Boskalis
Dredging & Marine Experts

PROJECT SHEET

DHIRUBHAI 1 & 3 GAS FIELDS DEVELOPMENT, INDIA
A LARGE-SCALE DREDGING, TRENCHING, PIPE PULLING AND BACKFILLING PROJECT

BOSKALISOFFSHORE : SKILLS, RESOURCES, EXPERIENCE

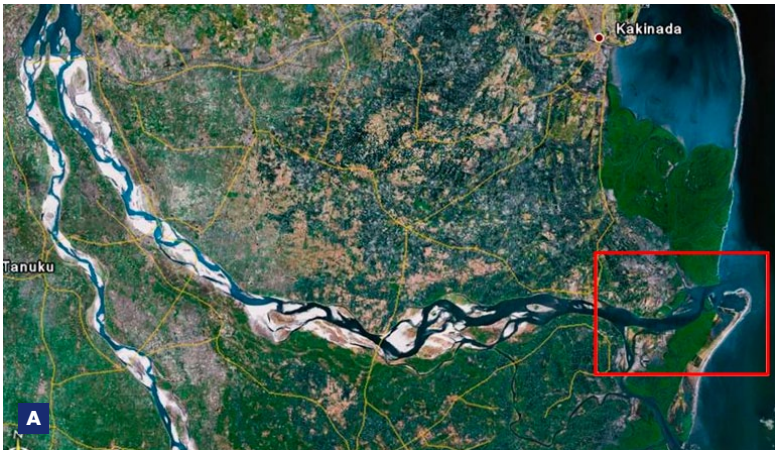
Boskalis Offshore brings together the offshore skills, resources and experience of Royal Boskalis Westminster.
The group's offshore capabilities include seabed rectification works for pipeline/cable and platform, installation, construction of pipeline shore approaches and landfalls, offshore mineral mining, offshore supply and support services and decommissioning services. Boskalis provides clients with tailored, project-specific solutions for above dredge related offshore services, as illustrated by the following project summary.

PROJECT DESCRIPTION

Reliance Industries develops the offshore gas field known as Block KGDWN-98/3 in the Krishna Godavari Basin, Bay of Bengal off the East Coast of India. The gas field will be linked to onshore customers and covers an area of approximately 7,500 km^2. The field stretches an area 40 to 60 kilometers southeast of Kakinada.
The scope of works comprised the dredging of a 21 kilometers long and 18 meters wide trench for three 24" gas pipelines, each with a 6" piggyback pipeline, one 12" effluent pipeline and two umbilical cables in water depths ranging from 0 to 50 meters. After pipe laying by the main contractor the pipeline trench was backfilled with partly rock and sand.

FEATURES

Client	Reliance Industries Limited
Location	Krishna Godavari Basin, off the East Coast of India
Period	August 2007 - November 2008
Main contractor	Allseas Marine Contractors S.A.
Contractor	Boskalis Offshore - Tideway JV



A Location map
B Trenching carried out by TSHD Cornelis Zanen
C Trenching work in the river mouth by CSD's Orion and Cyrus II
D Pipepull landfall point
E Landfall cable conduits

TRENCHING

Two Boskalis cutter suction dredgers (CSD's) were deployed in August 2007. The self-propelled sea-going CSD Cyrus II was utilized to dredge a work channel from the river mouth to offshore to enable access for the trailing suction hopper dredgers (TSHD's). The channel dredging work included

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dredging of a trench. The medium size CSD Orion was deployed to remove shoals in the river to allow TSHD's to enter the river and dredge the trench. Furthermore the Orion dredged the shore approach and an access channel of 1,250 metres plus turning basin for rock loading operations. The dredged spoil from the cutter dredgers was deposited by means of a spreader pontoon or via a shore connection.
The remainder of the trench was dredged with among others the Boskalis TSHD Cornelis Zanen. The total dredged quantity was approximately 8.5 million cubic metres. The dredged material was temporarily stored in predetermined underwater storage areas close to the dredge areas for later reuse as backfill material.

LANDFALL

As part of the landfall activities a cofferdam with wing-walls was installed at the transition from the river to the shore as well as a sheet pile anchor wall for the pull-in winch. Following excavation of the cofferdam by excavators and of the approach by CSD Orion and after installation of the 300 tons linear pull-in winch, the four pipelines were pulled ashore. For the shore approach of the umbilical cables two conduit pipes of approximately 170 meters were assembled, installed and pulled into the river prior to the pull-in of the umbilical cables. These cables were pulled around a bend to a total distance of approximately 300 meters each.

ROCK LOGISTICS

The client supplied the rock for the later rock backfilling to a temporary stockpile in the vicinity of the site. As part of the works a temporary haul road was prepared of around 2 kilometres length connecting the stockpile with the loading point at the river.

Furthermore, in order to load the rock onto the rock dump vessels, a sheet piled rock loading jetty of 160 meters wide was created where the vessels and barges could be moored alongside and loaded.

Approximately 900,000 tons of rock were transported to the jetty and loaded with heavy dry earth equipment onto the flattop barges and side stone dumping vessels. Since part of the public road was used for the rock transport, there was high emphasis on the safety aspects of the job. In the end all works were safely completed.

BACKFILL

After partial pipe- and cable laying by the main contractor the trench was backfilled. Parts of the pipelines were stabilized and protected by rock berms and where more scour was expected continuous rock dump including falling aprons were installed with a bedding layer of sand.

Two Boskalis vessels were deployed for the installation of rock. The side stone dumping vessel Cetus with dynamic positioning was engaged in the placement of rock berms on both the river and offshore sections. The fallpipe pontoon Zeepaard with dynamic tracking system on anchors placed the continuous berms and falling apron on the river section. Acoustic doppler current profilers were deployed for accurate prediction of the rock displacement in the actual current. Some 900,000 tons of rock were placed in accordance with the main contractor's design.

After installation of the berms, a TSHD backfilled the spaces in between the berms with sand. Parts of the trench not covered by rock were also backfilled with sand. The backfilling works were completed in November 2008.


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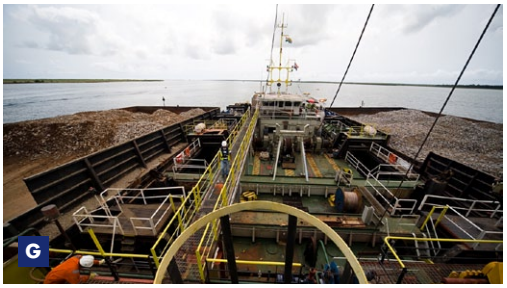
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F Backfilling carried out by Side Stone Dumping Vessel Cetus
G Fallpipe pontoon Zeepaard
H Purpose-built rock loading facility

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