defences located within Portrack Retail Park area consist of flood banks along the watercourse Lustrum Beck and tidal screens at the confluence with the River Tees.

2.1.6 A66 Long Newton Interchange

The A66 Long Newton Interchange and associated drainage including the balancing ponds were constructed and have been fully operational since May 2008.

Prior to the 25th/26th September 2012, there were no recorded incidents in this area and no history of flooding of which the Council has been aware. However since the September 2012 incident, and at the time of writing this area has seen flooding on 12th October 2012 and 25th, 26th and 27th November 2012, causing the closure of the A66, resulting in traffic being diverted onto the Local Authority's highway network.

2.2. History of Lustrum Beck

Lustrum Beck is classed as a Main River and flood risk management is the responsibility of the Environment Agency. The existing flood defences along Lustrum Beck were constructed in the 1960's. The historic significant floods that have occurred on Lustrum Beck are those from 1979 and 2000.

Lustrum Beck has a history of flooding dating back to 1771 with the worst flood occurring on the 29th of March 1979, which included substantial flooding of land, residential and commercial properties. Further floods occurred in April, June, October, and November 2000 all of which affected properties along Hartburn Avenue and the area around Browns Bridge. It was reported that properties along Darlington Road, Burnside Grove, Oxbridge Lane, Bishopton Road, Wrensfeld Road, the Adult Training Centre, Newtown Methodist Church, Kingdom Hall and Wrensfeld School were also affected by flooding during the severe event in November 2000.

The number of residential and commercial developments built over the years has created additional surface water run-off, and some are built on floodplain land that would have once stored much of the floodwater. Basically this means there are more properties but less surface area to store any floodwater.

A wider scheme for Lustrum Beck was considered by the Environment Agency in 2003 but due to the extremely high cost the scheme did not go ahead.

This flood alleviation scheme included a flood storage area at Hartburn and localised defences in the form of embankments, sheet piling and concrete floodwalls at the downstream area of Oxbridge, Newtown and Tilery. A plan of this scheme can be found in the appendices.

The scheme was considered through the Environment Agency's funding mechanisms which were available in 2003, whereby a scheme either secured full Flood Defence Grant in Aid (FDGiA) or no funding whatsoever, and unfortunately Lustrum Beck fell into the latter category so could not proceed.

A new funding mechanism, "Partnership Funding" was introduced in May 2011 which meant schemes can now be part funded by FDGiA, while the rest of the funding would need to be secured from other sources. A wider scheme for Lustrum Beck would now attract some FDGiA and so the Environment Agency felt that this would warrant further investigation but would also mean other funding would be required. Council Officers have requested that the Environment Agency also re-assess the costing to ascertain whether the overall cost of this scheme could be significantly reduced or whether a number of smaller schemes or measures would be more appropriate and affordable, these discussions are on-going. As it stands the large six fields scheme only attracts a low level of FDGiA funding and in the absence of other funding, the scheme is not economically viable.

Another small funding stream is through the Regional Flood & Coastal Committee, who raise a "local levy" to spend on key priorities in the area. Before partnership funding came into effect, local levy was mainly spent addressing some of the highest flood risk areas that did not qualify for central FDGiA. The area by Hartburn Avenue was the most vulnerable with only a 1 in 2 year standard of protection and therefore the RFCC allocated some funding to progress some local defences in the area first. The next highest risk area identified by the Environment Agency for local levy was Browns Bridge with a 1 in 20 year standard of protection and initially £150k was allocated for a small scheme. The Environment Agency commenced consultation with local residents on ideas for a scheme however; these works were not progressed due to the implementation of Partnership Funding and the Environment Agency's proposal to explore a wider and bigger scheme which would offer more protection.

A number of meetings have taken place between Stockton Borough Council and the Environment Agency, the Council have requested that the EA look to provide a scheme with the £150k that was originally allocated. However it is accepted that the proposed flood wall would have only provided a 1 in 30 year standard of protection and would have been exceeded, but it would afford some protection against lesser events. It is possible that a slightly larger scheme may attract some extra funding through FDGiA and Local Levy, and also offer a higher standard of protection to the Browns Bridge

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area and other wider community. It is therefore important that this option is explored by the Environment Agency as soon as possible, as there would only be one chance of funding for either Browns Bridge in isolation or a slighter larger scheme, if technically feasible.

3. Incident

3.1 Incident on 25th/26th September 2012

The severe event hit Teesside with heavy showers for in excess of 24 hours with a weather station in Bishop Auckland recording a month-and-a-half's worth of rain.

The nearest station to Stockton recorded a total of 104.4mm, which is equivalent of twice the average rainfall for a typical September.

Storm commenced: around midnight on the 23rd September 2012

Storm ended: around midnight on the 25th September 2012

Duration: approximately 48 hours

Total rainfall: 104.4mm

3.2 Rainfall Data

The nearest rain gauge to Stockton is at Harpington Hill in the upper reaches of Lustrum Beck, this gauge recorded the event total of 104.4mm which is equivalent of twice the average rainfall for September.

The rain started around midnight on the 23rd/24th continued on and off throughout the 24th and 25th September, very heavy at times, before clearing away around midnight on the 25th/26th September 2012. During these 48 hours, the Met Office suggest that between 60 and 90mm of rain fell meaning that Stockton had at least a month or a month and half's worth of rain during this period.

3.3 Weather and Flood Warnings

A Teleconference with all North East Emergency Responders took place on Monday 24th September 2012, to advise all emergency response organisations of the severe weather forecast and subsequently contact was made with relevant departments of the council to ensure everyone was prepared.

Following the weather warning Flood Alerts were issued for a number of rivers in the area, however the first Flood Warning issued by the Environment Agency Floodline was issued at 9.25 on 25/9/2012, stating that 28 properties were at risk of flooding from Lustrum Beck in the Browns Bridge area, unfortunately by then the properties were already under water.

4. Types of Flooding

4.1 Main River flooding

River flooding also known as fluvial flooding occurs when levels from the river become so high that they over top or breach their banks or flood defences, if any are installed. Main rivers are usually the larger streams and rivers, but some are small watercourses of local significance, they are shown on the Environment Agencies Main River Map. The Environment Agency is the risk management authority for main rivers, they have duties and powers relating to them. In Stockton, The Tees, The Leven, Lustrum Beck, Billingham Beck, Cowbridge Beck, Holme Fleet Beck, Saltergill Beck and part of the Old River Tees are all classified as main rivers. There is a plan showing main rivers in the Appendices.

4.2 Ordinary Watercourse flooding

Ordinary watercourses are every river, stream, ditch, sluice or drain, where water flows but are not main rivers (as described above). The local authority is the risk management authority for ordinary watercourses and has similar powers to the Environment Agency. Flooding can occur when the flows in the watercourse become too great for its capacity, if the watercourse becomes obstructed or it cannot discharge into a main river because the levels in the main river are too high.

4.3 Sewerage flooding

Flooding from sewers can originate from several sources; surface water, foul and combined sewers and rivers flooding into the sewerage network. The main causes of sewerage flooding are; blockages, defects such as collapsed sewers, mechanical failure such as pumping failures or overloaded sewers (flows are too great for the size of the sewer).

Sewers are designed to discharge into watercourses during rainfall events. These discharges can be from outfalls from surface water only systems or from overflows on combined sewer systems. Sometimes during long periods of wet weather or very heavy rainfall, these outfalls cannot discharge due to the raised level of the receiving watercourse.¹

4.4 Highway drainage

Highway drainage is the network of gullies, pipes and culverts that drain water from roads and footpaths. This system may connect to the sewerage system operated by Northumbrian Water or it may discharge into watercourses or retention facilities such as balancing ponds. Highway drainage can flood from blockages, defects such as collapsed drains, lack of capacity in the system or due to the inability to discharge into a watercourse or balancing pond due to the levels in that body of water being too high.

4.5 Culvert issues

A culvert is a covered channel or pipe, a culvert allows the watercourse to flow along its natural path without obstruction by construction of any infrastructure for example a highway. Some culverts have trash screens or 'grids' at either end to prevent obstructions entering the culvert and unauthorised access. These trash screens collect debris and require regular maintenance or in themselves can become a cause of flooding.

4.6 Run off

Run off from land or over land flows of water can be a cause of flooding, particularly in situations of prolonged rainfall where ground becomes saturated, or the natural water table is high and also in extreme events where the rainfall is so intense the ground is unable to drain, the water follows the natural topography of the land and will collect at a low point.

4.7 Tidal flooding

Tidal flooding is flooding from the sea and tidal rivers, which is a particular risk when very high tides and inclement weather combine, a large industrial area of the Borough is at risk from tidal flooding, though this was not a cause of flooding on 25th/26th September 2012.

5. Duties and Responsibilities

5.1 Lead Local Flood Authority

The Lead Local Flood Authority (LLFA) is the unitary authority or if there is no unitary authority then the County Council for the area. Stockton Borough Council is the Lead Local Flood Authority in its area. The LLFA has powers and responsibilities for flood risk management. The Technical Services Division of Stockton Borough Council has responsibility for Flood Risk Management and carrying out the LLFA role, which includes investigation of flooding incidents under Section 19 of the Flood and Water Management Act 2010. The LLFA have powers over ordinary watercourses, and not main rivers as these come under the jurisdiction of the Environment Agency.

5.2 Stockton on Tees Borough Council

Stockton on Tees Borough Council is the Highway Authority and as such has a duty to maintain the highway under Section 41 of the Highways Act 1980 and have responsibilities for highway drainage. Stockton Council's Care for Your Area Division are responsible for highway drainage and clearing trash screens on highway culverts, all trash screens receive regular inspections and maintenance is carried out as necessary. There is also a wet weather list of problem areas, whereby screens are checked when a warning of severe weather is received. Care for Your Area operates a 24 hour call out service and will respond to flooding incidents.

Stockton Council's Technical Services Division is responsible for Highways structures, which are routinely inspected once every two years, areas with known issues are inspected more regularly.

5.3 Environment Agency

The Environment Agency has powers and responsibilities for flood risk management on the main river network (main rivers are defined in paragraph 4.1) and also the sea. This includes providing a flood warning service. The Environment Agency can carry out flood risk management work, such as installation and operation of flood alleviation measures on main rivers, an example of this are the flood gates at Yarm. The EA maintains flood risk assets such as flood banks to manage water levels and ensure flood water can flow freely. The EA can also carry out work to prevent environmental damage to watercourses or to restore conditions. If a main river becomes blocked by an obstruction then, once notified the EA will remove it.

5.4 Northumbrian Water

Northumbrian Water Ltd is the water distribution and sewerage company in Stockton on Tees. Northumbrian Water is responsible for all combined drainage and sewerage systems and a number of surface water systems. Following sewerage flooding Northumbrian water can arrange for the area to be inspected and if necessary decontaminate.

5.5 Highways Agency

The Highways Agency is responsible for the Trunk Road network and associated drainage which includes culverts under Trunk Roads and balancing ponds. In the case of this report the Highways Agency are responsible for the A19 and A66. The A66 is operated by Aone on behalf of the Highways Agency and the A19 is operated by Autolink on behalf of the Highways Agency.

5.6 Riparian Landowners

Riparian landowners are those who own land adjoining a watercourse. As detailed with the EA document 'living on the Edge', riparian landowners have certain right and responsibilities, including the following:

- They must maintain the bed and banks of the 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.

Riparian landowners must understand and act upon these responsibilities².

5.7 Residents

Residents who are aware that they are at risk of flooding may be able to take action to help ensure that they are safe and their properties are protected, without taking unnecessary risks.

Community resilience is important in providing information and support to Neighbours, if flooding is anticipated.

Actions which could possibly be taken by residents include installing sandbags and moving valuable items upstairs and vehicles to higher ground. More permanent measures such as installing floodgates, raising electrical sockets and fitting non-return valves on pipes, may also be possible depending on individual properties.

It is helpful for anyone who is affected by flooding to try to document as much information about the incident as they can, and if possible take photographs. This is particularly helpful if residents are proposing to make an insurance claim.

Where properties are located near to main rivers residents are advised to sign up to the Environment Agencies Flood Warning System. **Floodline 0845 988 1188** and also report any incidents to the Environment Agency on **Incident Hotline 0800 80 70 60 (24 hours)**

6. Causes of Flooding on 25th/26th September 2012

6.1 Browns Bridge/Newtown



Fig 1 Photograph of Newtown Area



Fig 2. Bishopton Road/Browns Bridge

Figure 1 shows the extent of the flooding in Newtown and Wrensfeld, with a large number of residential properties suffering internal flooding, streets badly affected include Bishopton Road, Bedford Street, Wrensfeld Road, Dunmail Road, Duddon Walk, Tailrigg Close and Durham Road. The Bishopton Centre, Adult Education Centre, Kingdom Hall, Newtown Resource Centre and Crowe's Nest Day Nursery all suffered from internal flooding.

A number of roads including Bishopton Road, Wrensfeld Road, Grays Road and many surrounding estate roads were all impassable due to the extent and depth of the flood water, therefore putting additional pressure on the secondary highway network. The gardens and allotments on Dundas Street were also flooded. A number of gardens on Grays Road and Grange Avenue were also flooded.

The source of flooding in this area was both fluvial and surface water flooding. It began on Bishopton Road, when the highway drainage system which would normally discharge into Lustrum Beck via an outfall under Browns Bridge became full to capacity and flood water began to overflow onto Bishopton Road, leading to the closure of the road and threatening nearby 94 Bishopton Road. The levels in Lustrum Beck continued to rise and eventually overtopped the flood embankments causing much more widespread flooding to the Newtown and Wrensfeld areas.

The ordinary watercourse which runs across Grays Road and to the rear of the properties on Grange Avenue became tide locked, as it could not discharge into Lustrum Beck causing flooding to gardens on Grays Road, Grange Avenue and on Grays Road itself, leading to its eventual closure. This watercourse is prone to regular flooding in conditions where it can flow freely in to Lustrum Beck and affects the properties close to the culvert causing severe garden flooding.

6.2 Hartburn



Fig 3. Hartburn Area



Fig 4. Entrance to Burnside Grove

Figure 3 shows the extent of the flooding in the Hartburn/ Oxbridge areas, properties on Burnside Grove, Hartburn Avenue, Darlington Road and Oxbridge Lane are known to have flooded internally. Part of Ropner Park is shown to be flooded on the photograph. Figure 4 shows the entrance to Burnside Grove where a fire service rescue boat was used to evacuate residents. The grassed area adjacent to the ordinary watercourse (Greens Beck) which is a tributary of Lustrum Beck is also flooded however the flood water in that location is not thought to have entered any properties.

The flooding in the Hartburn area was mainly fluvial flooding from Lustrum Beck, though the properties on Hartburn Avenue can also suffer from surface water run-off issues, where the rain water follows the topography of the land and the water collects behind the flood defence wall unable to reach the beck. When the flood defences were constructed a small sump pump was also installed by the Environment Agency as part of those works, the pump was donated to the residents to remove the water building up behind the defences. The pump is the responsibility of the residents to operate and maintain.

The area could be protected by installation of the scheme at Six Fields or smaller more localised schemes focussing on the Burnside Grove/Oxbridge and Darlington Road areas, however feasibility would be subject to discussions with the Environment Agency.

Hartburn Avenue already has defences, which were constructed when the Six Fields scheme was originally planned, therefore this area has a much higher standard of protection than other locations on Lustrum Beck, hence further work would not be considered in that location. As Lustrum Beck is a main river, any schemes would

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need to be either carried out by the Environment Agency or with the Environment Agencies consent . The residents could also consider property protection measures. It is recommended that the residents of Hartburn Avenue ensure that the pump is operated and maintained as originally intended to protect their properties.

6.3 Norton/ Billingham Bottoms A139 / A19



Fig 5. Billingham Road/A139

Figure 5 shows the A139 Billingham Road roundabout junction with the A19 exit slip road. The flooding in this location started on the 26th September 2012, later than the other flooding incidents connected to Lustrum Beck. The A19 exit slip began to suffer from surface water flooding due to the drainage system surcharging and being unable to discharge into Billingham Beck due to the high river levels. The gully on the roundabout also began surcharging and started to form a puddle on the carriageway which grew in size until the carriageway was impassable.

The levels in Billingham Beck continued to rise overtopping onto flood plain land where the allotments and Billingham Beck Country Park are situated. The high river levels in Billingham Beck caused the ordinary watercourses to become tide locked, preventing discharge into Billingham Beck, causing severe flooding to the network of ordinary watercourses and drainage system.

A number of properties were flooded internally in the Mill Meadow Court and Chesham Road areas, with severe highway flooding to the A19 entry and exit slip roads, the A139 and some surface water issues on the main carriageway of the A19 itself, though it was passable. The gardens at the lower end of Costain Grove were also severely flooded to a depth of approximately 2 metres, which was threatening the properties though none are known to have suffered internal flooding.

The highway network suffered flooding again in this location on 26th November 2012 but no properties were affected.

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A series of meetings have taken place with other risk management partners to examine the causes of the flooding and how the risk can be reduced. At the time of writing this report, it is still very much an on going investigation and actions to be carried out are listed later in this document.



Fig 6. Business Units Order Wingate Way

6.4 Orde Wingate Way Businesses/Primrose Hill Area

Figure 6 shows the business units located at Orde Wingate Way, Lustrum Beck is shown in the centre of the photograph, behind the business units and in front of the residential properties on Dundas Street. The photograph clearly shows the 2 buildings which are situated closest to Lustrum Beck and at the lowest level, completely surrounded by the flood water from the Beck. The gardens of the properties on Dundas Street are also flooded, the flood water is not thought to have entered any of the residential properties. The allotments were also flooded.

The source of flooding in this location is fluvial flooding directly from the beck overflowing. The area could be better protected by installation of the scheme at Six Fields or a more localised scheme, as Lustrum Beck is a main river, any such schemes would need to be either carried out by the Environment Agency or with the Environment Agencies consent . The businesses could also consider property protection measures.

6.5 Portrack Retail Park



Fig 7. Business Units on Portrack Retail Park



Fig 8. Holme House Road

Lustrum Beck runs to the rear of Portrack Retail Park, the park itself is split into blocks of retail units and associated car parking. Figure 7 shows flooding to one of the retail units on Portrack Retail Park in total 3 Retail units were badly affected by the flooding, Betta Living, Race for Furniture and Home Interiors causing severe damage to the premises and temporary closure of the businesses. Holme House Road was also flooded and was impassable to most vehicles, Holme House Road is the main access to and from Holme House prison.

The flooding was fluvial flooding caused by the overtopping of Lustrum Beck to the rear of the retail units.

The area could be better protected by installation of the scheme at Six Fields or a more localised scheme may be considered, as Lustrum Beck is a main river, any such schemes would need to be either carried out by the Environment Agency or with the Environment Agencies consent . The businesses could also consider property protection measures.



Fig 9. A66/Long Newton

6.6 A66 Long Newton Interchange

Figure 9 shows the A66 at Long Newton Interchange closed in both directions due to flooding. The road has been closed on 3 occasions in the last 3 months, 25th/ 26th September 2012, 12th October 2012 and 26th/ 27th November 2012, due to the same flooding issues. The A66 is a Trunk Road forming part of the strategic highway and was closed for some considerable time on each occasion, leading to widespread disruption to travel.

It appears that the flood water has entered the carriageway from the highway drainage system and specifically overtopping of the balancing ponds which are part of this surface water system. Possible causes may be lack of capacity in the ponds or the associated drainage network, maintenance issues in the surrounding network, run-off from farmland or illegal connections into the system. A full investigation of the drainage system and site is required before a definite source can be identified.

The Highways Agency has examined the site to ensure all infrastructure is free from debris or spoil which would compromise any drainage system. They intend to undertake a CCTV survey of the systems to investigate the performance of the system.

During the incident the Highways Agency attended and installed 2 pumps, which were manned 24 hours per day to remove flood water from the carriageway and allow re-opening of the road as soon as reasonably practicable.

The investigations into the flooding are on-going at the time of writing and actions are suggested later in this report.

7. Recommendations

7.1 General Recommendations

It is recommended that Stockton Borough Council and all risk management partners review their response to the incident and improvements are made where necessary. This includes investigation of temporary protection measures where appropriate.

Residents who are at risk of flooding should also consider how they can prepare for future incidents and how they could protect their properties. Stockton Borough Council can provide advice on property protection measures if required.

Residents who have not signed up to the Environment Agency's flood warning service (Floodline**0845 988 1188**), should consider signing up to receive warnings.

It is essential that flooding and drainage issues are considered fully when new developments are proposed and sustainable forms of drainage are a key part of this.

7.2 Site Specific Recommendations

7.2.1 Browns Bridge/Newtown

- It is recommended that all potential flood alleviation schemes are considered, to examine which schemes have the potential to provide the greatest benefits whilst being affordable.
- Any current schemes in the area such as alleygates, need to be assessed to examine whether it's possible to incorporate any flood risk management measures into them.
- The surface water flooding issues needs to be fully investigated and proposals to alleviate this problem need to be considered.
- Residents should consider property protection measures as detailed above

7.2.2 Hartburn

- It is recommended that all potential flood alleviation schemes are considered, to examine which schemes have the potential to provide the greatest benefits whilst being affordable.
- The residents of Hartburn Avenue who already have flood defences in place and have ownership of the sump pump, must review the maintenance and operation of that pump, they should also have a plan in place for its operation in a flood situation.
- Residents should consider property protection measures.

7.2.3 Norton/ Billingham Bottoms

- Drainage issues relating to the ordinary watercourses and Billingham Beck need to be fully investigated via a joint approach with all relevant stakeholders. Any maintenance issues by riparian owners need to be considered at this time.
- Affected residents (or the management company in the case of flats) may wish to consider property protection measures.

7.2.4 Orde Wingate Way Businesses/Primrose Hill Area

- It is recommended that all potential flood alleviation schemes are considered, to examine which schemes have the potential to provide the greatest benefits whilst being affordable.
- Businesses should investigate property protection measures

7.2.5 Portrack Retail Park

- It is recommended that all potential flood alleviation schemes are considered, to examine which schemes have the potential to provide the greatest benefits whilst being affordable.
- Businesses should investigate property protection measures

7.2.6 A66 Long Newton Interchange

- The Highways Agency should investigate the drainage systems and balancing ponds.

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- Any issue with adjacent land owners should be considered and mitigation measures introduced if necessary.

8. Action List

Ref.	Location	Action	Responsibility	Review Date
1.0	Browns Bridge/Newtown	NWL investigating feasibility options to prevent the surface water flooding issue that occurs at the junction of Bishopton Road/Wrensfield Road. NWL to discuss feasibility options with SBC.	NWL/SBC	6months
1.1	Browns Bridge/Newtown	EA to provide estimated costs for the installation of a flood alleviation scheme at the 'Six Fields' site.	EA	January 2013
1.2	Browns Bridge/Newtown	EA investigating a smaller localised flood alleviation scheme at Browns Bridge, Newtown area.	EA	January 2013
1.3	Browns Bridge/Newtown	EA to progress de-silting works at Browns Bridge to locate NWL outlet.	EA	January 2013
1.4	Browns Bridge/Newtown	The property owners can consider property protection measures.	Residents	-
2.0	Hartburn	EA to provide estimated costs for the installation of a flood alleviation scheme at the 'Six Fields' site.	EA	January 2013
2.1	Hartburn	Owners of the sump pump need to review the maintenance and operation of that pump, they must also have a plan in place for its operation in a flood situation.	Residents	-
2.2	Hartburn	The property owners can consider property protection measures.	Residents	-
3.0	Norton/Billingham Bottoms	SBC to clear the overgrown vegetation along the boundary of the cycleway/Scott Bros land to help locate outfalls and provide easy access to carry out future maintenance to the outfalls.	SBC	January 2013
3.1	Norton/Billingham Bottoms	SBC highway drainage network needs to be identified and checked for any blockages within the area A139.	SBC	6months

3.2	Norton/Billingham Bottoms	The drainage ditch/channel between the fleet ponds needs restoring and investigation into silt levels within the fleet pond. SBC to investigate the lease that's currently in place for the fleet ponds.	SBC	6months
3.3	Norton/Billingham Bottoms	Highway Agency are responsible for the maintenance of the first 30 metres of the channel from the drainage outfall. Highway Agency to clean and restore their network removing the overgrown reeds from their system and check for blockages.	HA	6months
3.4	Norton/Billingham Bottoms	SBC to complete a topographical survey of the land adjacent to the A19/A139 exit slip road. Highway Agency to provide traffic management while works are carried out.	SBC/HA	6months
4.0	Orde Wingate Way	EA to provide estimated costs for the installation of a flood alleviation scheme at the 'Six Fields' site or to consider small localised scheme.	EA	January 2013
7.1	Orde Wingate Way	The businesses can consider property protection measures.	Businesses	-
8.0	Portrack Retail Park	EA to provide estimated costs for the installation of a flood alleviation scheme at the 'Six Fields' site or to consider small localised scheme.	EA	January 2013
8.1	Portrack Retail Park	The businesses can consider property protection measures.	Businesses	-
9.0	A66 Long Newton Interchange	Highways Agency is investigating the causes into the flooding and the performance of their drainage system, CCTV survey will also be carried out.	HA	6months

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9.1	A66 Long Newton Interchange	Highway Agency are considering purchasing an appropriate size HVP for regional resilience.	HA	6months
9.2	A66 Long Newton Interchange	The A66 Long Newton Interchange requires an investigation to identify if the adjacent fields are contributing to surface water flooding on the A66 carriageway.	SBC	6months

9. Conclusion

The 25th/ 26th September was classed as an extreme event and exceeded the 1 in 100 year storm. Flooding will always occur somewhere in these extreme events and it is never possible to completely eliminate that risk. Drainage systems are not designed to cope with events of that magnitude and surface water will take time to drain into those systems, causing problems in hundreds of locations. The extremely wet summer of 2012 has made matters worse; as the ground is saturated even less extreme events still have the potential to cause problems.

In Stockton up to 150 residential and business properties were affected on the 25th/ 26th September 2012, leaving some people homeless and forcing businesses to close. Clearly some action needs to be taken to reduce the risk of another event of this magnitude causing the same problems; though flooding is a force of nature and can never be completely eliminated. It is likely that weather events such as this one will become more frequent in future years.

Since the events of the 25th/26th September 2012, Stockton Borough Council and our risk management partners (the Environment Agency, Northumbrian Water, the Highways Agency and other parties as necessary) have worked continuously to investigate the flooding issues and this work is on-going. There are many complex technical issues to be overcome on some sites and many possible measures to consider. Any proposed schemes or measures will require funding and any such funding, if available will need to be secured. Some recommendations and an action list are contained in this report and it is suggested that a further short report on progress of these actions be submitted to cabinet in 6 months-time.

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Appendices

Glossary of Terms

LLFA	Lead Local Flood Authority
FWMA	Flood and Water Management Act 2010
EA	Environment Agency
NWL	Northumbrian Water Limited
HA	Highways Agency
SFRA	Strategic Flood Risk Assessment
PFRA	Preliminary Flood Risk Assessment
FDGiA	Flood Defence Grant in Aid

Useful Contacts

Environment Agency

Flood Line 0845 988 1188

Incident Hotline 0800 80 70 60 (24 hours)

<http://www.environment-agency.gov.uk>

Stockton on Tees Borough Council

Care for Your Area 01642 391959 (Office Hours)

Surveillance Centre 01642 528989 (24 hours)

Technical Services 01642 526727 or 526497

<http://www.stockton.gov.uk>

technicalservices@stockton.gov.uk

Northumbrian Water Ltd

Customer Contact Centre 0800 328 7648 (24 hours)

<http://nwl.co.uk/your-home/your-services/sewer-flooding.aspx>

(For issues relating to sewerage flooding, can arrange for the area to inspected and if necessary decontaminated)

Useful Links

Environment Agency – ‘Living on the Edge’

A guide to your rights and responsibilities of riverside occupation

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

References

¹Northumbrian Water Limited – Sewer Flooding

²Environment Agency – Living on the Edge

³Flood and Water Management Act 2010

Thank you to the Environment Agency for use of the aerial photography and the Highways Agency for the photograph of the A66