

Briton Ferry Flood Alleviation Scheme

Dŵr Cymru Welsh Water provide flood protection through a stormwater separation solution to address flooding of 40 properties in Briton Ferry

by Neil Campbell BEng (Hons) CEng MICE

Residents of Victoria Street, Briton Ferry have been flooded out on a number of occasions, with 40 properties officially added to the Dŵr Cymru Welsh Water Flooding Register. The Morgan Sindall/Grontmij team provided a Surface Water Elimination and Removal (SWEAR) solution to remove the Ynysmaerdy Stream from the combined network, by constructing a surface water pumping station capable of pumping storm flows at ~1200l/s directly to the River Neath. To further protect residents, a tidal pumping station was installed at the existing sewage pumping station, to ensure that the residents did not flood during tide locked conditions. This sustainable solution was completed under budget at a cost of £4.6m and will provide the residents with future protection of up to the 1 in 30 year return period design storm.



Sinking of stormwater shaft - Courtesy of Morgan Sindall plc



Preparation of kiosk baseslab - Courtesy of Morgan Sindall plc



Shaft and kiosk base constructed - Courtesy of Morgan Sindall plc



Pumping Station road pour - Courtesy of Morgan Sindall plc

Background and current arrangement

The driver for AMP5 investment was to prevent internal flooding of 26 properties and serious external flooding from a further 14 properties.

The catchment, serving a population of over 4,000 is a fully combined sewer system and also receives storm flows from the Ynysmaerdy Stream. The stream flow was accepted by Dŵr Cymru Welsh Water as part of the Neath Estuary Improvement Scheme in 1997. The stream enters the combined sewer network from a splitter chamber, which limits the flow entering a 450mm diameter surface water sewer/culvert, discharging into the Gradison Brook to 200l/s. All flows above 200l/s are directed to the Briton Ferry Combined system.

The maximum stream flow to the Briton Ferry combined network was estimated to be 2,500l/s. However, this is limited to approximately 1,200l/s by a 900mm diameter culvert running beneath Network Rail lines. This culvert connects to the foul system at the rear of Herne Street. The significant rainfall in 2007 caused the stream and foul system to combine to produce devastating flooding within Victoria Street.

Investigations were conducted into the feasibility for undertaking a combined scheme with Neath Port Talbot Council in order to allow the Ynysmaerdy Stream to be completely diverted into the Gradison Brook. However, due to existing fluvial flooding caused by the Gradison Book, there was no capacity to receive additional flows.

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Canal pipe bridge and vertical riser
Courtesy of Morgan Sindall plc



New Tidal SPS lifted into place
Courtesy of Morgan Sindall plc



Stormwater Pumping Station kiosk and generator
Courtesy of Morgan Sindall plc



New surface water outfall geo-membrane
Courtesy of Morgan Sindall plc

The existing Briton Ferry Sewage Pumping Station (SPS) receives both gravity flows and pumped flows from three other SPSs. Flows are pumped at a rate of 80l/s to Afan Baglan Wastewater Treatment Works. Prior to construction of Briton Ferry SPS, all sewage and surface water discharged directly to the Neath Estuary. The current SPS consent permits screened discharge to the Neath when the rate of flow is in excess of 71.2l/s.

During periods of intense rainfall and high tides, the pumping station at Briton Ferry experiences high sump levels as the combined sewer overflow (CSO) outfall cannot discharge against the tide. These levels are transmitted upstream to affect the local catchment and together with both the catchment runoff and stream flows, present a high risk of property flooding.

Design solution

The approach taken was to remove the Ynysmaerdy Stream from the combined network before it converged and was therefore still uncontaminated with foul sewage. Removal of the stream would release circa 1,200l/s capacity in the existing combined network to provide protection to properties in Victoria Street.

Additionally, by constructing a tidal pumping station, to operate at times of high tide and during a spill event, the remaining combined network would be further protected against flooding caused by tide lock of the CSO outfall.

Though the solution will introduce another pumping station into the network, it has been calculated to reduce both the frequency of operation of the CSO and the spill volume of untreated storm sewage to the river by over 130,000m³ per annum.

Design and construction of surface water pumping station

Investigations identified no accessible gravity route to the River Neath. Therefore a segmental 9m diameter, 6m deep pumping station was designed and constructed, capable of pumping 1,200l/s via a 700mmØ rising main.

The pumping station is located on land to the rear of Herne St. and consists of 2 (No.) 170kW pumps, operating duty/standby. An in situ reinforced concrete 3m x 4m interception chamber was constructed around the existing chamber where the stream flow joins the combined sewer network. This chamber enabled the disconnection of flows to occur.

The 700mm diameter ductile iron rising main runs from the pumping station at Herne Street, along Shelone Road and Church Street to the River Neath. During the investigation works, trial trenches, for route proving and human health tests identified that the rock head in the area was extremely close to the surface, in some places, directly beneath the under-course of the road.

The strength of this rock was tested and was confirmed to be of sufficient strength to negate the need for thrust blocks at the bends of the rising main.

An additional obstruction to be overcome was that the rising main route crossed the Jersey Canal at St. Georges Row. Although this canal is currently not in use, there are future plans to re-open it, so the team, with the approval of the canal board, designed a 3m high steel pipe bridge running over the canal. Flows gravitate from this high point, via a 900mm diameter pipe to a new precast headwall on the bank of the River Neath.

To expedite construction and minimise the works in the tidal zone of the River Neath, a precast Athalon headwall, held in place by platypus ground anchors and surrounded by Geoweb geotextile membrane was constructed during a series of low tides. The membrane was chosen as it could be installed in sheets and did not require a period of curing post installation.

Design and construction works on foul network

Disconnecting the surface water from the foul catchment reduced peak flows by up to 1,200l/s and added significant capacity to the existing sewerage network. This additional capacity was sufficient to protect the majority of properties from sewage flooding during storm events occurring at lower tidal levels.

However, some local upsizing in Victoria Street of the existing combined sewer (160m of 225mm to 400mm diameter pipe) was also required to prevent local minor under-capacity issues flooding properties in the 1:10 to 1:30 year design storm return years.

Retaining the existing network in Victoria Street could have resulted in flooding during a 1:30 year return period even with no tidal influence.

Tidal pumping station

To protect the properties from flooding during high storm events, it was necessary to provide a tidal pumping station downstream of the CSO overflow at the existing Briton Ferry SPS.

Discharge tidal pumping was proposed to ensure the discharge of storm flows to the River Neath during high tides. The tidal pumping station would connect to the existing 900mmØ outfall of the existing Briton Ferry SPS. Spill flows from the SPS would gravitate as normal to the River Neath. However, in tide-locked conditions the pumps would operate up to the design flow of 475l/s under MHWS level condition to prevent upstream flooding.

However, during the value engineering exercise, it was identified that the frequency and probability of the tidal pumping station being in operation was extremely low – just 1½ days over 10 years.

The team challenged Welsh Water standards and specifications and provided a lift pump within the existing overflow chamber. By

allowing the available network storage to be fully utilised, the lift pump needed only to cater for 350l/s. This challenge to the design standards saved the project over £1m.

Construction delivery

To date, with over 50,000 man-hours worked, the scheme had zero reportable accidents, through the proactive approach to health and safety and environmental incidents.

Construction began on 26 March 2012 with substantial completion of the storm pumping station five weeks early on 16 November 2012.

Currently Morgan Sindall are on site, completing the M&E installation/commissioning of the tidal pumps on the foul pumping station, with completion forecast for early July 2013.

Key participants	
Client	Dŵr Cymru Welsh Water
Principal Contractor	Morgan Sindall plc
Technical Consultant	Grontmij Ltd
Commercial Consultant	EC Harris
Hydraulic Modelling	Grontmij Ltd
Storm Pump Suppliers	Xylem

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