

Laighpark STW, Shieldhall STW & Dalmarnock STW

Scottish Water's Bundle 25A project improves water quality of the River Clyde and its tributaries

by Daniel Rudd

The Bundle 25A project consisted of four schemes for Scottish Water Solutions, all of which involved the upgrading of live wastewater treatment works in Glasgow. The three sewage treatment works that make up Bundle 25A are Shieldhall, Dalmarnock and Laighpark, all of which are located around the central belt of Scotland providing wastewater services to approximately one million customers. The aim of the £10m project was to improve drainage, help reduce flooding, support building developments and boost water quality in the River Clyde and its tributaries, which will ensure the works continue to meet statutory requirements.



Shieldhall STW upgrade - Courtesy of MWH Treatment

Laighpark STW

Laighpark STW treats sewage from the Paisley area, providing primary settlement, aeration and final settlement before final discharge to the White Cart River. The project is driven by a Capital Maintenance need, with the intention to improve the screening facility at the works.

Sewage from Paisley gravitates to the works inlet. Flows in excess of 6 x dry weather flow (DWF) pass straight to the White Cart River. The sewage is lifted by 3 (No.) inlet screw pumps to the inlet channel, where it passes through 3 (No.) mechanical screens and detritors, operating in parallel, to remove rags and grit.

The three inlet channels are combined at a balancing chamber and then split into two channels through which the sewage flows to the 8 (No.) primary settlement tanks (PSTs). Each channel supplies 4 (No.) PSTs, operated in pairs.

Construction was undertaken over a 27 month period, during which extensive operational interface and management was required to ensure the works continued to accept flows from main incoming sewers. Over 20 shutdowns were undertaken during the project. The most critical interface was undertaken during the widening of the existing inlet channel which was modified to install new fine screens as further protection of the downstream

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Shieldhall STW Upgrade - Courtesy of MWH Treatment

process. Temporary stanking and sandbags were utilised to provide additional protection from flow fluctuations, even though the works were carried out during low flows. This method of construction resulted in no requirement for over-pumping facilities.

During the installation of new MCCs a series of standby generators were required, with a total of 10 electrical outages being necessary; standby and generation works were provided for the period of each outage to ensure the works continued to meet its required consents.

Laighpark STW upgrade included the provision of a newly refurbished inlet works, comprising of refurbished Archimedean screw pumps, replacement coarse screens and screenings handling, grit detritor modifications, inlet channel widening to enable the installation of new fine screens and screenings handling, aeration tank refurbishment and final settlement tank modifications. Additionally the upgrade also:

- Replacement of 3 (No.) 19mm coarse inlet screens, screening conveyor and a new compactor unit.
- Clean out and refurbish existing 3 (No.) detritors, modify control systems to arrange suitable flow through inlet works.
- Inlet Pump house MCC to be replaced. New control kiosk to be installed to house new screw pump.
- 20 (No.) new actuated penstocks 8 (No.) at inlet channels to form a crossover facility within the inlet channels, 9 (No.) at the new 6mm fine screens and 3 (No.) downstream of the detritors) to be added to the system.
- Replacement of both substation 2 & 3 switchboards (LV).
- 4 (No.) New fine (6mm) screens to be added to the system at the downstream of the detritors with new compactor units and launder channels. Extensive civil works are required to allow installation of the screens.
- The existing CO₂ system shall be left unaltered and a new fire alarm system shall be installed in substation No. 2.
- Modifications to existing telemetry associated with the above items.
- Refurbishment of 3 (No.) inlet actuated penstocks.
- Supply of temporary pumping to allow modifications to 3 (No.) channels to be made. Programme to be supplied.
- Replacement works associated with excessive sagging of the 4 (No.) concrete walkways above the aeration lane weirs.
- Refurbish the 4 (No.) adjustable aeration lane weirs (this item will only be carried out following replacement of the supporting concrete beams).
- Inlet screw pumps refurbishment including new top and bottom bearings on 2 (No.) pumps, new motor on 2 (No.) pumps, re-screed 2 (No.) pumps, refurbish lube oil system on one pump and decommission lube oil system on 2 (No.) pumps.



Laighpark STW upgrade - Courtesy of MWH Treatment



Laighpark Inlet Channels - Courtesy of MWH Treatment



Laighpark STW panoramic view - Courtesy of MWH Treatment



Shieldhall STW - Courtesy of MWH Treatment

Shieldhall STW

Construction started at Shieldhall WTW in 1975. It was proposed to replace the original works, built in 1910, in two phases to treat sewage from a population of 500,000 in the Glasgow area.

The area served lies on the south bank of the River Clyde and extends to Cambuslang in the east, Barrhead and Carmunnock in the south and Hillingdon in the west.

- **Phase I:** Comprises the preliminary and primary treatment along with storm treatment and sludge handling.
- **Phase II:** Comprises secondary treatment and was originally completed in 1984. Current legislation however prevents the dumping of sludge at sea and has driven the need to treat imported sludge and the sludge from the primary settlement tanks.

The crude sewage enters the approach channel to the screen inlet chamber from three inlet sewers:

- Directly from high level Renfrew and Braehead sewer.
- From a low level sewer taking combined flows from Govan via the inlet pumping station.

The crude sewage is screened and de-gritted prior to primary treatment. Flows in excess of 7,822 l/s (150 MGD) overflow from the grit channels to the adjacent storm channel. High lift screw pumps lift the preliminary treated sewage for treatment in 12 (No.) horizontal flow settlement tanks.

During storm conditions, the overflow passes to horizontal flow storm tanks which overflow to the river. When storm conditions subside, the contents of the tanks are returned to the main flow via the low level sewer.

Construction of the Shieldhall STW works were undertaken over a 26-month period. Existing works operations and stormwater management were critical due to the works being performed within the existing storm reception channel. Temporary stanking was provided during break-out work of the existing channel which allowed the installation of new penstocks to take place. These penstocks were then used as a replacement for temporary works due to the smart thinking of the project team and sequencing of construction and deliveries.

Diversion of high voltage cables and data/telecoms were undertaken during the weekend in order to minimise the disruption to the local community.

Shieldhall STW Upgrade consisted mainly of storm water handling upgrades, installation of new storm screens and screenings handling, increased wash water provisions, final settlement tank modifications, sludge RAM pump overhaul, activated sludge plant aerator modifications, grit removal and classification upgrade and extensive Archimedean screw pumps refurbishment.

The upgrade consisted of:

- Modifications to the Low Lift Pump house switchboard to increase safety and extend the operational life.
- Storm Screens to be replaced and associated screen handling and isolation penstocks installed. Existing bay area to be extended to accommodate new screens.
- Replace bridge mounted enclosures and power and control panels for 12 (No.) FSTs.
- Replace membranes within aeration tanks.
- Major overhaul of sludge ram transfer pump No 2.
- Specialist electrical work on 11kV switchboards for substations No. 1 and 2.
- Replace existing grit classifier and pipework modifications.



Laighpark STW panoramic view - Courtesy of MWH Treatment



- Fire alarm system to be installed within low level pumping station building.
- Low level screw pump refurbishment including inlet penstock work to allow isolation of screws. New top and bottom bearings on 1 (No.) pump, new gearbox and motors on 2 (No.) pumps, re-screed 2 (No.) pumps and upgrade existing condition monitoring on 4 (No.) pumps.
- High level screw pump (in pre-sedimentation building) refurbishment including new top bearings on 3 (No.) pumps, new bottom bearings on 2 (No.) pumps, new gearbox and motors 4 (No.) pumps, re-screed 4 (No.) pumps and upgrade condition monitoring on 6 (No.) pumps.

Dalmarnock STW

Dalmarnock STW treats sewage from a population of 190,000 in the eastern drainage area of Glasgow and a small part of the former County of Lanark. The site has been designed to treat a flow of

150ML/d (defined as DWF for the site). It was the first sewage works built on the site in 1894 and a pipe to take the resulting sludge to Shieldhall STW was constructed in 1914.

The STW now in operation at Dalmarnock opened in 1968 and the old works was demolished, although the same sludge disposal system is used today. Crude sewage enters the works via 3 (No.) 2.29m diameter sewers. Flows up to 100ML/day (0-3DWF) are pumped to full treatment and flows of 3-6DWF are pumped to stormwater tanks. Flows of greater than 6DWF are channelled directly to the River Clyde.

Construction of Dalmarnock STW was completed within a 6-month period and activities were undertaken in a specific sequence agreed with the works operators. MWH only had access to a single pump at a time, which ensured the works performance and process were not put at risk due to the construction taking place.



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Project 1 - Capital Maintenance Works

The capital maintenance works involved the relocation of existing pipework and motors relating to the hydraulic actuators of the existing works pump station, final settlement motors and gearboxes, minor electrical works and civil remedial works associated with the above activities.

Relocation of hydraulic operated actuators on crude sewage pump discharge valves:

- The hydraulic pump, motor and control valve manifold for the 8 (No.) hydraulically operated valves were relocated from the current position local to the valve support. This new position shall be on a stool 1m above the existing sump level.
- New hydraulic pipework installed to the relocated position of the hydraulic pump motor and control valves. The hydraulic pipes were positioned to avoid tripping hazard and have permanent soft securing clamps.

Boxed spares for final settlement tanks:

- New gearbox and high efficiency electric motors sized to match the current speed of rotation of the existing FST.

Electrical Requirements associated with the repositioning of hydraulically actuated power packs:

- Submersible junction boxes, cabling, containment, brackets, terminations and motor isolators.
- Typically, the installation included a junction box for the power supply, located above the pump walkway at the cable tray and cabling to an isolating switch at the motor (applies to all hydraulic valve power packs).

Project 2 – Odour Control Works

Odour control works included the upgrade and modification of the existing odour abatement system for the sludge wet well odour control system (WWOCS), general ventilation odour control system (GVOCS) and modifications the hydraulic pump room building.

Sludge Wet Well Odour Control System (WWOCS) re-commissioning:

- Modifications to the WWOCS system discharge stack.
- New ducting and fans to provide continuous extraction and negative pressure on the Wet Well.

General Ventilation Odour Control System (GVOCS) re-commissioning:

- Install new carbon media in the filter and dispose of the spent carbon.
- Modifications to the GSOCS discharge stack.

Hydraulic Pump Room building holes:

- Seal up the Hydraulic Pump Room building holes to allow the air to vent outside.

Sludge Overflow Tank vent filters:

- New carbon media trays.

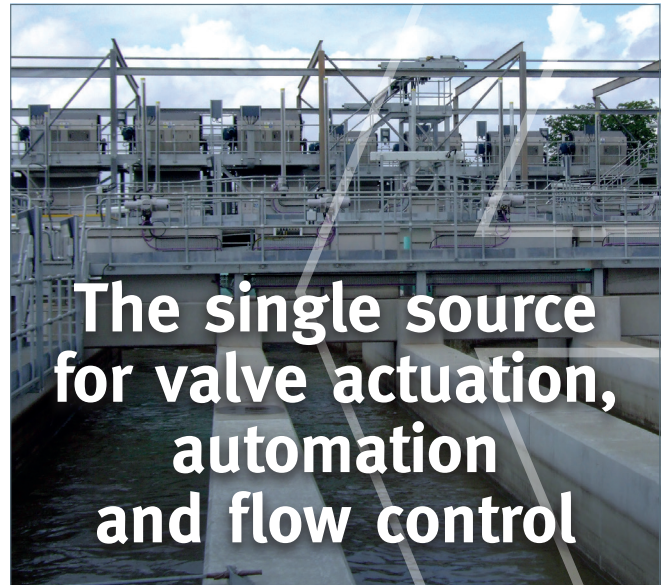
H₂S Monitoring Equipment:

- Supply, install and commission a permanent breakthrough H₂S monitors.

Summary

Although these schemes were delivered safely, the wastewater treatment works had contained operational issues with the potential to impact on project delivery. Through excellent foresight, planning and client management MWH was able to deliver the projects effectively whilst at the same time assisting Scottish Water in overcoming issues.

The Editor & Publishers would like to thank Daniel Rudd, Proposals Manager with MWH Treatment, for providing the above article for publication.



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