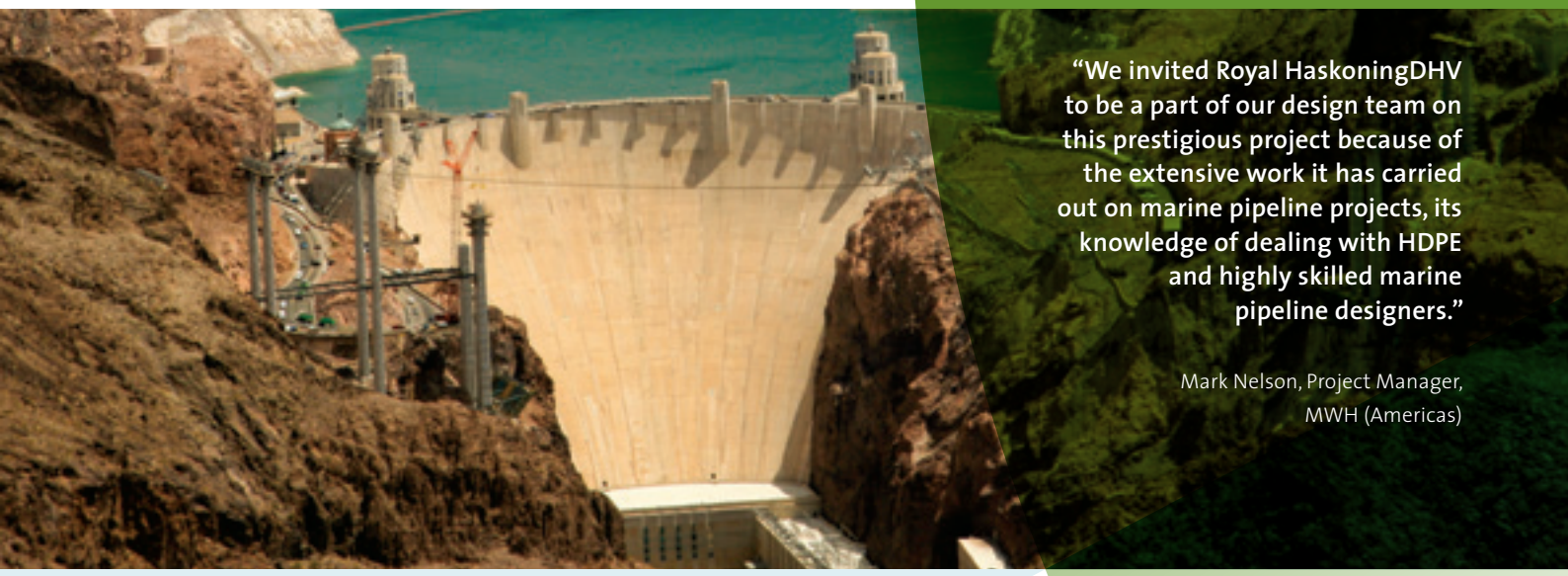
Royal HaskoningDHV
Enhancing Society Together

client | MWH Americas



"We invited Royal HaskoningDHV to be a part of our design team on this prestigious project because of the extensive work it has carried out on marine pipeline projects, its knowledge of dealing with HDPE and highly skilled marine pipeline designers."

Mark Nelson, Project Manager, MWH (Americas)

Pipeline pours back used Las Vegas litres

Built in the 1930s, Lake Mead sits behind the Hoover Dam, providing a municipal water supply to Nevada, Arizona, and California. Due to drought and a steeply rising population over the past decade, water levels have dropped dramatically.

The 19km Las Vegas Wash channel conveys highly treated wastewater to the lake; however, dilution capacity has decreased due to falling lake levels, and both effluent and nutrients are concentrated in certain areas of the lake.

Set up to improve water quality in the Las Vegas Wash, Lake Mead and the Colorado River system, the Clean Water Coalition (CWC), has commissioned an $800m (£502m) project as part of the water quality solution that will build one large pipeline to collect tertiary treated wastewater from several wastewater treatment facilities and convey it through the River Mountains via a 14.4km tunnel. Once the effluent has travelled through the mountains, it will begin a 30m descent that will produce the hydraulic head needed to generate electricity as the effluent is passed through a hydropower station, the water will then enter a distribution system that will take it deep into the lake via five pipelines.

Once complete, the project, known as the Systems Conveyance and Operations Program (SCOP), will help the CWC maximise return flow credits, monitor water quality and improve dilution, enable the location of discharging effluent to be adjusted and, in addition, protect the habitat.

Commissioned as a sub-consultant by MWH Americas, a leading global wet infrastructure engineering firm, Royal HaskoningDHV is involved in the design of the submerged section of the pipeline.

Project Director, Dave Watson explains Royal HaskoningDHV's role in the project, "We are directly responsible for designing the five 1600mm diameter High Density Polyethylene (HDPE) pipelines directly laid on the lake bed, and jointly responsible for the dredged pipeline segments, that will carry the effluent to discharge points at different depths and locations. This means that in low flow conditions, where only one pipe is required, water can be directed to the pipe best suited at the time, depending on lake level and water temperature."

MWH is responsible for the section of pipeline that runs from the hydropower station to the lake. Once the pipes enter the water, they will be buried in a dredged trench on the lake floor.

Pipeline pours back used Las Vegas litres

"We share joint design responsibility with MWH at this point, taking full responsibility where the pipelines emerge from the trench and run across the lake bed. The pipeline within the trench will stretch for 2.32 km and then vary in length between 0.9 km and 2.53 km when situated on the lake floor."

Designing a large-scale dredging and pipeline installation project for a lake brings with it its own challenges. Add to that the requirement to consider the environment in all aspects of the project, innovative, sustainable and practical design solutions are crucial to its success.

"Preparing for a project of this size on a land-locked body of water means you can't just summon a dredger or pipeline barge," Dave explains. "So we've had to design the pipeline knowing that any equipment, plant or materials will need to be transported by land.

"One of the reasons we chose HDPE is because it can be transported in its solid raw form and constructed on site which means we won't be transporting ready-made pipes. This alone will significantly reduce the number of vehicles needed, thereby reducing emissions, fuel, and other associated costs. The team will achieve further environmental benefits by using continuous concrete pipeline collars.

"The original proposal was to remove the dredged material from the lake bed to an onshore storage area, and then replace it once the pipes had been installed. Plastic pipes require special backfills, but by using our own designed system of weighting by a continuous concrete collar, there is no need to import engineering backfill. This means we are able to dredge, place the extracted material next to the underwater trench, lay the pipe, and then re-use the dredged material as backfill."

A further challenge emerged when designing the air capture chambers that will replace the original control structure for managing effluent flow and air release.

"The control structure was going to be housed in a huge underwater chamber, but health and safety was an issue, so we looked at alternatives. Together with MWH, we designed a safer system using air capture chambers that slow the flow, allowing the air to escape via a network of extraction pipes."

Royal HaskoningDHV took a collaborative approach to the design. "I led the team as Project Director, alongside Project Manager Wasim Hashim and Design Engineer Henry Nwaokobia," Dave explains. "Other specialists who carried out the work in Las Vegas operated from MWH's offices over a seven month period. The resultant design fully demonstrated the benefits of team working".

As a popular tourist destination, construction work can only take place during the winter months to minimise impacts to recreational boaters on Lake Mead. Construction was scheduled to begin in the second half of 2010 but has been delayed due to financing/economic issues. The diffuser pipeline has an estimated contract value of £50m.

Dave Watson
T: +44 (0)191 211 1315
E: david.watson@rhdhv.com

00146-cs-mac-mo-rhdhv-0713-gb-v01-cwa

royalhaskoningdhv.com

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