



Appendix A: Successful flood alleviation and resilience initiatives

The following case studies demonstrate successful approaches to flood alleviation and resilience within South Yorkshire:

- **Bentley Ings Pumping Station, Doncaster**
- **Phase 1 of the Rotherham Renaissance Flood Alleviation Scheme, Rotherham**
- **Lower Don Valley Flood Alleviation Scheme, Sheffield**
- **Lang Avenue, Lundwood, Barnsley**



SMART Investment – Bentley Ings Pumping Station (BIPS), Doncaster

Highlights

- £14 million refurbishment scheme
- Located in the River Don floodplain in the Doncaster area
- Protects approx. 1669 residential properties and 150 businesses at the north end of Bentley during a flood event
- Improved resilience and access to BIPS during a flood event
- Active flood management – BIPS operates continually to protect over 3000 properties in the area
- Originally constructed in the early 1940's before becoming Environment Agency (EA) property in the early 2000's
- Next step investigations spurred by the 2007 flooding incident when the pumping station's low laying electrical equipment became submerged causing flooding to approx. 600 properties
- New station has a 50 year structural life and a 25 year Mechanical, electrical, instrumentation, control and automation (MEICA) life span



Above: The original 1940's era design of Bentley Ings Pumping Station

Key Information

- Located in the managed River Don floodplain, BIPS does not manage water levels in the River Don. Instead BIPS directs water from Mill Dyke, Swaithe Dyke, and Bentley Ings Drain into the River Don
- Originally built in the 1940's to help alleviate mining subsidence issues by Danum drainage commissioner on behalf of the National Coal Board under the Doncaster Drainage Act (1920)
- Became EA property in 2006 as part of the critical ordinary watercourses transfer process. This 2 year process moved approx. 1800 ordinary (non main river) watercourses with roles in flood management under the EA's jurisdiction

Refurbishment favoured over replacement due to multiple factors:

- £8 million capital saving over accommodating new build site which would redirect flow 3km downstream to a new pump site
- Capital carbon saving of 60% (20% over government targets) by repurposing existing 1940's concrete structures
- 13% cost efficiencies over the cost of a new build





Refurbishment allowed the existing site to have increased functionality and capabilities:

- Operational Carbon reduced by 20% through modern pumps
- 20% increase to pumping capabilities through 4 modern pumps with greater resilience
- Rotatable pump stand with stand-by position should one pump fail
- Future proofed equipment has electrical controls raised above the 1/1000 flood levels.
- Improved access & resilience – The new high level causeway with integrated 1.5m high culverts allows water to flow through the Doncaster Flood Corridor unimpeded while maintaining vehicular and pedestrian access to BIPS during a flood incident
- Installation of fish friendly dry weather flow pump designs especially designed to allow fish to pass in and out of the pumping station undamaged.
- Enhancements to biodiversity in the local area by installation of hedgerows, grasslands, and trees
- Increased security – CCTV, alarms, and forced entry resistant perimeter fencing



Above: The Refurbished Bentley Ings Pumping Station. Note the original 1940's design in the centre surrounded by raised modern technology and high security fencing

Further Information

For further information on the Bentley Ings Pumping station, please contact:

Environment Agency

Email

Connectedbywater@environment-agency.gov.uk

Phone

03708 506 506



Left: The high level access causeway with 1.5m high culverts beneath. Bentley Ings Pumping station can be seen in the distance.



Responding to the Climate Emergency - Rotherham Renaissance Flood Alleviation Scheme - Phase 1 (Templeborough to Rotherham)

Project summary

- The Rotherham Renaissance Flood Alleviation Scheme (RRFAS) extends 5km along the River Don corridor in Rotherham.
- The scheme is being delivered in phases, supported by adopted Supplementary Planning Guidance.
- RRFAS Phase 1 (a £16.3m project in Templeborough and Rotherham Town Centre) was constructed between 2006 and 2011 and provides:
 - A reduced risk of flooding to people, property and infrastructure;
 - Improved economic conditions in key employment areas, and;
 - The catalyst for developments within the Rotherham Regeneration Area and future phases of RRFAS, by fixing Flood Defence Levels.
- Funding has been secured from several organisations.
- RRFAS Phase 1 won the Flood Risk Management category of the BURA Waterways Renaissance Awards in 2010.



Above: Phase 1 construction works

Detailed description

The Rotherham Renaissance Flood Alleviation Scheme (RRFAS) is being promoted through a partnership approach comprising of the Council as lead partner, the Environment Agency and several stakeholders. When complete, the scheme will extend over 5km of the River Don, through Templeborough, Rotherham Town Centre, Parkgate and Kilnhurst. This scheme is vital to Rotherham's economy, by reducing the risk of flooding to:

- Over 200 existing businesses.
- Key parts of the strategic highways network and many local roads.
- The rail network and tram / train network (including Rotherham Central and Parkgate stations).
- Water, sewerage and critical utility company networks.

All of the above were impacted during the June 2007 flood event, when there was £15m of additional cost incurred by the Council, plus the substantial costs incurred by residents, businesses and infrastructure operators.

An options study was completed in 2003, with the preferred option being to construct new flood defences along the River Don corridor.

Between 2006 and 2011, RRFAS Phase 1 was constructed, delivering new flood defences and bridge modification / removal works, which in combination, provide a 1 in 100 year Standard of Protection. Structure foundations have been designed to allow raising without further modification for a future climate. In addition to engineering works, by working in partnership with a range of organisations, the scheme delivered a new wetland nature park which provides compensatory floodplain and environmental improvements in an urban area.





Innovation and impacts

The works in Templeborough were completed in 2008, at a cost of £15m. Funding was provided from several sources, which included regeneration and economic development funds (£5.8m European Regional Development Fund and £7.4m Yorkshire Forward), with smaller contributions from the Council (£1.4m) and Yorkshire Regional Flood and Coastal Committee Local Levy (£0.4m).

£1.3m of further works, between 2009 and 2011, reduced the risk in Rotherham Town Centre. This included the removal of the Grafton Old Bridge (Don Bridge) near Parkgate, which reduces flood levels along around 2km of the River Don.

In 2011, the "Rotherham Regeneration Area Flood Risk Toolkit" was adopted by the Council as Supplementary Planning Guidance for the Don corridor. This allows RRFAS to be delivered in phases and for new development led projects to deliver parts of the scheme.

In 2012, major land raising works were undertaken by the private sector on the former Guest and Chrimes site (near Rotherham Town Centre) to create another section of RRFAS, and this land is now occupied by Rotherham United's football stadium and the Council's central office.

RRFAS Phase 1 has:

- Reduced the risk of flooding to people, property and infrastructure.
- Created improved economic conditions in key employment areas that protected existing jobs and create new ones.
- Enabled Flood Defence Levels to be fixed for a 1 in 100 year Standard of Protection (allowing for climate change) over a 5km extent of the River Don.
- Delivered planning policy that supports the construction of future phases.

The above created the catalyst to deliver the remaining phases of RRFAS, 1.5km of which are already under construction in Rotherham Town Centre, including new flood defences near Ickles Lock and at Forge Island, which includes a new Canal Barrier.



Above: Centenary Riverside wetland

Image from: [Centenary Riverside - Reserves - Sheffield & Rotherham Wildlife Trust \(wildsheffield.com\)](http://CentenaryRiverside-Reserves-Sheffield&RotherhamWildlifeTrust(wildsheffield.com))

Contact Details

Peter Henchley
Flood Risk Engineer (Capital Flood Alleviation Schemes)
Rotherham Metropolitan Borough Council

01709 254485
peter.henchley@rotherham.gov.uk

More information on the Rotherham Renaissance Flood Alleviation Scheme is available on the Council's website.
<https://www.rotherham.gov.uk/>



Responding to the Climate Emergency - Lower Don Valley Flood Alleviation Scheme, Sheffield

Project summary

- This scheme stretches 8km along the River Don; from Nursery Street in the City Centre to Blackburn Brook near Meadowhall.
- The £21 project was completed in 2017.
- It delivered new flood defence, infrastructure, river maintenance and riverside enhancement.
- It better protects over 500 businesses, securing approximately 5,000 jobs.
- In addition to reducing the risk of flooding, the scheme has:
 - Improved safety and public access to the river;
 - Reduced the risk of impacts to highways networks and power and telecommunications infrastructure, and
 - Improved the opportunity for investment and regeneration in the area, to deliver new homes and jobs.



Above: Construction of flood defences.
Source: CPCCivils

Detailed description

The Lower Don Valley is one of Sheffield's key economic areas; home to hundreds of businesses providing thousands of jobs and employment opportunities for the city and the wider region.

The large flat areas of land along the River Don have formed Sheffield's industrial heartland since the industrial revolution and include major businesses such as Sheffield Forgemasters and Gripple to this day. Unfortunately, the lower lying nature of this area left it susceptible to the effects of flooding.

The area suffered flooding in 2000 and 2007 causing significant disruption to businesses and infrastructure. The flood event in 2007, the worst flood event since the Great Flood of 1864, resulted in as many as 2,300 properties being flooded across Sheffield. The impact on the Lower Don Valley was particularly bad.

In response, the Lower Don Valley Flood Alleviation Scheme was developed by Sheffield City Council in partnership with the Environment Agency and supported by the Sheffield Chamber of Commerce and Industry. This has delivered improved defences at over 50 locations along its 8km length. Interventions included:

- Flood defence walls, flood gates, and other infrastructure improvements
- Channel maintenance
- River maintenance and riverside enhancement, including installation of a fish pass at Sanderson's Weir
- designed to allow for the provision of further climate adaptation in the future

The scheme has been designed to provide a 1 in 100 year standard of protection with climate change built in to 2039. It also allows for the provision of further climate change adaptation in the future.





Innovation and impacts

The delivery of the scheme was innovative, being the first such scheme in the country to use private sector contributions from a Business Improvement District; securing £1.4m of contributions towards the £21.4m total scheme costs, with the remainder financed by public funds.

Overseen by a Steering Group made up of local businesses and experts and chaired by the Chamber of Commerce the Business Improvement District, as well as bringing in capital funding, provided a revenue stream for ongoing channel maintenance, delivered by the River Stewardship Company (a social enterprise). This was partly delivered through a programme of weekly volunteer days, which engages local interest from communities and businesses.

The Lower don Valley Flood Alleviation Scheme has been successful since its delivery in reducing the risk of flooding in this key economic area as well as delivering physical and environmental improvements.

The scheme has:

- Reduced the risk of flooding for hundreds of existing businesses, giving them the security to invest and grow.
- Reassured potential new investors that flood risk is being addressed, giving them confidence that new development near the river is viable.
- Provided the conditions to safeguard existing jobs, support the creation of new jobs, and prevent the loss of jobs through businesses moving to other areas.
- Improved public safety related to flood risk to highways, footpaths and local visitor attractions.
- Improved access to the river as a public amenity wherever possible.
- Put in place long term maintenance and management arrangements to ensure sustained high standards of water quality and natural environment.



Above: Completed flood defences

Contact Details

James Mead
Flood & Water Service Manager
Sheffield City Council

07425 635790
james.mead@sheffield.gov.uk

More information on the Lower Don Valley Flood Alleviation Scheme is available at:
<https://www.sheffield.gov.uk/content/sheffield/home/planning-development/master-action-plans/lower-don-valley-flood-defence.html>



Responding to the Climate Emergency - Lang Avenue, Lundwood, Barnsley

Summary

- The Lundwood area is prone to flooding, suffering extensive flood events in 2007, 2012 and 2019.
- Key stakeholders involved in the response to flooding include Barnsley Council, Barnsley Homes, The Environment Agency and Yorkshire Water.
- Property resilience measures were successfully deployed following the 2007 floods.
- A flood alleviation scheme is being developed for the area; however early maintenance works to ditches has taken place resulting in a reduction in flooding.



Above: Flooding at Lang Avenue

Detailed description

The Lundwood residential area has suffered extensive flooding, most recently in November 2019 (affecting around 70 properties) and February 2020; however anecdotal evidence suggests much earlier flood events possibly as early as the 1950s. The most recent flood events saw with some properties inundated to a depth of approx. 1.0m.

Many of the homes affected in Lang Avenue form part of the Council's housing stock and as such are home to residents who may be vulnerable or on lower incomes.

A collective response to flood alleviation measures is required from key stakeholders in the area including Barnsley Council, Barnsley Homes, The Environment Agency and Yorkshire Water.

Following the 2007 floods Barnsley Council undertook a number of proactive steps to improve property resilience and provide a level of protection for internal areas, including:

- 282 flood vents
- 25 door guards, and
- 15 waste pipe locks

A flood alleviation scheme is being developed which will:

- in the short term, introduce measures to address imminent threat from surface water flooding, and
- in the longer term reduce the risk of flooding to 90 properties.





Solutions

Proactive engagement has been on-going with local residents, Barnsley Council Member and officer representatives, Bernaslai Homes and the Mayor of South Yorkshire.

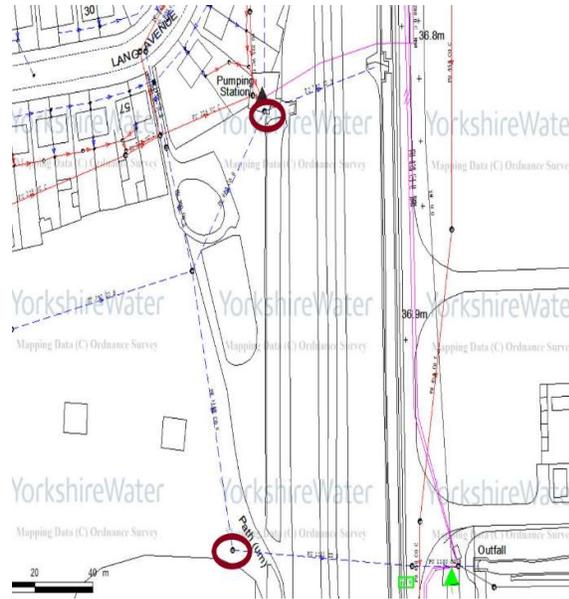
Enzygo Ltd was commissioned by Bernaslai Homes to investigate flooding issues at Lang Avenue. As a result, four key resilience solutions are recommended to mitigate flooding in order of priority:

1. Survey and repair Culverts 1 and 2 and flapped culvert outlet installation.
2. Offline surface water storage retrofitted to Yorkshire Water surface water drainage system.
3. Regrading and re-kerbing highways to provide adequate exceedance conveyance away from properties.
4. Offline conveyance pathway from highway (Lang Avenue) to recut ditch routing south on western side of TPT embankment.

The maintenance of the ditches has now taken place and has resulted in a reduction in flooding.

Stages 2 and 3 are ongoing and a detailed design for removing highway water out of the Yorkshire Water network will significantly reduce the impact of surface water flooding.

Further proposal's with be encouraged to reduce the impact of climate change over the coming years.



Above: Details of existing infrastructure at Lang Avenue

Contact Details

For further information please contact:

Edward Allen
 Flood Risk Coordinator
 Barnsley Council
EdwardAllen@barnsley.gov.uk

Matt Bell
 Head of Highways, Engineering & Transportation
 Barnsley Council
MatthewBell@barnsley.gov.uk