Preston UID Scheme

£114 million upgrade to improve the River Ribble estuary and the coastal environment

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Introduction

As part of the work to protect the environment UU are building a 3.5 km long storm water storage tunnel in the Preston and Penwortham areas. This will bring significant environmental improvements to the Fylde coast bathing waters and designated shellfish beds located within the Ribble Estuary.

At present when Preston experiences heavy rainfall the sewers in Fishergate Hill, Marsh Lane, Watery Lane and near Penwortham pumping station become overwhelmed, resulting in storm water overflowing into the River Ribble.

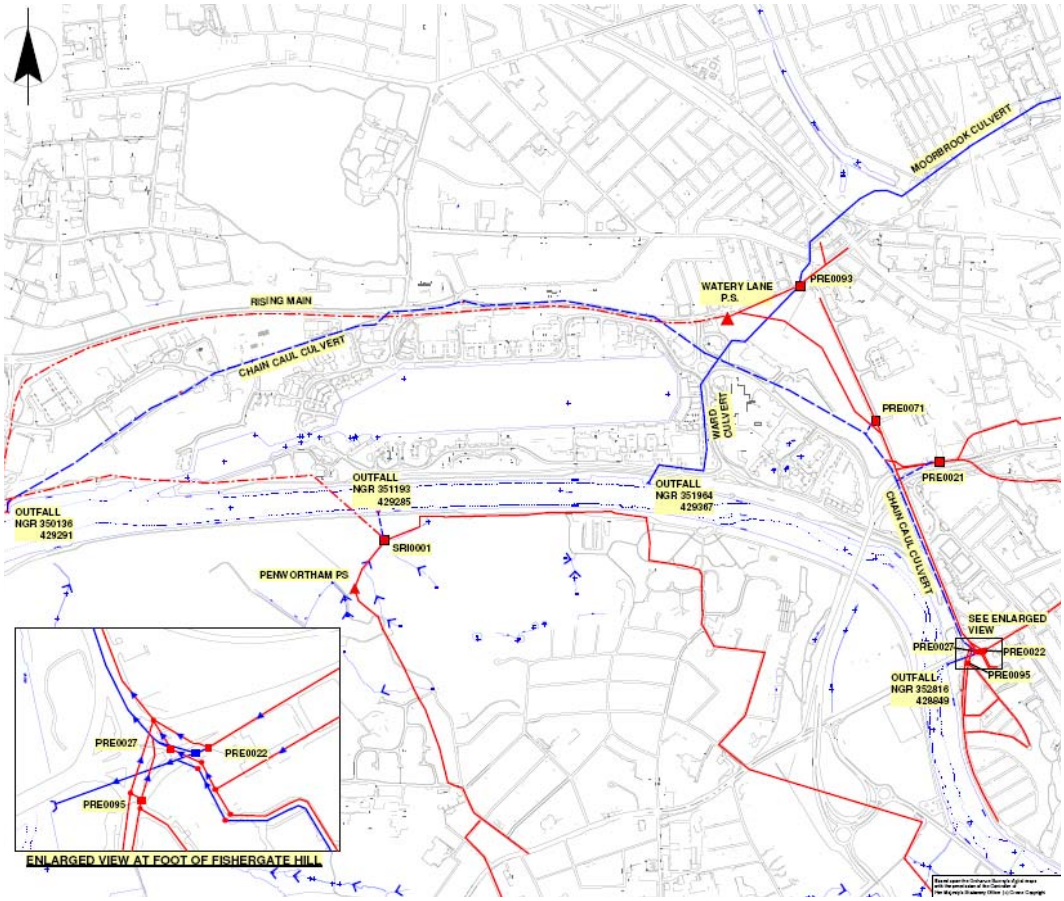


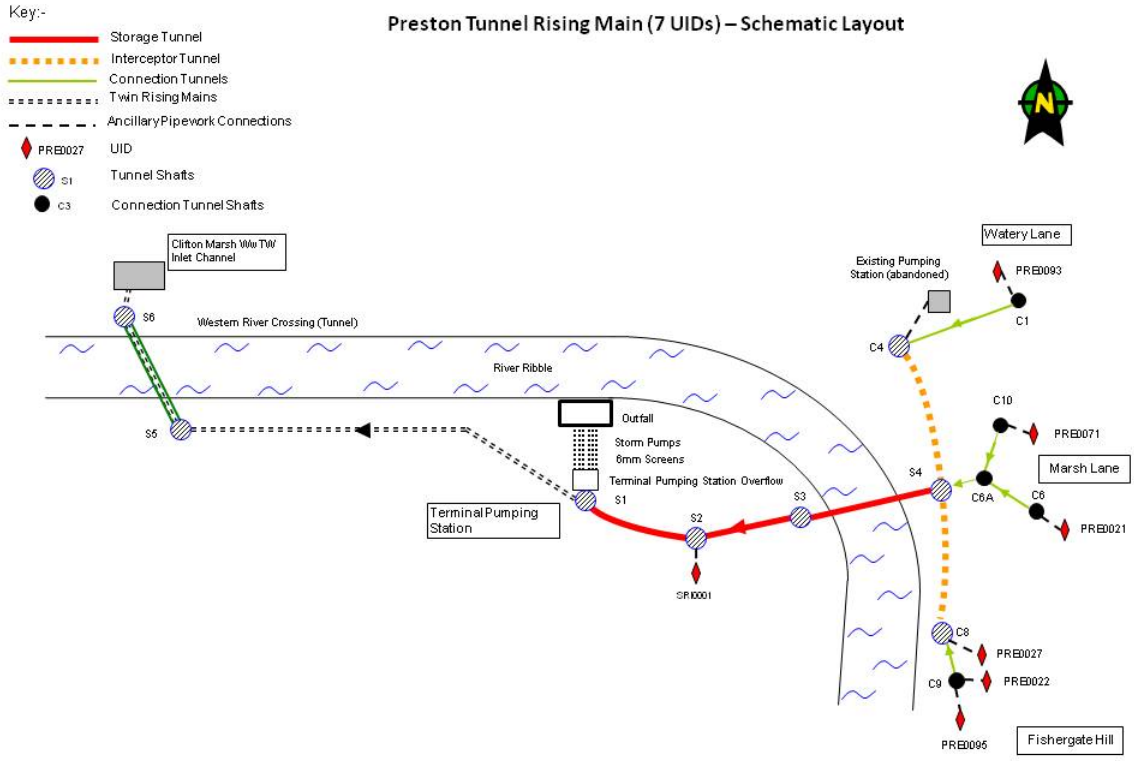
Diagram of Preston, showing the position of the 7 UID's.

This £114 million project will reduce the number of spills to the River Ribble. The new storage tunnel will retain storm water that previously overflowed into the river, before it is pumped to Preston wastewater treatment works.

In order to construct the stormwater tunnel a number of shafts must be built which allow access for the tunnelling machines and spoil to be removed. The shaft locations are dictated by the location of the current network as we must pick up the flows before transferring them to the new tunnel. The shafts are up to 10.5m in diameter at an average depth of 26m.

The tunnel and shafts provide approximately 40,500 cubic metres of storage. Stormwater volumes in excess of this will pass through mechanical screens before being discharged to the River Ribble at the pumping station site. The contents of the tunnels will be transferred via the pumping station to Preston Wastewater Treatment Works at Clifton Marsh for treatment.

A schematic of the solution showing the route of the storage tunnel is shown below. The construction of a storage tunnel will minimise the overall impact to the city centre. By working closely with the local councils it is intended to keep disruption to a minimum. Construction work began in spring 2010 and overall completion is expected by 2012. The aim is to complete the major work within the city centre by Christmas 2011.



Regulatory Drivers

The drivers required to be met by this project are

- Bathing Water: 3 spills per bathing season agglomerated
- Shellfish: 10 spills per annum agglomerated
- Aesthetic: Spills to be screened. Design for 1 in 5 year flow

Maintenance

- Replace Watery Lane Pumping Station and the 2 rising mains

Solution / Scope

In order to progress with this project the approach was to:

- Combine all drivers
- Utilises the storage at Clifton Marsh WwTW (spill 1.5 times per bathing season)
- Limits spills at Clifton Marsh WwTW to Regulatory Drivers

The solution, determined by modelling was:

- To provide storage volume in tunnel of approximately 40,500m3
- To control emptying of the tunnel system to:
    - Min rate 430 l/sec
    - Max rate 1500 l/sec
    - The pump rate is variable and controlled by level in pumping station and the available capacity at Preston WwTW

The project is made up of the following elements:

- 1.61km 2.85 ID Interceptor Tunnel
- 2.2km 2.85m ID Storage Tunnel
- 0.85km 2.85m ID Western Tunnel
- 0.6km 1.5m ID Microtunnels
- 30m ID Wet/ Dry well Pumping Station
- 6 No 300kw DWF pumps
- 5 No. 220kw storm pumps
- 4 No. Escalator screens: 9.00m3/s (5 year flow)
- 5 No. 1200mm ID rising mains (Pumped Storm Outfall)
- 2 No. 800mm ID rising mains (DWF/ Storm)
- Abandonment of Watery Lane PS
- Abandonment of 36" and 38" rising mains
- PS control building to house electrical & Mechanical components

Detailed Assessment

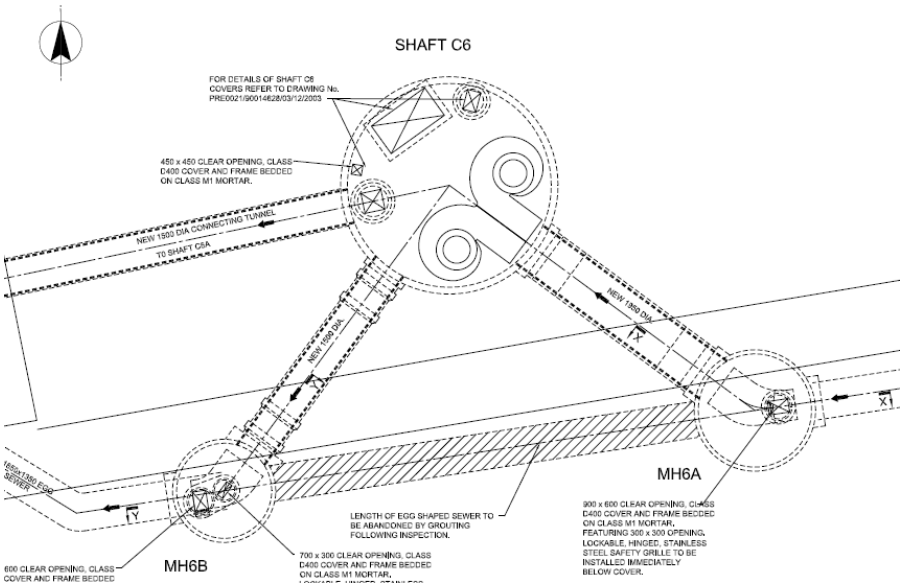


Diagram showing the details of a connection at one of the drop shafts

Due to the limited space in the centre of Preston the drop shafts had to be constructed with the smallest footprint possible. Therefore ideal vortex drop shaft arrangements could not always be accommodated.

To prove the internal design of the shaft a series of physical hydraulic models were constructed.

Picture of scaled model of shaft C6.

The physical model demonstrated the benefits of minor modifications to the shaft. The modifications included:

- Overflow weir level increased by 345mm
- Benching realigned and reduced in height
- Nosing removed
- Reduction of entrained air
- Baffles across orifices reducing air being carried to outlet tunnel
- Benching to drop pipe base detailed to reduce deposition

Summary

The value of using physical models to prove / improve a detailed hydraulic design of a structure is demonstrated in that:

- minor modifications resulted in reduction in air entrained in forward flow
- Reduction in air reduces risk of failures due to air movement

For more information visit:
Project Website ; http://capitalprogrammes.unitedutilities.com/preston