

PROJECT SHEET

ENVIRONMENTAL MONITORING DAYA BAY
DREDGING APPROACHES NANHAI PETROCHEMICALS PROJECT

INTRODUCTION

In Daya Bay, P.R. China, a USD 4.3 billion petrochemicals complex was being built by CNOOC and Shell Petrochemicals Company (CSPC). Daya Bay is located in the southwest of China, Huizhou Municipality, Guangdong Province. The project called for the construction of two marine facilities, one nearby the petrochemicals complex, the other one further offshore. Early 2004, the Boskalis International bv and Nanjing Changjiang Waterway Engineering Bureau (NCWEB) partnership commenced dredging for the CSPC Nanhai Petrochemicals project. Key requirement of the project was to preserve the sensitive environment in Daya Bay. Hydronamic, Boskalis' own engineering consultancy, designed the required monitoring plan and took responsibility for its implementation.

DREDGING WORKS

The scope of work for the dredging operations in Daya Bay comprised dredging of a new harbour (Donglian harbour) at the southeast of the complex, including berthing area, turning circle and approach channel. For the import of feedstock, a dolphin berth with turning circle dedicated to the Nanhai Project had to be constructed some 300 meter east of the island of Mabianzhou to receive ships in the range of 60,000 - 80,000 DWT. Mabianzhou is situated



FEATURES

Client	CNOOC and Shell Petrochemicals Company
Location	Daya Bay, Huizhou, Guang-dong Province, P.R. China
Period	2004
Contractor	Boskalis International bv / Nanjing Changjiang Waterway Engineering Bureau



- A Location map
- B Visual inspection of coral
- C TSHD 'Queen of the Netherlands' dredging in Daya Bay

about 10 km south/southeast of the project site. In total an amount of approximately 8 million m³ of clay had to be dredged. The (Chinese) dredging spread of 2 small size trailer suction hopper dredgers (TSHD's) at the start of the project had been extended to 7 trailers after 4 months. Equipment on site also included a dipper dredger, a grab dredger and 6 transport barges. The small trailers dredged the shallow areas around Donglian Harbour and part of the approach channel. The deeper part of the channel and the Mabianzhou area were dredged by Boskalis' large TSHD 'Queen of the Netherlands'.



ENVIRONMENTAL REQUIREMENTS

Daya Bay comprises an area of about 600 km² with a winding coastline of 92 km in length. The bay has a rich benthic and pelagic environment with several sensitive areas including biotopes with coral formations, seaweeds, oyster beds, aquaculture sites and fishing areas. To satisfy CSPC's requirement of preserving these sensitive areas, dredging and navigation was performed with minimum damage, interference or disturbance to the environment. No overflowing of hopper dredgers as well as transport barges was considered to be one of the main mitigating measures implemented during the dredging operations. Besides this, strict control of water quality at coral and aquaculture sites was required. Suspended sediment concentration (SSC) levels at aquaculture sites were confined by strict limits which were even more stringent at coral sites. Hydronamic's environmental specialists designed the required monitoring plan in consultation with the Client. During construction

phase Hydronamic was responsible for the execution of the monitoring program and reporting to the Client.

MONITORING PROGRAM

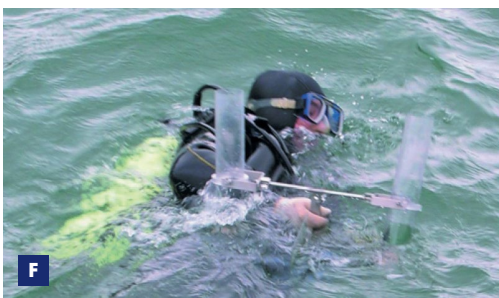
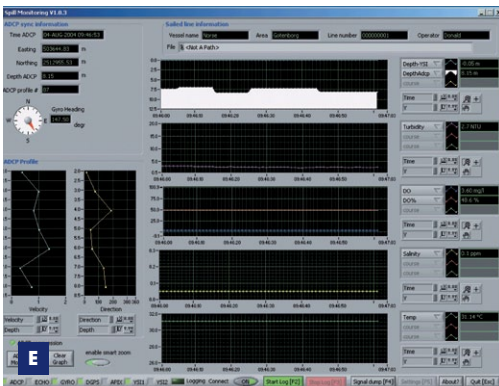
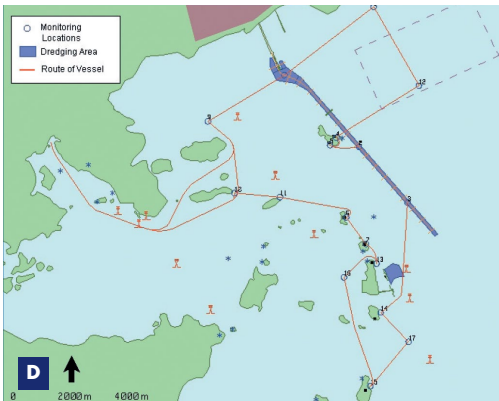
During the execution of the dredging works water quality monitoring was carried out at 17 locations around Daya Bay. At these locations turbidity, dissolved oxygen (DO), salinity and temperature was monitored with direct-reading-instrument YSI on a daily basis. Current velocity and direction were measured by ADCP (Acoustic Doppler Current Profiler) at the same time. During the first phase of monitoring, water samples were taken frequently and analysed for SSC, to establish the relation between SSC and turbidity. The monitoring devices were operated from a purpose-built frame mounted on deck of the monitoring vessel 'Yangpingji 88'. All collected data was stored on the monitoring computers on board the vessel and postprocessed in the site office at the end of the day for daily reporting to the Client. Another important element of the monitoring plan included sedimentation rate monitoring at coral sites. At 7 locations where coral is present, sediment traps had been installed.

Once per week a team of scuba divers collected the trapped sediment and the average sedimentation rate per day was determined. At the same time the diving team captured movie-shots of the corals which were used to visually establish sedimentation on the coral.

ENVIRONMENTAL LIMITS

Any exceeding of the environmental limits was reported to the Client immediately. In case ongoing exceeding should be observed a detailed study of the monitored data had to be carried out and the source(s) of the increased SSC in the water had to be determined. Thereupon, appropriate action by means of applying additional mitigating measures were to be taken.

During the whole dredging project, no exceeding of environmental limits has taken place. It is demonstrated that, with proper planning of dredging operations, taking full account of a precious environment, with adequate and accurate monitoring, plus management of environmental effects, dredging and environmental care can well go together.



- D** Monitoring locations
- E** Logging system onboard monitoring vessel
- F** Scuba diver with sediment trap
- G** Monitoring vessel 'Yangpingji 88'

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