**PRESS RELEASE**

World-class sewer pump station relocation project reaches completion

***29 January, 2014:*** *The multi award-winning, R120-million Mahatma Gandhi Road Sewer Pump Station relocation project in Durban officially reached completion in November 2014, following three years of industry-leading innovations and world-class project management.*

As one of the largest pump stations in KwaZulu-Natal, the Mahatma Gandhi Road sewer pump station transfers all sewage from the Durban CBD, Berea and surrounding areas across the harbour to a treatment works on the seaward side of the Bluff.

Due to the fact that it occupies a prime site within the upmarket development zone of the Durban Point Development Corporation (DPDC), eThekwini municipality requested that the pump station be relocated adjacent to the northern entrance of the recently commissioned Durban Harbour Tunnel.

Hatch Goba KwaZulu-Natal lead for water and tailings, **Kendall Slater** highlights the fact that the original pump station is supplied by a 1 350 mm diameter gravity sewer, located 250 m from the new site development. “The gravity sewer therefore had to be extended by 221 m, while the pump station was constructed 13 m below ground level,” he notes.

**First-of-its-kind micro-tunnel solution**

**Montso Lebitsa**, Hatch Goba manager for Tunnels and Trenchless Technology, explains that the most appropriate and least risky solution for the extension of the sewer under the congested Mahatma Gandhi Road was identified as a trenchless method using slurry type, AVN micro-tunnelling technique. There are many different trenchless technology methods in the market, but ground conditions, limited working space, size of sewer and vertical alignment control were primary factors influencing the choice of a technique. The other challenge was the horizontal curved alignment to bypass the historical buildings. The first-of-its-kind in Sub-Sahara Africa, “this type of tunnelling method was unique in South Africa, and sets the precedent for future project innovations. The installation took just 24 days to complete in May 2012, which is a major achievement.” Micro-tunnelling is a “none-manned” mechanised pipe jacking technology, whereby all jacking and alignment are controlled from the computerised control cabin at the top of jacking pit, clarifies Lebitsa.

The 221-m long micro-tunnel consists of; a 113 m straight section from the jacking pit; a 102 m curved length with 350 m radius ( to bypass the protected historical Harbour Master Building); and a 6 m straight section breaking into the existing Harbour Tunnel northern entrance of the Harbour Tunnel.

The length of the tunnel was in excess of the designed length for the conventional hydraulic drive from container to machine. As a result, an electrically-driven hydraulic power-pack within the micro-tunnel was used to accommodate the longer distance tunnel drive.

This process of pipe jacking involves advancing rotating “micro-TBM” machine cutter-head and the jacking equipment in the jacking pit, which pushes a string pipes behind the micor-TBM. The excessive length of pipes to be jacked including around the curved section would normally increase pipe skin friction exponentially. To cater for this, two intermediate jacking stations were installed at 33 m and second one at further 100 m behind the machine, with eight 646 kN and 700 mm stroke hydraulic cylinders. These intermediate jacks would be used for staged incremental jacking, thus help reduce the length of pipes to be pushed installed to reduce the jacking pressures on the front pipes. Intermediate jacks,” he explains.

The Micro tunnel boring machine (Micro-TBM) with an advanced laser guidance system was used for this intricate and highly-complex task. The laser target position was relayed to the control cabin to allow the operator to effect steering adjustments as necessary to follow the design “pre-programmed” alignment. When the tunnel reached the curve, Slater points out that a gyroscope guidance system was used to control line and level.

“The alignment was checked manually every 40 m using standard surveying equipment to ensure that the positioning system remained accurate. The TBM reached the end point within a deviation of less than 20 mm, which is testament to the accuracy of the guidance system and ability of the operating team,” he continues.

At shallowest, the micro-tunnel was at depth of 6 m below ground and some 4 m below natural water table. The micro-TBM used a pressurised slurry system. The slurry, a “conditioned fluid, usually water or mixed with bentonite in difficult and highly permeable ground conditions”; was pumped to the front of machine to generate a positive pressure at the cutting face of the excavation, thereby preventing collapse. “Water was used initially for slurry. Bentonite was later used as the ground conditions became unsuitable for the use of water.”

The same slurry was used as a transport medium for the excavated material, and is pumped back via a slurry return pipeline into a separation plant at the surface.

The 250 m3/hr separation plant was equipped with a vibrating shaker screen rack, two 15-inch hydro-cyclones, and an agitator, designed to separate solids (in this case sand and pebbles) from slurry fluid. After the excavated material was separated the reconditioned slurry fluid is re-used and pumped back into the circulating slurry system.

**Laying the pipeline**

Each concrete pipe was lowered into the jacking pit via a crane and inserted into the collar of the previously inserted pipe. A wooden packing was inserted between each pipe to prevent cracking as a result of point loads occurring during the jacking process. The hydraulic jacks were then closed onto the other end of the pipe, which continued the drive.

Slater states that the entire pipeline was jacked forward from the rear end of the pipeline. “The pipes needed to be designed not only for the permanent loading conditions but also the temporary forces on the pipes during installation. Bearing this in mind, inter-jack stations were available to reduce the forces on the pipes, and minimise the risk of damage and associated downtime.”

**About the pump station**

The pump station consists of four main components, namely; the screening chamber, wet well, dry well and surface structure. It houses four 250 kW immersible pumps connected to two 1 000 mm diameter rising mains that cross the harbour through the tunnel. The pumps are also connected to a combination of stainless steel and HDPE pipework, ranging between 600 mm to 1 000 mm diameter.

The pump station operates automatically, depending on the inflow to the station, which varies over a 24 hour period. Slater says that the sump level is constantly monitored for fluctuations in flow. “As the inflow increases, the pumps speed up via variable speed drives. The number of pumps running and their respective speeds is determined by a programmable logic controller (PLC) system.”

What’s more, the pump station also features a ventilation system, an odour control system, backup generator and several sluice gates that allow various portions of the station to be isolated. The inlet sluice gate is programmed to close when power failures occur. Its motor is controlled by a UPS (Uninterrupted Power Supply) which closes the gate even when there is no power, thereby preventing the pump station from flooding.

**Health and safety success**

Slater admits that deep excavations, confined spaces, methane contamination, tripping and falling hazards, high scaffolding, deep water and high traffic areas presented a high number of potential health and safety risks to the project. “Despite these potential risks, the main contractor accumulated close to 270 000 lost time incident (LTI) free hours with only a single LTI recorded over the three year construction period. This is an outstanding accomplishment.”

**Achievements formally recognised by industry**

The South African Institution of Civil Engineering (SAICE) Divisional Award for Operation and Maintenance Projects was presented to Hatch Goba in October 2014 in recognition of the lead role that the company played in ensuring the overwhelming success of the project. Hatch Goba was again commended one month later with a special mention in the Civil Engineering Contractors category at the prestigious Best Projects Competition hosted by Construction World magazine.

“The success of the Mahatma Gandhi Road sewer pump station project is a result of various teams working well together, including; client, contractor, sub-contractors, architects and the Hatch Goba team. Thanks to everyone that contributed to these coveted achievements,” Slater concludes.

***Ends***

**Notes to the Editor**
There are numerous photographs specific to this press release. Please visit <http://media.ngage.co.za> and click on the Hatch Goba link.

**About Hatch Goba**
Hatch Goba supplies process and business consulting, information technology, engineering, procurement and project and construction management and operational services to the mining, metallurgical, energy and infrastructure industries.

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