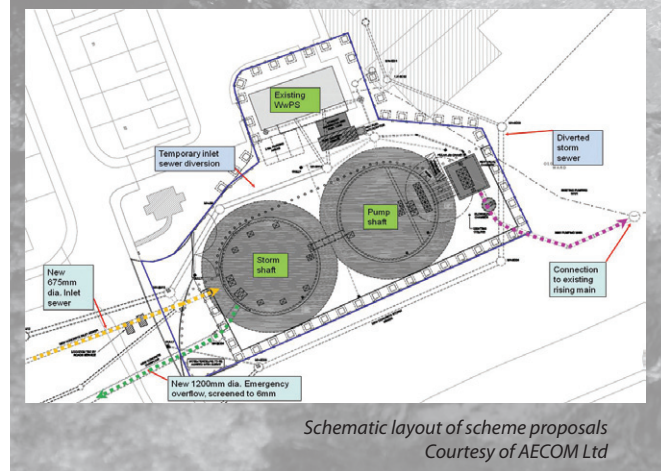
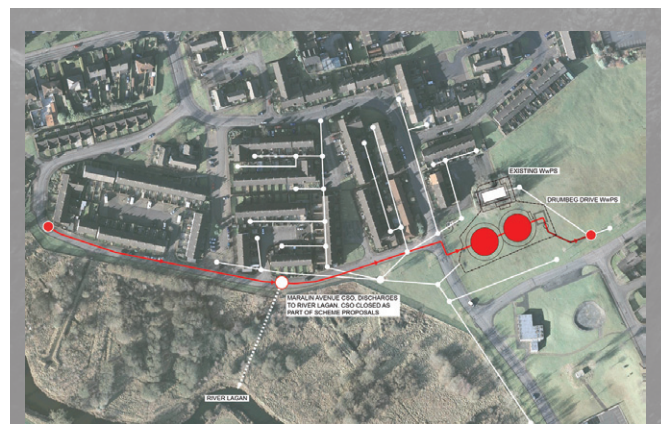


Drumbeg Drive Wastewater Pumping Station

a complex project to protect the quality and appearance of the River Lagan, one of Lisburn City's greatest natural assets

by Sam McManus BEng CEng MICE

The existing Drumbeg Drive Wastewater Pumping Station (WwPS) is Northern Ireland Water's (NI Water) second largest pumping station in the City of Lisburn, Northern Ireland which has a population of over 116,000. It was commissioned in the early 1970s and it is a critical asset to the overall operation of the sewerage network. It receives flows from a gravity sewerage network which includes a few outlying pumping stations. The flows are pumped from the station via a 500m long, 600mm diameter rising main to a manhole located near Lisnagarvey High School and then gravitates to the New Holland Wastewater Treatment Works (WwTW). The existing pumping station utilises three pumps in a duty/assist/assist regime with no provision for standby pumping or emergency overflow. The Maralin Avenue Combined Sewer Overflow (CSO) acts as a storm relief when flows exceed the maximum pumping capacity of 519l/s.



Background

Commissioned by NI Water the Lisburn Drainage Area Plan (DAP) identified excessive spills from the sewerage network to the River Lagan which were considered as unsatisfactory intermittent discharges (UIDs) by the Northern Ireland Environment Agency (NIEA). In order to reduce spills to meet river water quality standards the modelled outputs from the DAP made recommendations for the provision of a new WwPS at Drumbeg Drive including 1,500m³ stormwater attenuation along with the addition of emergency storage capacity.

In developing a viable solution a number of options were considered with input from contractors, ground specialists and NI

Water operational staff. The ground conditions were found to be particularly challenging including the presence of a sandstone artesian aquifer approximately 10m below ground level which constrained the viable options. Further negotiations with NIEA were needed and specialist contractor input was also needed. The accepted solution was a twin shaft construction adjacent to the existing station, retaining the existing control building to house new control panels. The presence of the aquifer has necessitated the provision of a concrete waterproof liner to the 1,500m³ storage tanks to prevent aquifer contamination. Provision of a permanent standby generator was also required to satisfy NIEA (in lieu of provision of 452m³ of emergency storage volume) as deeper tanks were not viable in the ground conditions.

Scheme drivers

Maintenance

Unreliable pumping of flows, aged equipment and pumps that are a subject to frequent blockages, causing surcharging in the upstream sewerage network, routine cleaning of existing wet well and associated operational costs.

Pollution

Unsatisfactory Intermittent Discharges from the Maralin Avenue CSO to the River Lagan having detrimental effect on water quality combined with lack of emergency storage at the existing WwPS.

Access

Site layout restricts access of maintenance vehicles.

AECOM has provided outline civil design, NEC project management, site supervision, Health and Safety CDM coordinator and stakeholder engagement services.

Following review of the project drivers and outline scope of works, a feasibility study was undertaken in order to ensure that most appropriate proposal could be selected. This included thorough consideration of possible options. Factors such as site footprint, constructability, health & safety and operational aspects, as well as whole-life costs including CAPEX, OPEX and NPV calculations were taken into account.

It was subsequently recommended and agreed that construction of a new pumping station with pass forward flow rate of 519l/s (as existing), incorporating the required 1500m³ storage volume would be a satisfactory and the optimum solution. The proposal also involved the following:

- Provision of a new emergency overflow sewer screened to 6mm.
- Wet-well separated from the storage compartment for easy and safe maintenance.
- The existing pumping station building retained to house the new control panel and provide welfare facilities.
- Closure of the Maralin Avenue CSO.
- Upgrade of the existing inlet sewer to convey the flows to the new pumping station and reduce surcharges in the sewerage network.

Scheme development

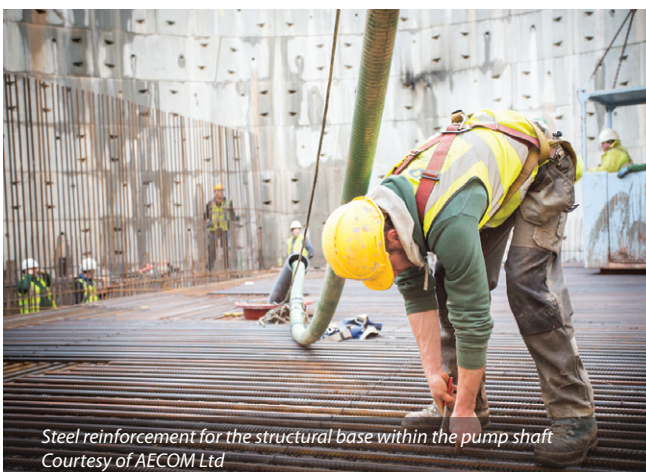
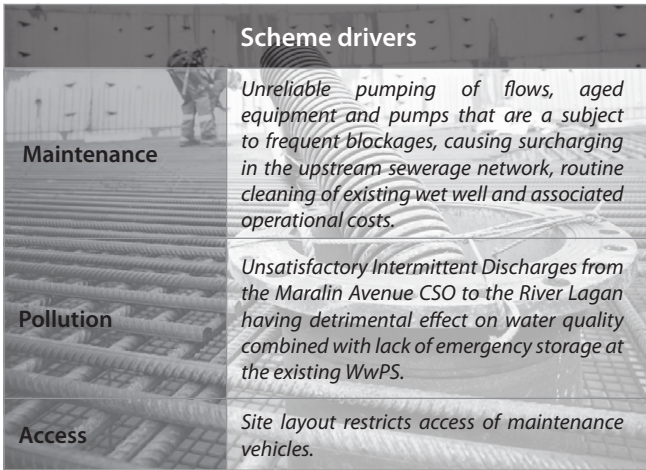
In order to progress the design the IWWF contractor, John Graham Construction Ltd was engaged by NI Water for essential early contractor involvement to develop the outline design to assist in the production of robust works information for the NEC Engineering and Construction Contract.

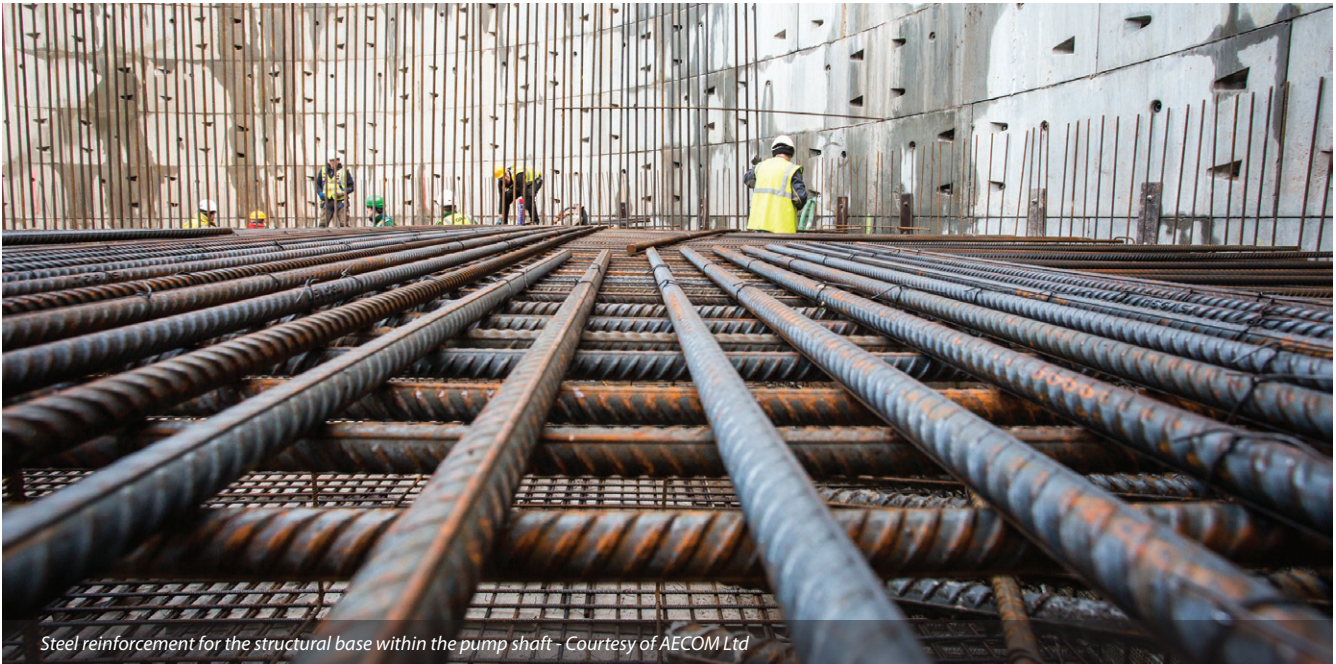
All design amendments and updated site investigation records were forwarded to the hydraulic networks modeller for assessment of model outputs. It was of paramount importance to ensure that the revised hydraulic model did not highlight any detrimental effects caused to the existing sewage infrastructure and that the main water quality driver for this project was achieved.

The developed solution for the project resulted in the construction of twin segmental shafts adjacent to the existing station. Two structures provide the required storage volume of 1,500m³, avoiding impact on the aquifer.

Detailed scheme description

- Sewage is delivered to the pumping station via 2 (No.) combined 525mm dia. and 750mm dia. sewers. As part of the contract an additional 675mm dia. inlet sewer was constructed in order to reduce the top water level in the gravity network upstream of the pumping station. This subsequently reduces the risk of out of sewer flooding.
- The new WwPS includes 2 (No.) 20m dia. segmental shafts, valve and flow meter chambers. One of the shafts consists of the wet well and storage compartment, the second shaft provides the remaining storage volume (1,500m³ in total).
- Under normal conditions flow will be directed via a dry weather flow channel through the shafts to the foul wet well. Within this wet well a sump will be provided for the location of the foul pumps and jet type aeration cleaning pumps. Under normal operating conditions the effluent level will be kept within the depth of the sump. The foul wet well will be isolatable from the rest of the pumping station to facilitate maintenance.
- The new WwPS will be equipped with 4 (No.) submersible pumps in duty/assist/assist/stand-by arrangement. The flow will be pumped away at the current rate of 519l/s via





Steel reinforcement for the structural base within the pump shaft - Courtesy of AECOM Ltd

an approximately 500m long, 600mm diameter existing rising main. The flows then discharge to a gravity sewer which feeds New Holland WwTW.

- Associated lifting equipment and facilities for wash down will be provided.
- Stand-by power generator will be provided to reduce the risk of flooding and pollution incident in case of power failure.
- The new control panel will be housed in the existing WwPS building.
- The new WwPS is equipped with a new 1,200mm diameter emergency overflow, screened to 6mm and is in full compliance with NIEA requirements.
- New access road suitable for a 6,000 gallon tanker will be provided.

Stakeholder management

In advance of construction commencement, the project team consulted local authorities and community in order to increase awareness of the need for sewerage infrastructure improvement. It was crucial to demonstrate how the temporary inconvenience

associated by construction works would be outweighed by a long term benefits. This approach and contractor's attention to the health and safety matters on and around the site resulted in no complaints received from members of the public.

Contract details

The contract was procured as Design and Build, utilising the NEC – Engineering and Construction Contract (ECC) – Option A, Priced Contract with Activity Schedule. The project was tendered amongst a select list of contractors appointed under NI Water's 'Integrated Wastewater Framework'. The contract was awarded to John Graham Construction Ltd work commenced on site in July 2013.

Current situation

Commissioning of the new WwPS was completed in June 2014 with handover to NI Water Operations staff in July 2014.

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Overhead view of the 20m diameter pump shaft - Courtesy of AECOM Ltd