

PROJECT SHEET

DUQM LIQUID BULK BERTHS
 MULTI-DISCIPLINARY DREDGING, RECLAMATION
 AND MARINE CONSTRUCTION PROJECT

BOSKALIS

Royal Boskalis Westminster is a leading global marine contractor and services provider. With safety as our core value, we offer a wide variety of specialist activities to the oil & gas and renewables sectors. These activities include marine installation and decommissioning, seabed intervention, marine transport and services, subsea services and marine survey. In addition, Boskalis is a global dredging contractor, provides towage and terminal services across the globe and delivers marine salvage solutions.

By understanding what drives our clients we are able to provide the solutions that enable them to meet their specific business goals. For this reason we are constantly looking for new ways to broaden and optimize our offering and are committed to expanding our proposition, supported by our financial strength.

With our committed professionals in engineering, project management and operations, 900 specialized vessels and an unprecedented breadth of activities in 90 countries across six continents we help our clients in the offshore industry push boundaries and create new horizons.

INTRODUCTION

In recent years the Government of Oman is in the process of developing the Port of Duqm as a strategic dry dock, free trade and industrial zone serving as a catalyst for the development of the Al Wusta region. The long-term objective of the project is to stimulate trade and economic development in the Duqm area and the wider al Wusta region. The construction of the Liquid Bulk Berths port facilities is part of the master plan for Duqm port.

FEATURES

Client	Special Economic Zone Authority Duqm (SEZAD)
Location	Duqm, Al Wusta Governate, Oman
Period	April 2017 - April 2020
Contractor	Boskalis Westminster Oman LLC
Type of contract	Engineering, Procurement & Construction

MAIN ELEMENTS OF THE PROJECT

- deepening of the access channel and port basin to a depth of 18 meters
- reclamation of new land for expansion of the port
- construction of a 1 km long quay wall, twin 400 m long jetties and rock revetment in a dry construction pit

MAIN PROJECT QUANTITIES

Dredging	25,800,000 m ³
'Dry' excavation	9,345,000 m ³
Soil improvement by compaction	1,300,000 m ²
Rock revetment	3,637 lin m - 1,300,000 metric ton of rock
Concrete quay wall	1,000 lin m - 5,300 blocks of up to 80 ton
Steel jetty piles	330 pce

DESIGN (HYDRONAMIC)

Project design and engineering activities were carried out by in-house engineering company Hydronamic.

The Hydronamic team was engaged from tender to project completion, ensuring continuous transfer of knowledge during all project stages. Already at tender stage the team proposed an ingenious solution to meet the extremely tight project schedule - being the construction of the civil components, quay wall and jetties, in dry conditions, by creating a temporary polder.

A Aerial view



Said strategy was crucial to win the contract and made the project unique. It meant that the team not only had to design the main elements of the works - access channel, reclamation, quay wall, jetties and revetment - but also had to engineer the ring dikes and dewatering system enabling the safe dry excavation of the polder, which extended to 20 meters below sea level.

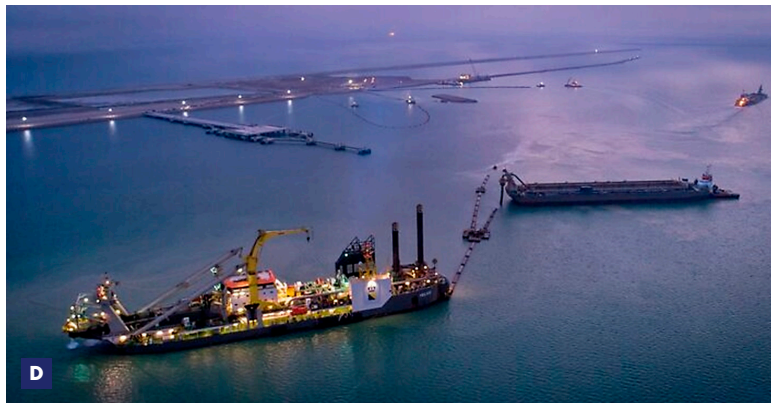
This required joining forces with disciplines within the Boskalis organization and external specialists, mobilizing our own experts as well as managing expertise provided by third parties within our network.

Taking full responsibility over the design and engineering of both the permanent and temporary works was challenging and kept the team creative and focused on exploring any and all opportunities that could be identified. As a result the team was able to implement design optimizations in rock works, soil improvement and dewatering resulting in substantial cost savings.



DRY EARTH MOVEMENT (BOSKALIS EARTH MOVING & MINING)

A significant volume of excavation by means of dry earth moving equipment had to be carried out. Excavated materials were transported to various plots within the port boundaries where materials were used to raise existing ground levels to design levels.



A part of the excavated materials consisted of mudstone, silt stone and lime stone layers which had to be pre-treated by large bulldozers equipped with rippers. In other areas rock layers had to be pre-treated with hydraulic hammers. A system of trenches was created in the slope of the excavation by heavy duty trenchers in order to evacuate seepage water and stabilization of bunds.

SOIL IMPROVEMENT AND COMPACTION (COFRA)

In order to meet the contractual requirements there was need to carry out ground improvement in the form of compaction. Several compaction methods were applied to obtain the required results by and under the supervision of Boskalis subsidiary Cofra. Compaction of the terrain was generally achieved by deploying Cofra Dynamic Compaction (CDC) hammers. For parts of the terrain that required improvement of layers with incremental thicknesses, deployment of dynamic compaction rigs and vibro-flotation rigs was required.

DREDGING (BOSKALIS INTERNATIONAL)

Duqm project was the maiden project for cutter suction dredger Helios. Even though the unit came fully prepared for dredging rock, at some areas the rock to be dredged was highly diverse, to the extent that economical dredging was challenging. During the project state of the art cutters were developed to overcome this challenge. At one location a limited volume of rock with strengths of more than 150 MPa required pre-treatment by means of drilling and blasting to achieve design level.

PRIME MOVERS DEPLOYED ON THE PROJECT

- Cutter suction dredger Helios.
- Trailing suction hopper dredgers Queen of the Netherlands, Fairway, Prins der Nederlanden and Crestway.

- B** Overview of the complete excavation pit with the quay wall and the two 400 m long jetties.
- C** Cofra Dynamic Compaction (CDC).
- D** Cutter suction dredger Helios loading a barge.