

PROJECT SHEET

HALF MOON BAY ISLAND, KINGDOM OF BAHRAIN
COST-SAVING DESIGN AND CONSTRUCTION OF A LAND RECLAMATION / LAND CREATION PROJECT

INTRODUCTION

'Half Moon Bay' island is situated in the Seef area of Manama in the Kingdom of Bahrain. The purpose of the island is to accommodate a future 5 Star Hotel development as well as several villas. Engineering Department Hydronamic was engaged to develop the design of the island and to provide advisory services to Boskalis Westminster Middle East.

Through good co-operation between the design engineers of Hydronamic and the construction team of Boskalis Westminster Middle East innovative ideas were developed which could be integrated into the rock protection design resulting in the successful and efficient construction with significant cost savings to the project.

DESIGN PHASE

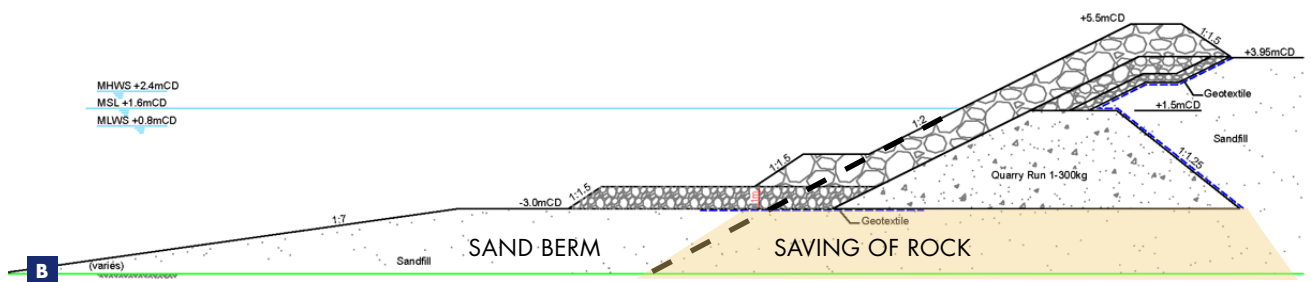
The design and construction of the land reclamation / creation project was awarded on a lump sum fixed price basis. Hydronamic were engaged to execute the design component. This included translating the clients initial ideas into a concept design and then developing this further into a preliminary and ultimately into a design approved for construction.

FEATURES

Client	International Hotels Company
Location	Kingdom of Bahrain
Period	2005 / 2006
Contractor	Boskalis Middle East / Hydronamic



- A** Location map
- B** Typical cross-section of the innovative rock protection with sand berm
- C** Overview of the finalized Half Moon Bay island



From an initial requirement for the creation of a suitable location for a hotel development a 15 hectare land mass was created consisting of three islands in a circular formation enclosing an inner basin. The three islands are separated from each other by two channels.

An interesting design optimization which was realized is the innovative sand berm solution in the deeper parts of the island. Taking into consideration the abundance of sand in the area and the relative scarcity of suitable aggregate Hydronamic designed this innovative sand berm solution for the deeper sections of the islands, as can be seen in the typical cross section diagram (Fig b). Instead of a costly quarry run bund, which is the conventional design requirement, sand was used in the foundations to a level of -3 m below Chart Datum. A protective geo-textile cover on top of the sand berm was introduced to prevent any possible erosion. The exposed outer perimeters of the islands were clad with 0.5 to 1.5 tonne rock armour protection with a slope of 1 to 2. The scour protection is extending at the base to include for protection against potential scour. The rock protection thereby facilitating recreational beaches to form the shore line of the inner basin. As part of the design process two studies were performed by Alkyon, an independent engineering consultancy bureau. These studies were a water refreshment study for the inner basin and a wind and wave action simulation study. Final design review and verification was done by Dr. J. van der Meer of Infram, also an independent consultancy bureau. As a direct consequence of this design the total rock requirement for the project was reduced by approximately 50%.

CONSTRUCTION

Once the design was finalized Boskalis Westminster Middle East started work on site in May 2005. Rock protection installation was sublet to local contractor Al Hassanain. Construction challenges included the design of a purpose made geo-textile laying pontoon as well as the spud barge 'Overseas 9' to construct the scour protection. The construction of the scour protection at the entrance of the island was challenging, because of the long reach necessary. The reclamation work was performed using the TSHD Coastway (fig d), the spreader pontoon Liftmix and auxiliary equipment. Construction of the islands was completed in February 2006.

During the execution phase Hydronamic provided the site engineering support. This included issuing specifications and tolerances for rock placement, geo-textile and sand berm installation. Several optimizations to the design were proposed by

Hydronamic, these included for a reduction of the toe protection of rock armour at locations where the seabed substrate was hard. Also rock aggregate optimizations at specific locations were implemented due to the combination of small islands.

The evaluation walkover survey showed that the rock protection was constructed according to the design. The accuracy of the rock placement above water was within the tolerances as specified in the design report. In order to obtain enough safety margin in the design at the head of the rock protection some corrective actions were implemented during construction.

ENGINEERING TOPICS

During the preparation and construction of the project several engineering topics were solved. Hydronamic advised on the following items:

- Feasibility and implementation of the sand berm solution at level -3 m Chart Datum
- Detailed design report including specifications
- Engineering management of Alkyon studies
- Advices on geotechnical site investigation
- Site supervision work with comparison of design and construction
- Practical guidelines for construction
- Several comparisons of theory against practice were made
- Design optimizations during construction > Review of As build drawings
- Implementation of maintenance monitoring plan
- Review of Rock Armour Quality of Bahrain Quarry 'Askar' during construction
- Guidelines for construction of bottom protection with purpose build geotextile laying pontoon.

MAINTENANCE OF THE ISLAND

A maintenance monitoring plan was implemented during the one year maintenance period, this included bathymetric surveys of the beaches, monitoring rock and sand berm levels and walkover surveys.

Changes to the beaches in the inner basin were monitored and minor remedial works were carried out to the eastern beach, The observed beach slope was 1 to 1.1. The rock protection performed according to design and during the monitoring period no damage or settlement was measured or observed. After two years there have been no measurable signs of erosion to either the innovative sand berm or the toe protection, indicating that both are performing.



D The TSHD Coastway at work

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