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WALLRUS - CSO Compliance in Coastal Waters

By

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1. INTRODUCTION

To comply with EEC directives, regarding beach and bathing water quality objectives, Dwr Cymru Welsh Water (DCWW) have undertaken a substantial programme of capital works involving the assessment and improvement of sewerage discharges along the Welsh coastline. From Rhyl in the north to Penarth in the south a total of 26 unsatisfactory coastal discharges have been identified, all of which must be improved to achieve compliance by 1996.

Typically, reasons for compliance failure are unscreened short sea outfalls, unsatisfactory treatment facilities (in some cases non-existent) and poorly sited outfalls.

Remedies include improved primary and/or secondary treatment facilities and correctly positioned long sea outfalls. However, most solutions involve transfer pumping stations at the site of the existing outfall, discharging to new treatment works and outfalls.

In considering the transfer process, flows to the pumping stations during periods of rainfall are normally controlled by combined sewage overflows (CSO) on the outfall sewers. With such an arrangement it is of paramount importance to ensure that CSO discharges achieve compliance with the relevant environmental standards.

Wallace Evans Ltd have been engaged by the client DCWW to undertake the design and analysis of the works together with the Environmental Impact Assessment of the improvements at all 26 locations.

2. CSO ASSESSMENT PROCEDURE

The National Rivers Authority (NRA) determined that environmental protection standards for coastal discharges from CSO's shall relate to discharge frequency dependant upon the status of the receiving waters:-

Bathing beaches - maximum of 1 spill/bathing season
Water Contact Areas - maximum of 3 spills/bathing season

It was agreed, between DCWW and NRA Welsh Region, that for schemes in Wales a CSO procedure as detailed in "Coastal Research Report No.5 - Estimating The Frequency of Operation of Storm Outfalls and Overflows Method 1" WRc Report C408, should be adopted.

This report is one of a series produced from the coastal research club programme funded by Seven Water Plc's, (to whom distribution of the report is limited). For this reason, it is not possible to provide a full explanation of the analysis procedure in this paper, but only to give a brief resume of the principle stages. The research presented three methods relating to CSO analysis as listed:-

Method 1 - the simplest method
Method 2 - an interim procedure
Method 3 - the 'SMARTS' method

For the majority of schemes in the DCWW programme Method 1 is being used as, at the time of undertaking, this was the only method available. Wallace Evans Ltd are currently applying methods 2 and 3, in conjunction, to later studies.

3. METHOD 1 SUMMARIZED

Irrespective of which method is applied a verified WASSP/WALLRUS model is a prerequisite.

Method 1 involves the completion of three steps:-

Step 1 - Preparation of Historical Storm Data.

Historical hourly rainfall data is obtained from the Metrological Office for the rain gauge site nearest to the study area. There are approximately 200 sites throughout the UK and 10 within Wales. The historical data is then screened to identify bathing season events. Events are defined in respect of several parameters appertaining to the storm characteristics.

Step 2 - Derivation of System Response Curves.

Using selected events from regional TSR with the verified model a ranking of spill volumes from the CSO is produced. The data is subjected to a regression analysis which derives a relationship in respect of spill volume and rainfall characteristics (normally linear).

Step 3 - Calculation of Spill Frequency.

By applying the regression equation to the historical rainfall data a spill volume for each historical event is determined and thus a spill frequency established.

When the frequency of spill is greater than permitted there are two standard solutions available (or a combination of the two). Either increase the continuation flows and/or provide attenuation storage at the CSO. The analysis of spill volumes and frequencies from the historical event data provides a good indicator of storage volumes required to achieve compliance.

4. ABERYSTWYTH

In order to achieve beach and bathing water quality compliance at Aberystwyth, Dwr Cymru Welsh Water intend to install full treatment and U.V. disinfection to replace the existing unsatisfactory short sea outfall. Sewage will be pumped from the harbour to a new treatment site 3km inland. Existing tidal storage tanks at the harbour will be converted to storm settlement tanks incorporating a storm water overflow.

Using a verified WALLRUS model and "Method 1" analysis Wallace Evans have been able to satisfy the NRA that the overflow will discharge less frequently than the required once/bathing season maximum.

An analysis of inland CSO's within the catchment was also undertaken to prove that discharges from these did not cause failure of coastal waters via discharges to rivers.

5.0 CONCLUSION

The use of the methods outlined in this paper have enabled Wallace Evans to maximise the benefit of existing storage and optimize pumping requirements whilst ensuring that the environmental protection standards are satisfied.

This type of solution and analysis may well prove to be a cost effective way of managing storm flows in many existing coastal towns where new or improved facilities are being introduced.

The methodology is also easily adopted to inland situations where water courses are sensitive to frequency of CSO discharge.

Question

Martin Osborne Hydraulics Research

Cheered that there was correlation with Design Storms. Would increasing them by 10 % (in line with the findings of MO's Paper) have given even better answers ?

Answer

Yes it probably would.

Question

Richard Kellagher Integrated Hydro Systems

RK had carried out a similar method of assessment which he had found to give good results but was the 3 years of data sufficiently for assessing overflow spills ?

Answer

The 3 years of data was only use to look at the "London Bus " effect of storms coming in groups, with the large volume of storage the NRA were worried that the tanks would not be sufficiently empty when the next storm came along. The overall assessment of pumping rate and storage volume had been done on the 10 years of data.

Question

David Beale DHV Burrow-Crocker

Did they consider reducing the flow to treatment to less than 3 DWF ?

Answer

Yes they did consider it and it would have been possible but the NRA had insisted on 3 DWF to treatment.

Question

Rob Henderson Wessex Water

Were the Authors sure that the SSO's were the culprit for the bathing water failures ?

Answer

No they were not because the outfall at present hides the effect of the SSO's. They had assumed that

once the main outfall had been cleaned up then any spill to the beach from the overflow would cause a failure. This assumption had been supported by detailed studies that had been carried out in Anglesey.
