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# Mossel Bay sea water intake and brine discharge sub-sea pipelines

Murray and Roberts Marine (MRM) recently installed a 900 mm diameter HDPE pipeline, equalling the biggest HDPE pipeline ever installed on the South African coastline, as part of the emergency desalination plant at Mossel Bay. MRM was awarded the contract for a 900 mm OD HDPE sea water intake pipe and a 630 mm OD HDPE brine discharge pipe to assist in providing the Mossel Bay Municipality and PetroSA with 15 ML/day of potable water. The sea water intake pipeline totalled 920 m and the brine discharge section 730 m. MRM was tasked with the fabrication and installation of the two pipelines which included the design and construction of all temporary works, installation pipe stress analyses and buoyancy checks

## **FABRICATION AND LAUNCHING**

In June 2010 MRM started with the construction of the pipelines by butt-welding 12 m pipe sections into pipeline strings of approximately 120 m (due to the constraints of working within a very restricted site). The intention was to flange the individual strings together during the pipe launch.

The inner weld beads were removed after welding to allow for pigging of the pipelines.

To provide on-bottom stability to the pipelines, reinforced concrete weight collars were fabricated and attached to the pipes at a spacing of 4,8 m (this spacing being determined by working closely with the permanent works designer to ensure

adequate freeboard on the collars during the launch). The collars weighed 2,7 t for the 900 mm pipe and 1,3 t for the 630 mm pipe. This resulted in both pipes having 20% residual buoyancy, which is less than the industry standard of 35%. The weight collars for both pipelines were attached on land (onto the 120 m strings) prior to the pipelines being installed.

To move the pipe strings smoothly on land during the launch, a 120 m long temporary rail track resting on sleepers and track ballast was constructed. Steel bogies were fabricated and placed on the tracks, with the collars resting and running on the bogies. The bogies could accommodate both weight collar sizes.

## **'FLOAT AND SINK' INSTALLATION**

The marine pipelines were installed using the air displacement 'float and sink' method. Unlike standard practice, MRM decided to start the sinking from the offshore side due to the very shallow seabed profile posing the danger of trapping air in

the pipe. Before floating out the limiting wave conditions were calculated carefully to ensure no overstressing of the pipe, both during floating and sinking (when the most severe stress would be put on the pipe).

Both pipes were pulled by a tug into the ocean with a floating (30 t SWL) fibre rope. Once fully floating and in position the sinking was controlled through opening and closing of valves by divers.

Pre-positioned 5 t concrete blocks on the seabed provided the anchor points to initially pull the pipes down, while a sea anchor was put out to resist the installation pulling force, which reached 10 t for the 900 mm pipe and 6 t for the 630 mm pipe. On the land side the installation force was resisted with a 12 t drum winch.

To ensure the flange connections held during the sinking stresses, temporary steel pipe clamps were designed to stiffen these connections and transfer the stress to the HDPE part of the pipe.

The connection to the landline pipe was then made with a flanged spool connection.

### COFFERDAM

To facilitate with the launch and burial of pipes through the surf zone a 150 m long temporary sheet-piled cofferdam was constructed. Ten metre long sheet-piles were driven to design depth with a 3 t vibrating piling hammer.

The cofferdam was dredged to launch levels using excavators and an innovative dredging manifold (designed and constructed specifically for this project) that swept the cofferdam floor and deposited the dredging material by pushing it over the cofferdam walls in a 20 m 'rainbow'.

### INTAKE AND DIFFUSER STEEL STRUCTURES

A 16 t intake manifold and 7 t diffuser structure were floated out (using buoyancy bags and the residual buoyancy of the closed-off structure) from Mossel Bay harbour, sunk in position and connected to the intake and diffuser pipes. Both structures were then weighted down with 3-inch stud link ballast chain. Great care was taken in placing the ballast to avoid any damage to the anti-corrosion paint.

All the marine works were successfully completed in March 2011.

The design of all temporary works and installation stress calculations were

carried out by the Murray and Roberts Marine design office in Cape Town. ■

#### PROJECT TEAM

**Marine Contractors** Murray and Roberts Marine

**Marine Consultants** RLH Consulting Engineers

**Client** Mossel Bay Municipality

- 1 900 mm OD HDPE pipe launched at sunrise on high tide
- 2 Tugboat towing out the 15 t steel intake structure with its buoyancy bags
- 3 Diver preparing to assist with sinking of pipe
- 4 Sinking the 630 mm OD HDPE brine pipeline; the diffusers were blanked off and post-installed by divers



Source:

[http://www.saice.org.za/downloads/monthly\\_publications/2011/2011-Civil-Engineering-may/files/res/downloads/book.pdf](http://www.saice.org.za/downloads/monthly_publications/2011/2011-Civil-Engineering-may/files/res/downloads/book.pdf)