North Coast Wastewater Treatment Scheme

extensive sewerage upgrade improves NI bathing waters

by Eric Stewart

In May 2007, less than two years after construction start, Northern Ireland Water (NI Water) put into operation its hugely complex North Coast Wastewater Treatment scheme. The myriad of new infrastructure, which includes a modern wastewater treatment works, 16 new or refurbished pumping stations, a 1,200m long sea outfall and 25km of pipelines, represent an investment of £45m to overhaul the existing systems and improve the quality of bathing waters around the beautiful North Coast region.

Completed North Coast WwTW designed to treat up to 38 million litres wastewater a day *photo courtesy Northern Ireland Water*

The Project

Spanning a distance of around 16 kilometres, the North Coast Wastewater Treatment scheme represents the most complex EU Urban Wastewater Treatment and EU Bathing Waters Directives compliance scheme ever to be undertaken in Northern Ireland. At a cost of £45m, the contract forms one of NI Water's largest ever single capital investment projects undertaken to meet current environmental regulations and improve the quality of bathing waters around one of the North's premier tourist resorts.

Delivering the project a month ahead of schedule NI Water, its joint venture project managers MWH-RPS and their contracting partners, Biwater Graham JV confidently met local bathing water compliance dates and satisfied a range of important stakeholders. Supporting the contractor in a civil design capacity were Scott Wilson Consulting Engineers.

Need for the scheme - previous situation

The North Coast is designated an Area of Outstanding Natural Beauty and is recognised as a premier tourist location attracting thousands of visitors each year.

Previously, wastewater treatment for the coastal towns of Castlerock, Portrush and Portstewart involved only preliminary treatment and discharge to the sea through short sea outfall pipes.

In Coleraine and Articlave, treated effluent was discharged to the tidal stretch of the River Bann and the Articlave River respectively. Coleraine WwTW was overloaded and frequently failed to meet its proper discharge standard, while Articlave was an old works that required significant operator intervention to maintain the processes.

Objectives

The overall objective of this multi-million pound scheme was to raise the standard of treatment and in doing so improve the quality of bathing waters around the North Coast area by removing discharges of untreated wastewater. In particular, four of Northern Ireland's most popular beaches Castlerock Strand, Portstewart Strand and the Portrush Mill and Curran Strands, as well as the water in the tidal stretch of the River Bann, would benefit from the scheme.

The project would also accommodate future growth in the area in

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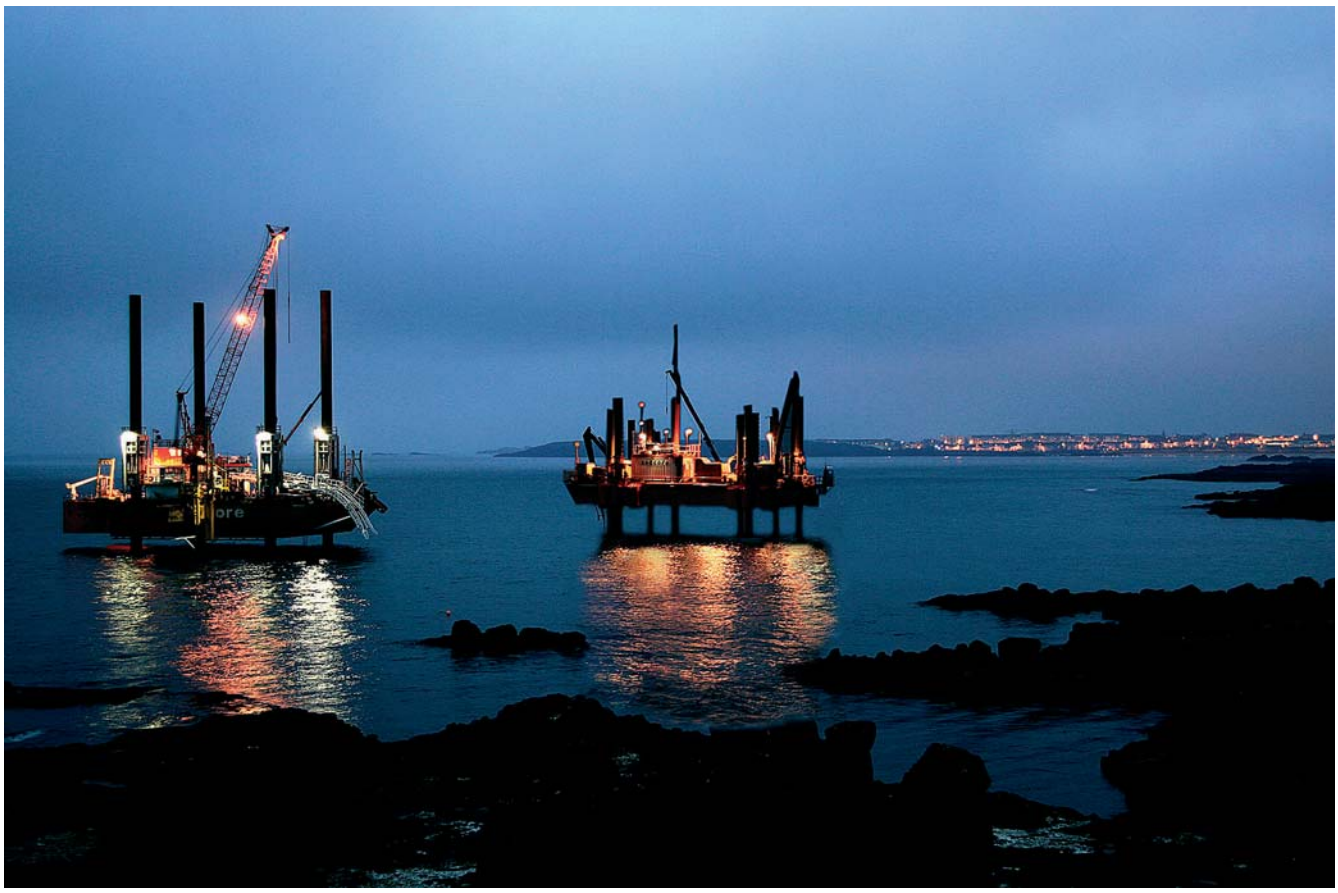
Causeway St Pumping Station (left) and Dhu Varren Pumping Station (right) *courtesy of Northern Ireland Water*



Two large scale rigs were used to lay the 1200m long sea outfall *courtesy of Northern Ireland Water*

terms of residential, commercial, tourism and industrial development to the year 2030, representing a population equivalent of 107,000.

Design

Operationally, the scheme was designed to rationalise the existing sewerage systems and reconfigure the network so that wastewater from the urban areas of Castlerock, Articlave, Coleraine, Portrush and Portstewart (all within the scenic North Coast area) would be collected and transferred to a new two stage treatment works at Craigtown More - a greenfield site between Portrush and Portstewart.

The requirements of the sewerage system are varied and fluctuate seasonally due to the area's main industry of tourism.

Within the design of the new wastewater treatment works, additional measures had to be taken to ensure effective removal of possible fats, oils and greases (F.O.G) which could enter the sewerage system from the higher accommodation occupancy and increased restaurant business in the area during peak tourist seasons. As a result, systems such as a dedicated F.O.G removal system and a fully automated hot and cold wash system for the inlet screens were incorporated into the design.

Value engineering workshops and regular design meetings with NI Water's end user ensured that the team was able to build the most advanced works possible without compromising on performance or running costs. The innovative design and state-of-the-art systems installed allow for minimal operative intervention and only require NI Water employees to manage the plant on a part time basis.

Within the rest of the network, the 16 new and refurbished pumping stations have been designed along a cascade system, so that the smallest pumping stations are pumped into the main/terminal pumping stations and then finally to the main treatment works.

Eight of the pumping stations have been designed to not only pump but also to contain storm water in extreme conditions.

Sympathetic construction

The main pumping stations are situated at prominent locations along the coast or within town centre sites. For this reason, NI Water, together with the project management and design and build teams, developed aesthetically pleasing solutions which integrate effortlessly with their surroundings and add amenity benefit to the area.

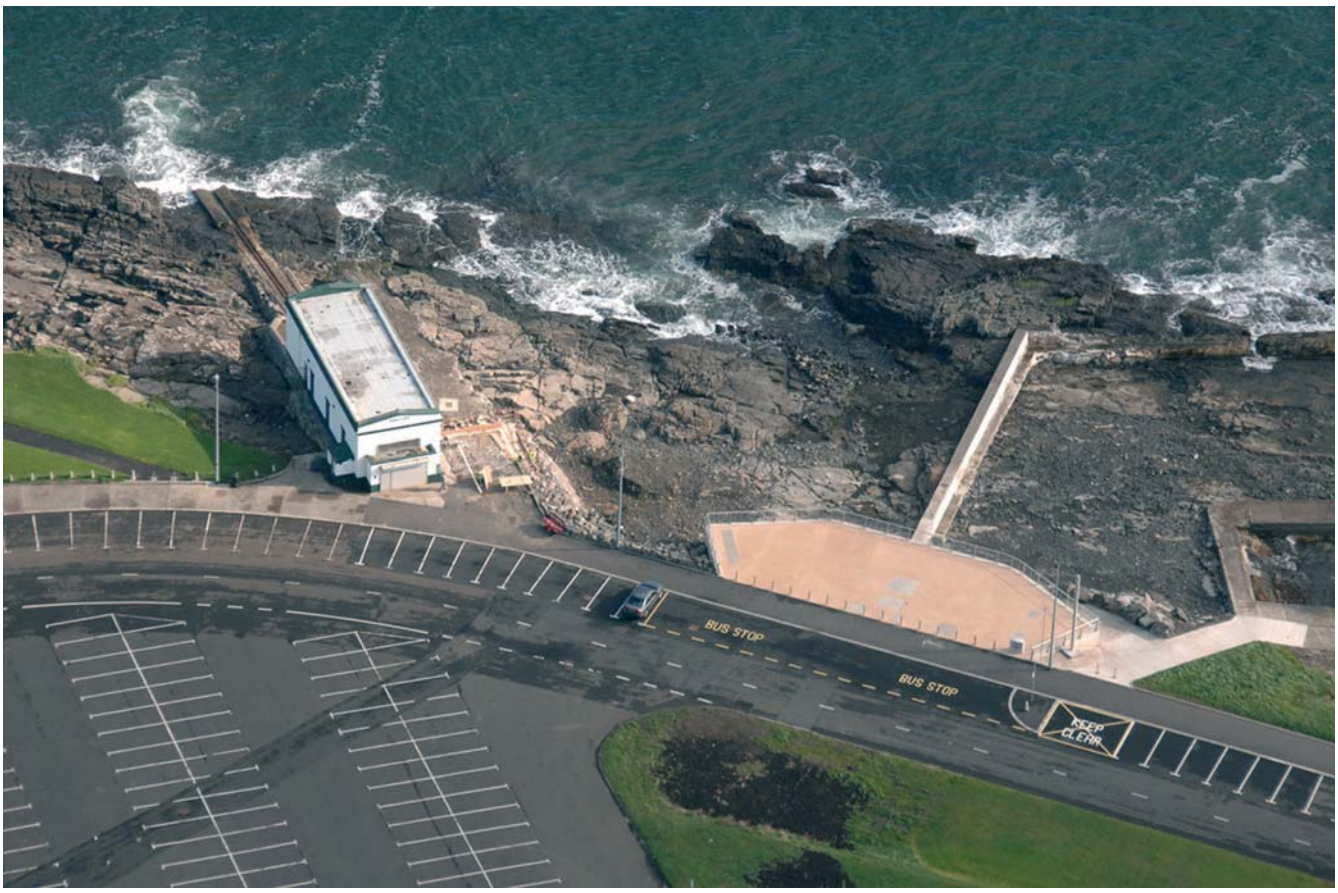
At Dhu Varren PS, located at East Strand in Portrush, the team worked closely with Coleraine Borough Council to design a building that would incorporate much-needed public convenience, baby and water sports changing facilities.

In Portush town centre, Causeway Street PS has been largely buried and creatively landscaped to provide an attractive recreational area, while along the coast the new pumping station at Lansdowne includes a public viewing platform. The building here is level with the roadside and from its rooftop it offers passers-by a large open space from which to take in the breathtaking coastal views.

To promote sustainability Dhu Varren, Causeway Street, Riversdale and Articlave Pumping Stations were constructed with shafts using precast concrete segmental lining rings. The construction of these shafts, by the Caisson method, also boosted a more environmentally friendly means of construction - considerably reducing the number of construction vehicular movements and the amount of spoil removed from site.

For the 25km of pipelines installed, slip-lining techniques were utilised where possible to reduce the environmental impact and minimise disruption to businesses and road users. Where it was not possible to slip-line pipelines, other methods such as micro-tunnelling and pipe-jacking were used.

The installation of the 1,200m outfall pipe, using two off-shore rigs, was carried out by specialist marine company Seacore. The route of the outfall was carefully chosen following consultation with the



Aerial view of new Lansdowne Pumping Station which incorporates a fantastic viewing platform *courtesy Northern Ireland Water*

Environment and Heritage Service and other statutory bodies to ensure that it did not impact on any significant, rare or inter-tidal plant, marine life and animal communities.

Major challenges

While sympathetic construction techniques and innovative design solutions helped to address some of the aesthetic issues surrounding the scheme, perhaps the biggest challenge which faced the North Coast project management team programme-wise was the construction of the long sea outfall pipe. This was one of the most critical aspects of the entire project as without it, the new wastewater treatment works could not be commissioned.

Weather conditions dictated that work on the outfall could only take place between the months of March and October. Utilising the expertise of the marine sub-contractor, large quantities of rock were removed by underwater explosives and a trench was excavated through sandy sections with the use of a high powered water pump. The first 300m of pipe were laid by the "float and drop" method while the remainder was laid by a "stinger" technique from the deck of the offshore rig. Good use of resources, planning and sheer determination helped to deliver this part of the scheme on target in October 2006.

Within the laying of the 25km of pipelines and gravity sewers was the installation of twin 800dia pipes crossing under the River Bann - one of Northern Ireland's busiest waterways. To minimise disruption, installation was achieved by directional drilling through the river bed. This was a particular challenge as an unexpected rock was encountered which required the use of special cutting heads.

Operationally, all of the existing sewerage systems had to be maintained throughout the two years construction phase. This necessitated careful planning and the implementation of complex "overpumping" regimes and critical breakthrough operations.

Stakeholder Engagement

The programme of works for the North Coast Wastewater Treatment Scheme was carefully planned to minimise disruption, particularly during peak tourists seasons. Weekly meetings took place with DRD Roads Service to assist in programming all pipelaying activities and no major works were undertaken on roads while high volumes of holidaymakers were visiting the area or while important events were being held. In a bid to keep key stakeholders informed, the project team met every month with staff and elected representatives from Coleraine Borough Council; Coleraine and Portrush Chambers of Commerce and Portrush Community Development Group. Special monthly progress reports were prepared and regular site visits organised to ensure that all the public bodies and interest groups were furnished with up to date information on the project.

Commissioning

The complexities surrounding the North Coast scheme meant that meticulous planning was required to ensure a smooth commissioning process. Each pumping station was carefully tested and brought on line separately so that every element of the cascade system could be effectively monitored. After months of preparation, the new WwTW went into operation in May 2007, well in advance of the main summer season and a full month ahead of the original programme.

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