



St Helen's Rock Pump Station, Umzimkhulu Water Scheme

The St Helen's Rock Pump Station under construction

OVERVIEW

St Helen's Rock Pump Station is nine kilometres upstream from the Umzimkhulu River at Port Shepstone and provides up to 54 Mℓ per day of raw water to the Bhobhoyi Water Works which supplies the greater Port Shepstone area to as far as Margate.

Engineers in the early 1970s blasted and anchored the pump station into a virtually sheer granite slope section – a marvellous engineering feat for the time.

However, after more than 30 years, lowering water levels in the Umzimkhulu River saw the system experiencing severe strain.

The Ugu District Municipality commissioned Royal HaskoningDHV to undertake a complete overhaul and upgrade of the raw pumping facility to double its capacity. At the same time, the municipality would construct a new off-channel storage dam.

The municipality invested R83 million in the complete upgrade of the facility, which now ensures a supply of 81 Mℓ per day, with pumping capacity potential of 108 Mℓ per day.

ELECTRICAL – CHICKADEE LINE

St Helen's Pump Station required an extra 2 MVA load to support its upgrades. Eskom's Port Shepstone substation, equipped with a 20 MVA transformer, had no spare breaker, and the existing Oribi

NB113 network with poor voltage regulation and capacity constraints would not be able to handle the increased 2 MVA load. It was then agreed that the upgraded pump station should be fed from the existing Port Shepstone NB129 network.

SETTLING CHANNELS

The civil contractors constructed an additional pair of raw water settling channels for sand and grit removal to operate in parallel with the existing pair of channels feeding the high-lift pump station.

As excavation proceeded, the design and construction of the settling channels' foundation columns required adjustment to suit the conditions.

During construction of the channels, numerous challenges were encountered, such as the following:

- Overflow water from the existing settling channels had to be controlled while the pump station remained functional.
- Allowance had to be made for scouring overflow water.
- At this remote location constant supervision was needed to monitor the delivery of over 300 tons of concrete and 32 tons of high-tensile steel reinforcing for steel cages which went into the construction of the new channels.
- Limited available space on the ledge.

FINALIST Technical Excellence Category

KEY PLAYERS

Client

Ugu District Municipality

Professional team

Royal HaskoningDHV

Main contractors

Pilcon / Unicon Joint Venture (civils), Sulzer Pumps (mechanical/electrical), Burlington Electrical t/a MG Electrical (MV Eskom Line)

GANTRIES

The various gantries and cranes servicing the pump station were required to be extended, upgraded and equipped. The crawl beam involved a 10 m long extension of the lower gantry on the low-lift structure, 11 m high columns with 31 kg/m capacity and a 4 m extension on the upper gantry.

CRANES

The main pump station cantilever crane beam was replaced with a 122 kg/m I-beam, 10 m long and secured into the main reinforced ring beams with steel plates. The 2.5 m cantilever would have to be able to lift the new 1 580 kW motors, and weight testing was closely monitored. A new 13 m geared chain block was also imported from

Settling channels under construction



The construction of gantries under way



The low-lift trolley under construction



Germany, which enabled the crane beam to continue functioning.

The existing 5 t low-profile overhead gantry crane inside the main pump station building was replaced with a 10 ton SWL capacity crane.

LOW-LIFT FACILITY

Sleeper rails

With lowering river levels the suction intakes had been operating barely below the water surface and required extensions, as well as longer rails to carry new sets of low-lift pumps down the river.

The 1973 engineers had blasted a 36° slope into the granite rock face onto which a further two pairs of sleeper rails could to be constructed.

Once the sleeper rails started to take shape it became critical that the angle enabled the trolley and suction bell mouths to clear the rock surface which could not be blasted or removed.

A large portion of the 200 t mass-filling and 100 t high-strength concrete on the sloping rock face was passed from hand-to-hand in buckets, as pouring concrete down the 36° slope had its limitations.

The river was protected at all times from run-off from the slopes.

Low-lift trolley

The new low-lift facility included two 90 kW self-priming pump sets (each with a duty point of 270 l/s x 22 m head) with associated suction and delivery pipework, valves, electric power cabling and controls. All this was mounted on a fabricated steel, rail-mounted trolley with an aluminium-clad steel-framed enclosure.

Low-lift winch house

The new 10 t SWL winch, complete with drive motor, brake and drum, was mounted on a common base plate which could safely lift the trolley with a rising main full of water. The rock face which had been exposed for the past 40 years was showing signs of severe weathering (fissures), so rock anchorage was inserted 10 m into the mountain and tied into the back of the winch house structure.

Construction of the new winch house consumed over 100 t of concrete and included steel reinforcing cages.

HIGH-LIFT PUMP STATION

Pipework

The entire suction and delivery pipework system inside the high-lift pump

station was replaced. This comprised new ND750s from flanged bell mouth suction channels to the new pumps, and ND700 delivery pipework between pump delivery flanges to existing ND600 flanges in the valve chamber leading up the mountain.

High-lift can pumps

The existing 200/250 GME horizontal split casing pumps were replaced with four new 3.3 kV x 600 kW pump sets. The existing concrete plinths were incorporated into the construction of the new plinths for the new can pumps. This required the cutting and removal of several tons of concrete using the new gantry crane.

THE PUMP STATION BUILDING

The entire mezzanine decking system equipment within the pump station was replaced in stages. An awning was installed to protect new electronic equipment from ultra-violet exposure, and the entire building was painted.

CONCLUSION

Before 2010 the St Helen’s Rock Pump Station was providing an average of 54 Mℓ per day of raw water to the Bhobhoyi Water Works. Today, the pump station is providing an average of 66 Mℓ per day through the off-channel storage dam into the treatment works with a maximum capability of 82 Mℓ per day.

The new Umzimkhulu off-channel storage dam holds almost a billion litres of raw water and is maintained at full capacity.

This three year project was completed despite the difficult technical and logistical challenges of working within the confines of a 1973 functioning facility constructed into a weathered rock face. □



The completed high-lift pump station

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