

# Wastewater Pumping Stations Upgrade Project

## Northern Ireland Water's efficient procurement delivers widespread environmental benefits

by Peter Ferguson

**N**I Water has over 1,200 wastewater pumping stations within its asset portfolio. Some of these assets date back to the 1960s and many are sited at coastal locations throughout some of Northern Ireland's most popular tourist areas. The Wastewater Pumping Stations Upgrade Project represents a £4.5m investment by NI Water to improve the efficiency and reliability of a number of wastewater pumping stations in their asset portfolio. The innovative approach to procurement, design and project management has seen NI Water and their contract team complete 34 schemes on time and under budget; reducing the risk of out-of-sewer flooding and delivering environmental improvements in popular coastal regions across counties Down and Antrim.



### Background and need

In 2012, NI Water's Asset Management division developed a list of stations which were becoming increasingly prone to blockages and which were resulting in out-of-sewer flooding. These stations were having huge financial implications for NI Water in terms of operational call outs and maintenance and were struggling to meet Northern Ireland Environment Agency's (NIEA) requirements.

To address the situation, and tackle the worst performing stations, NI Water allocated £2m initially towards a capital works refurbishment programme (with the possibility of increasing the package of funding to over £4m after 12 months) and so the Wastewater Pumping Stations Upgrade Project (WwPS Upgrade Project) came about.

### Objectives and drivers

The main objective for the WwPS Upgrade Project was to reduce both the financial and environmental costs associated with blocked pumps and resulting pollution incidents. NI Water set out to do this through:

- **Removal of inlet screens and installation of solids handling pumps:** Screens were source of many blockages.
- **Improved benching:** To reduce blockages in pumps.
- **Improved control philosophy:** This would also reduce blockages in pumps.
- **Improved efficiency:** The installation of more efficient pumps and improved control philosophy to reduce running costs - less callouts and power usage.

The package of work also gave NI Water's Engineering Procurement team the opportunity to address other key issues such as:

- **Health & safety:** All pumping stations refurbished will meet current H&S standards with improved access and lifting arrangements.
- **Enhanced service level & site aesthetics:** Removal of public nuisance and improvement of site surroundings.
- **NIEA storage requirements:** Where possible storage was improved to future proof stations against ever increasing NIEA discharge requirements. This was generally achieved

by converting dry wells to wet wells.

- **NIEA discharge requirements:** Screens added to all emergency overflows.

#### Procurement route

The package of work was tendered to NI Water's four Integrated Wastewater Framework (IWWF) Contractors based on NEC3, ECC Form, Option B: Priced Contract with Bill of Quantities, with the Contractor taking responsibility for both Civil and MEICA design.

Tender submissions were assessed in accordance with Tender Evaluation and Assessment Methodology utilising a 70/30 Cost/Quality Criteria.

The contract was awarded in July 2012 to Biwater Graham Joint Venture (BWG) with URS providing civil design.

#### Forward thinking

At the time of tender, NI Water was rolling out other capital works projects that would see a number of wastewater pumping stations fitted with intelligent pump station manager (IPSM) systems. The IPSM functionality integrated numerous control panel components to monitor performance, improve efficiency and reduce the level of maintenance required.

NI Water was able to incorporate the IPSM functionality into the scope of work for the WwPS Upgrade Project to deliver a full upgrade solution. The full scope included:

- Installation of washwater booster sets.
- New lifting equipment.
- Mechanical and electrical upgrade works.
- Installation of new pumps and control panels.
- Upgrade of site services - lighting & heating.
- Installation of new overflow screens.
- Installation of new access covers, ladders, stairs, access ways and doors.
- Reinforced concrete works.
- Site enhancements/landscaping.
- Clean down of wet wells and dry wells.
- Confined space operations.
- Turn of flows.
- Commissioning: 21-day tests carried out on each site to prove performance.
- Provide training for the new control systems to NIW operations.
- Provide back up and support during the commissioning and handover phase.

#### Design and construction

Graham Construction Ltd (GCL) worked closely with its designers, URS and its wider supply chain to develop a standardised design solution for all pumping stations. Early and ongoing collaboration with supply chain members along with regular value engineering ensured efficiencies in design to complete a challenging programme of work and fulfil client operational needs.

Pre-construction, GCL discussed and planned phased operations with NI Water teams, making note of historical issues on each site. A scope of work for each pumping station was agreed and permits put in place before any site works commenced.

Weekly whereabouts lists were issued to all team members while daily notifications were also issued to NI Water telemetry as to pumping station status and operation once in GCL control.

In terms of getting projects to site quickly and fulfilling budget spend, the WwPS team devised a 'traffic-light' system to identify which of the stations posed the least complications. This involved gathering information on things such as land ownership details,

existing power supplies, access issues etc. Once the relevant data was analysed, any 'good-to-go' sites were labelled green allowing the contractor to commence work; sites with only minor issues were coloured amber and those with more serious problems were marked red.

The team met every two weeks to discuss progress, address any problems and re-evaluate issues so that amber sites were constantly turning green - ensuring fluidity of work for contractor and guaranteeing contract spend for NI Water.

A dedicated Lands Liaison/Customer Care Officer worked as part of the team to manage the numerous land issues and carry out effective communications with the many stakeholders and householders affected by the individual schemes.

Project management was enhanced by the use of a dedicated project 'Sharepoint' site – a centrally-located information network to which each member of the team had remote access. This acted as an integral information and communications tool onto which every team member uploaded relevant data.

Tasks were recorded after each bi-weekly meeting and were completed/reviewed in the two weeks following.

To ensure a smooth commissioning process, defect review meetings were held before a 21-day test started on any pumping station. Handover meetings were arranged with NI Water's Engineering Procurement and Operations teams and their project support team in McAdam Design.

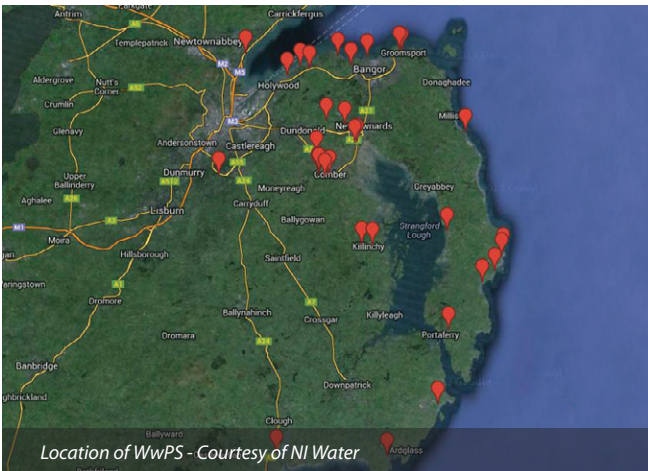
In a bid to constantly improve the entire construction and commissioning process, 'Construction Meets Design' sessions were held on site to review issues and carry forward lessons learned to the next sets of designs.



Seacourt WwPS. Photograph illustrates the inaccessibility of some of the sites - Courtesy of NI Water



Upgraded Seacourt WwPS - Courtesy of NI Water



Location of WwPS - Courtesy of NI Water



New panel and crane in Comber Road PS - Courtesy of NI Water



Comber Road WwPS: Peter Ferguson, NI Water (right) with members of the project team from Graham Construction and McAdam Design beside the old and new storm pumps - Courtesy of NI Water

## Challenges

The majority of the pumping stations being refurbished had the same operational and technical challenges which mainly revolved around over-pumping and keeping the station live while the work was being carried out. However, many other challenges were presented to the team pre and during construction in terms of site locations, supporting mains infrastructure and power supplies:

- Pumping stations located in popular coastal and amenity areas; in close proximity to domestic dwellings; and along privately-owned roads.
- Replacement pumping main along a busy Greenway, popular with cyclists and pedestrians and where a gas main had previously been laid.
- Getting 3-phase power supplies to remote sites.
- Planning permission. Three stations required full planning applications due to their sensitive locations and the siting of kiosks etc.
- Maintaining operation during construction.
- Confined spaces for carrying out work.

The following two short case studies help to portray elements of the WwPS Upgrade Project and the challenges faced by the team as it carried out the work:

### Case study 1: Comber Road WwPS, Newtownards

Comber Road WwPS was the largest of the upgrades under the WwPS scheme and proved to be a difficult challenge as the team balanced the continued operation of the station with the extensive refurbishment works. The pumping station delivery puts forward 40l/s for foul flows and the storm pumping station is designed for 250l/s.

The team had to control and divert these flows during the decommissioning stages of both existing mechanical and electrical systems, whilst installing the most up to date systems for the control and delivery of the up-to-date station.

Large scale over-pumping operations dealt with high volumes of incoming flows resulting in zero incidents during the construction phase. The old shaft driven pumps, which were 20 years old, were replaced by new Xylem dry well submersible pumps which are much more efficient and able to deal with heavy ragging solids in the flows. These more effective pumps will reduce the level of maintenance required by NI Water operations staff. The new control system installed is able to monitor the efficiency of the pumps, their power output and run time to allow better preventative maintenance of the station.

The extensive mechanical changeovers were supported by numerous civils upgrades to deliver a fully refurbished pumping station. Overall the upgrade of this station represents the largest investment by NI Water in the 34 selected sites, being £250,000 of the overall £4.5 million budget.

### Case study 2: Groomsport Harbour WwPS, Groomsport

As its names suggests, Groomsport Harbour WwPS sits prominently alongside the harbour in the picturesque village of Groomsport.

The pumping station was converted from a 'dry well' station to a 'wet well' pumping station to increase emergency storage capacity and help to prevent spillages during storm conditions. The new wet well pumps are more efficient and reliable meaning there should be less blockages in the future and thereby fewer NI Water call outs to the pumping station in the future.

An emergency overflow screen was installed in the pumping station in line with NIEA requirements and the installation of a telemetry column, allows the pumping station to be remotely monitored by NI Water.

Ahead of construction, the project team saw an opportunity to make some major aesthetic changes in the area as part of this upgrade through clever design and the use of more visually-pleasing materials. Although it meant having to apply for planning permission, it was felt that the removal of the old pumping station, a concrete structure from the 1970s which impeded the seaside view of some nearby houses, would reap dividends.

Working closely with the local council and community association, NI Water and its construction team developed proposals for the new pumping station which not only reduced the size of the building but which also incorporated attractive stone cladding and soft landscaping.

Even the telemetry pole was installed to look like a lighting column to match others in the area. The end result is a wastewater pumping station that is much more efficient and reliable and which doesn't detract in any sense from the beautiful surroundings in which it is located.

#### Environmental improvements & community benefits

The WwPS upgrades have delivered environmental improvements by reducing the potential for out-of-sewer flooding, but in many occasions they have also totally transformed the aesthetics of the area around each pumping station resulting in a much improved environment for NI Water customers.

By converting many dry well stations to wet well stations NI Water has been able to remove old, unsightly concrete structures and replace them with simple kiosks to transform many coastal locations while improving the performance and compliance aspects of the assets.

Where possible low-cost but effective landscaping has been introduced to soften areas and one particular case, at Cloughey North WwPS, a special mural was designed for the front of the pumping station by local school children.

#### Summary

The success of the WwPS projects has been realised on economic, environmental and social levels. Thirty-four pumping stations have been successfully refurbished under budget and continue to deliver cost savings to NI Water.

In addition to the reduction in call outs by NI Water Operations staff, the improvements made at each pumping station are having a significant positive affect on power consumption, with early indications showing that power usage at some stations has almost halved.

The success of the project has largely been achieved through great teamwork and communication; design innovation and standardisation; local supply chain flexibility and importantly end user intervention. Almost 60,000 man hours were employed throughout the 34 sites with no reportable accidents which is testament to the meticulous on-site communication and supervision.

The emphasis placed on considerate construction at each site has been reflected through the countless letters of gratitude received by the project team from local residents.

The WwPS Upgrade Project has proven to be an excellent example of NI Water investing to deliver efficient and effective wastewater infrastructure; improve the level of service and local environment for our customers and support the local construction industry.

*The Editor & Publishers would like to thank Peter Ferguson, Senior Project Manager with NI Water, for providing the above article for publication.*



*Groomsport Harbour WwPS prior to refurbishment. Shows close proximity to houses - Courtesy of NI Water*



*Groomsport Harbour WwPS after refurbishment - Courtesy of NI Water*



*Local school children help NI Water staff to complete the landscaping at Cloughey North - Courtesy of NI Water*



*The project team donated Christmas trees to a local primary school. The trees were removed from a plantation adjacent to Bradshaw's Brae PS to facilitate access of machinery - Courtesy of NI Water*