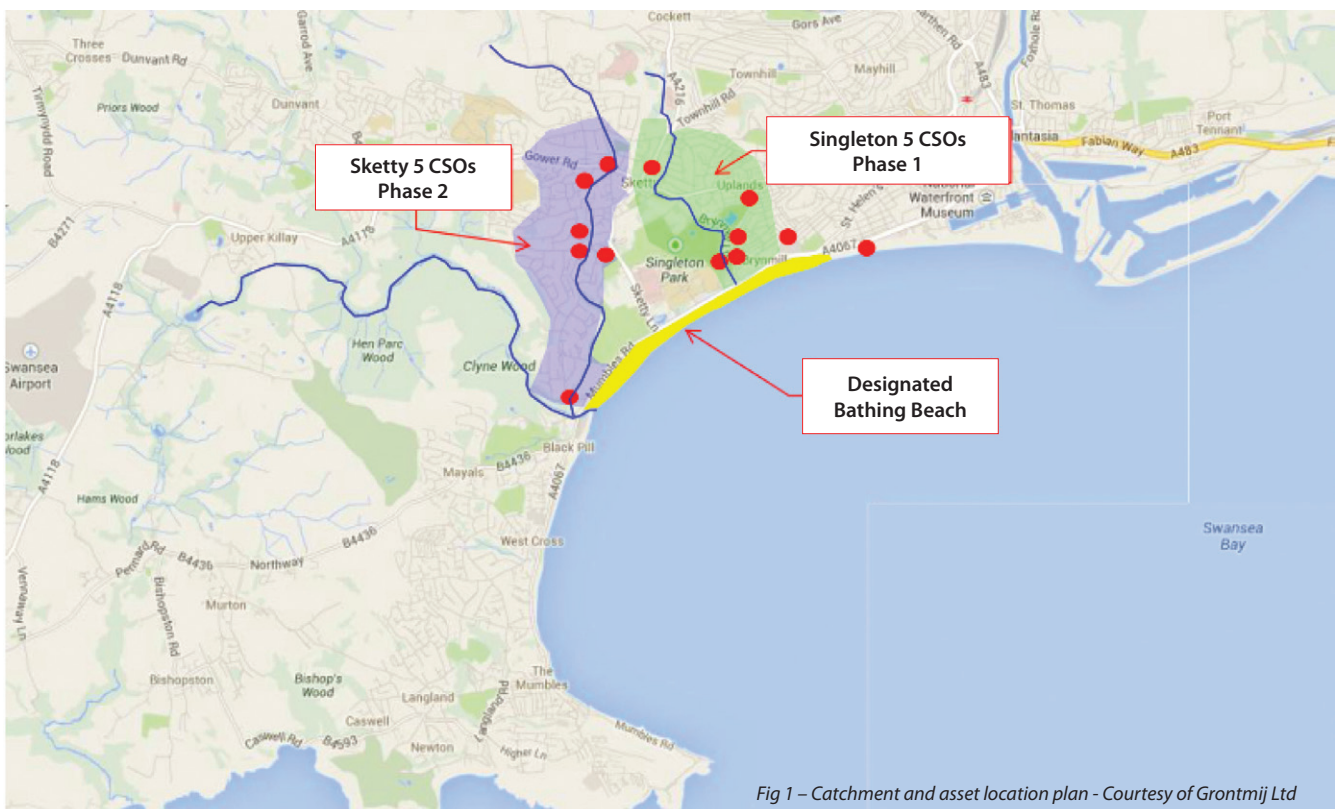


Singleton Park (Swansea) 5 CSOs Scheme

meeting the Revised Bathing Water Directive by addressing the unsatisfactory intermittent discharges from five CSOs as part of the Swansea Bay Strategy

by Fred Watson-James BEng (Hons) & Neil Campbell BEng (Hons) CEng MICE

Welsh Water has been working closely with Natural Resources Wales (NRW), previously Environment Agency Wales, over the past 10 years reducing the impact of sewage discharges and evaluating what else needs to be done in order to protect water quality in Swansea Bay. Phase 1 of this exercise included the detailed investigation within the Brynmill area of Swansea which identified five combined sewer overflows (CSO) in need of work to improve the performance of the assets in this location. Through sewer network modelling, these CSOs were rationalised into three, thus reducing spills, construction and operational costs.



Overview

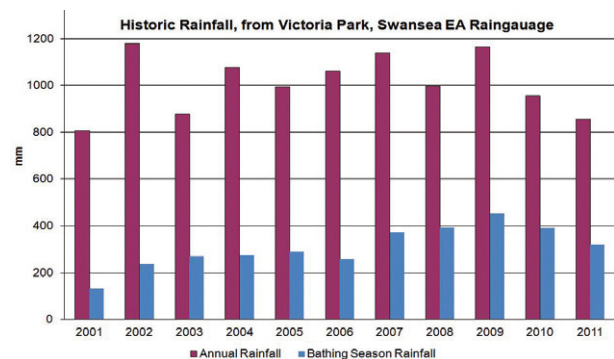
Of the 192 (No.) CSOs in the greater Swansea sewer network, thirteen were identified as discharging with a direct effect onto the designated bathing beach. They either discharged direct into the beach/bathing waters, or into a watercourse, which subsequently discharged to the bathing water. Of these 13 (No.) CSOs, seven were identified as spilling on average greater than three spills per bathing season and a total of twelve did not have satisfactory screening arrangements.

Welsh Water met with Natural Resources Wales (NRW) and agreed an overall strategy to ensure that over both AMP5 and AMP6 periods, a series of projects would be undertaken on the identified CSOs to reduce the frequency and improve the aesthetic quality of that spill.

Investigations

In order to gain a better understanding of the Swansea catchment, Dŵr Cymru Welsh Water appointed Morgan Sindall and Grontmij to instigate a series of investigations including a 12 week flow monitoring exercise within the sewer networks surrounding the 13 (No.) CSOs.

A sewer network hydraulic model build and verification exercise was undertaken by Grontmij using the information gathered from these surveys to verify the existing drainage area model of the Swansea catchment. This sewer network model was run using actual rainfall data sets, recorded between 2001 and 2011 by NRW's rain gauge station, located in Victoria Park, Swansea. As shown in the graph below, the average long-term annual rainfall for Swansea of approximately 1,050mm matched this 11 year period, ensuring a like for like comparison going forward.



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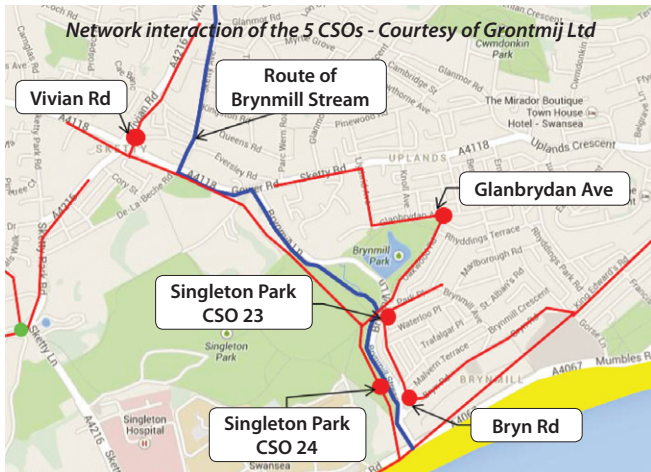
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The spill outflow of all 192 (No.) CSOs within the Swansea Catchment was run through the hydro-dynamic coastal model of Swansea Bay, developed on behalf of Welsh Water by Intertek.

The hydro-dynamic model predicted the impact of CSO discharges on water quality at the bathing water. Based on this analysis, if no action was taken, the bathing water was forecast to fail compliance with the new 'Sufficient' standard that Welsh Water is aiming to achieve.

Of the thirteen CSOs with a direct impact, the first cluster of CSOs progressed was named the Singleton Park 5 CSOs. These comprised; Vivian Road CSO, Glanbrydan Avenue CSO, Singleton Park CSO 23, Bryn Road CSO and Singleton Park CSO 24.

These CSOs were identified by the sewer network model as an area of the network which was under-utilised, and therefore by proposing a holistic approach to the flow management within the catchment, the CSOs were able to be rationalised from five to three, whilst still maintaining an average of three spills per bathing season across all three assets. In addition to the network alterations, the CSOs required new screens to meet the aesthetic driver standard of 6mm in 2-Direction screens.

Combined sewer overflows

The five CSOs spill into the Brynmill Stream which flows through Singleton Park. As shown in the illustration (top left), spills from Vivian Road and Glanbrydan Avenue discharge via surface water systems before spilling to the Brynmill Stream, whilst the other three discharge directly into the stream. This stream flows along the eastern boundary of Singleton Park, where it is then culverted beneath Mumbles Road before discharging onto the beach at Swansea Bay.



The CSOs operate in a 'daisy-chain' system, relieving the catchment at points throughout the catchment.

Vivian Road CSO: This CSO receives gravity flows from the top of the catchment, and historically relieved the network by discharging via a 'hole in the wall' to the culverted Vivian Stream, a tributary of the Brynmill Stream. Due to changes to the network downstream and to the catchment upstream, this CSO was designed not to operate due to hydraulic overload.

After ensuring that all identified developments in the Unitary Development Plan (UDP) were identified in the future model, it was designed that this CSO could be sealed and de-commissioned, without causing detriment to the network whilst eliminating environmental impact to the watercourse. All flows from Vivian Road now gravitate directly to Singleton Park CSO 24.

Glanbrydan Avenue CSO: This asset is also in the upstream catchment which drains to Singleton Park CSO 24. Glanbrydan Avenue CSO is another 'hole in the wall' CSO, and any historic spills were unscreened and discharged via a surface water system into Brynmill Stream, on the eastern side of Brynmill Park, just upstream of the outfall of CSO 23.

Due to the location of the asset, in the junction of two narrow residential streets, the approach taken was to construct a new CSO chamber downstream of the existing chamber and within Singleton Park. To minimise construction time and impact on residents, a 5.2m x 3m x 2.9m Pipex px prefabricated CSO chamber was designed and installed.

Through Supply Chain management, Morgan Sindall was able to deliver the Hydro International static screen to the Pipex px factory for fabrication and fixing prior to installation on site. This eradicated construction risks and ensured the screen was fitted under factory conditions.



Singleton Park CSO 23: This asset receives flows from a local catchment, situated between the Vivian Road and Glanbrydan Avenue catchments. It spilled unscreened flows into the Brynmill Stream below the footbridge at the eastern entrance of Singleton Park, a highly visible location.

The original CSO was located near a busy road junction/mini roundabout at Park Place and Brynmill Lane and model predictions indicated that it only operated once during the 11 years of Bathing Season Rainfall.

The solution was to abandon the CSO altogether and divert upstream flows to the adjacent 450mm diameter gravity sewer that flows to Singleton Park CSO 24. This solution incorporated the construction of a new 55m long 450mm diameter relief gravity sewer downstream of the diversion.

Bryn Road CSO: Received continuation flows from CSO 23, as well as a small local catchment and is another unscreened, shallow chamber, spilling unscreened flows into Brynmill Stream.

The CSO was located on a narrow, steep road and was predicted to operate seven times during the 11 year Bathing Rainfall. However, alterations to the upstream network at CSO 23 reduced the number of spills to five. The solution therefore was to abandon this CSO and pass flows forward to the Cricketers trio of CSOs, which will be addressed as a separate project in year five of AMP5, thus reducing the number of assets and spill locations to the environment.

This flow management enabled savings to be made on the overall capital budget whilst also reducing the number of future assets that need operational maintenance.

Singleton Park CSO 24: This CSO is situated within the park itself and receives all continuation flows from Vivian Road and Glanbrydan Avenue CSOs and the new diverted flows from the old CSO 23.

Spill flows discharged via an unsatisfactory screen to the Brynmill stream, which discharges to Swansea Bay foreshore, in the middle of the designated bathing beach. The existing chamber, of 10.5 x 3.6m x 3m deep was of sufficient size, and in good condition, to be reused to incorporate a new ROK2 mechanical screen, capable of screening in excess of 500l/s.

The old cover slab and openings were removed and the chamber was covered by a new precast concrete slab, with separate man access and full screen access openings, to allow safe maintenance.

Construction delivery

The CSOs required to be constructed in sequence; with construction of CSO 24 first, to ensure that the increased flows arriving at this CSO would all be screened if there was a storm event. Construction started in August 2013 and was completed in November 2013.

Decommissioning works at CSO 23 followed in November 2013 and were completed in December 2013. Construction at Glanbrydan Avenue CSO began in December 2013, with completion in March 2014. Bryn Road and Vivian Road were also decommissioned in March 2014.

Design and construction

The key project participants were:

Client	Dŵr Cymru Welsh Water
Principal Contractor	Morgan Sindall plc
Technical Consultant	Grontmij Ltd
Commercial Consultant	EC Harris
Hydraulic Sewer Modelling	Grontmij Ltd
Hydrodynamic Modelling	Intertek Energy & Water Consultancy Services
Prefabricated CSO Chamber	Pipex px (for Glanbrydan CSO)
Static Screen Supplier	Hydro-International (for Glanbrydan Avenue CSO)
Mechanical screen Supplier	Huber Technology (for CSO 24)

Project status

All CSOs are now operational and have been handed over to Welsh Water Operations, with positive feedback received from the Operators, including the recent quote below.

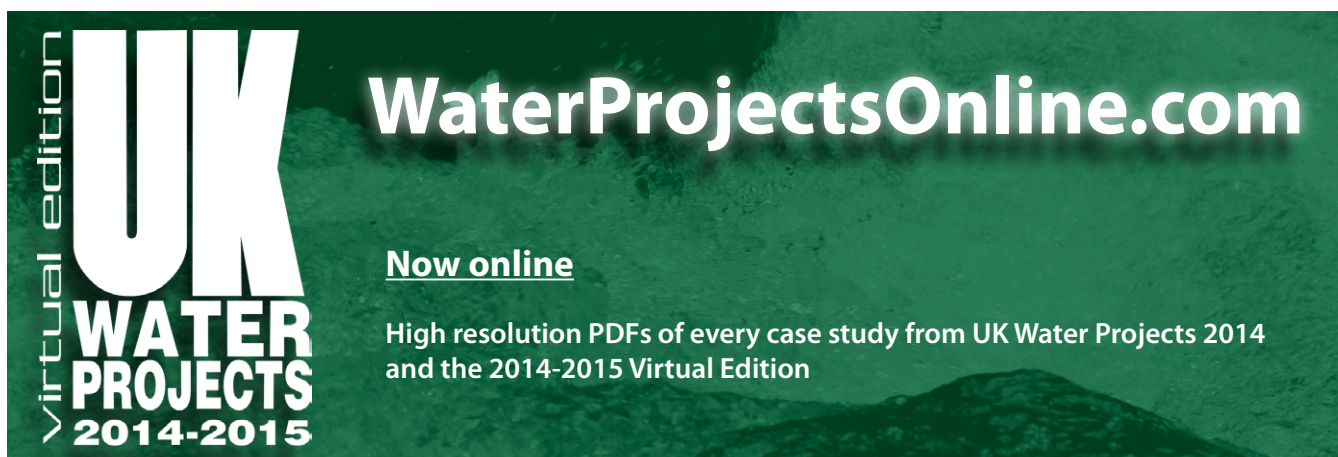
"The investments made on the network will greatly improve the performance of the sewerage network and ensure the maintenance surrounding the management of the assets will be dramatically reduced."

"We are confident the improvement work will greatly improve the aesthetic quality of the Brynmill Stream and in turn drive a reduction in the number of customer calls regarding debris observed within the stream and foreshore"

The Morgan Sindall/Grontmij team are now progressing construction of Phase 2, the Sketty 5 CSOs, in 2014/15, to continue the Swansea Bay Strategy and ensure that the bathing beach meets the revised Directive.

The Editor & Publishers would like to thank Fred Watson-James, Graduate Engineer with Grontmij Ltd, and Neil Campbell, Principal Engineer also with Grontmij Ltd, for providing the above article for publication.

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