Boskalis
Dredging & Marine Experts

PROJECT SHEET

FALMOUTH CRUISE SHIP TERMINAL PROJECT
MANAGEMENT OF ENVIRONMENTAL IMPACTS
(INCLUDING LARGE SCALE CORAL RELOCATION)

INTRODUCTION

The Falmouth Cruise Ship Terminal (A) has been initiated by the Port Authority of Jamaica and Royal Caribbean and was designed to host the largest cruise ships in the world, Oasis of the Seas and Allure of the Seas. Boskalis was awarded the contract for the marine works. The project started in 2009 after receiving the permits and beach licences from the National Environment and Planning Agency (NEPA) and ended in July 2010.

WORKING IN A SENSITIVE ENVIRONMENT

The Environmental Impact Assessment (EIA) conducted in 2007 indicated that besides coral reefs (B), mangroves and seagrass the project area contained also sensitive marine resources such as star fish, sponges, lobsters, sea-urchins, conch (C) and bioluminescent phytoplankton (glistening waters) and identified the following potential impacts from the project:

- Loss of habitat and diversity including coral cover, fish habitat, seagrass beds and bioluminescent plankton
- Increased turbidity and sedimentation levels

MITIGATION OF ENVIRONMENTAL IMPACTS

The environmental permits and licenses for the construction of the terminal issued by the NEPA came with strict environmental requirements focusing mainly on the protection of corals, seagrass and benthic fauna in the dredging footprint. Hydronamic, the in-house engineering company of Boskalis, developed and executed a large-scale Environmental Management Plan in close collaboration with NEPA and coral reef specialists from Deltares, Rotterdam Zoo and Sustainable Oceans International to preserve the biological resources meeting the requirements in the permits and licences.

FEATURES

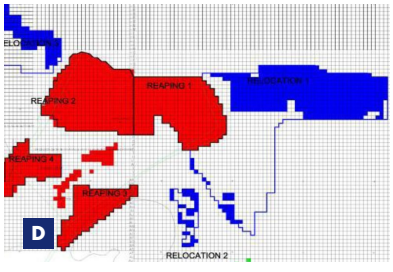
Client	E. Pihl & Son A.S.
Contractor	Boskalis Westminster St. Lucia Ltd.
Location	Falmouth, Jamaica
Period	2009 - 2010

The Environmental Management Plan consisted of:

- Water quality monitoring
- The installation of silt screens
- A return water sinkerline made of High Density Polyethylene (HDPE)
- A closed 'environmental' bucket on the grab dredger
- Coral relocation
- Relocation of benthic fauna (other than coral) and seagrass
- Installation of artificial reef units

DREDGING & RECLAMATION WORKS: AN INNOVATIVE APPROACH

The marine works consisted of dredging an access channel and two berthing basins along the terminal. Considerable attention was paid by Boskalis specialist engineers and ecologists to design a work method that minimized turbidity and associated sedimentation. Dredging works were conducted in two stages starting with the removal of the soft top layer with the grab dredger Packman in September 2009 lasting until January 2010. Disposal of soft material took place offshore with barges in water depth over 1000 meters. Removal of the medium density and the harder layers was executed with the Cutter Suction Dredger (CSD) Ursa starting in March 2010 lasting until June 2010.



A The Falmouth cruise ship terminal, Jamaica
B Coral reef in front of Falmouth
C Conch shell
D Layout of coral relocation program with reaping areas in red and receiving areas in blue

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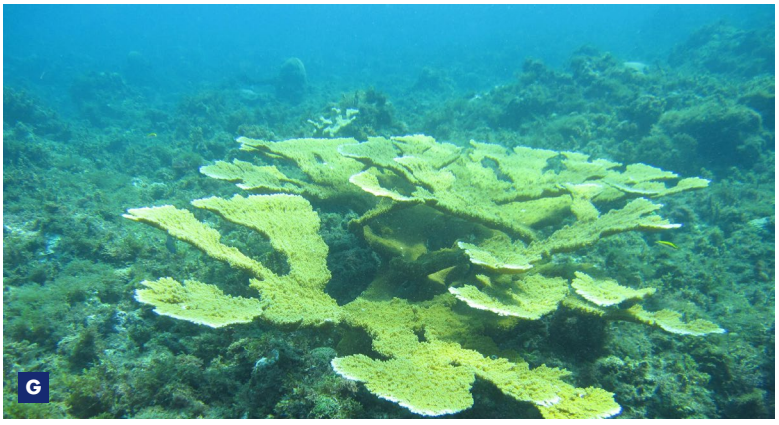
Dredged material was placed onshore in a reclamation area. To mitigate against the discharge of sediment laden excess water directly into the bay from the reclamation area Boskalis moved the discharge point outside of the environmentally sensitive areas. This was done via a return water pipeline. This unconventional idea required an innovative approach.
After 100 years of using steel sinkerlines, it was decided to use a HDPE sinkerline. Engineers of the maritime dynamics department together with a well organized operational team were responsible for the successful sinker operation down to 60m water depth.

CORAL AND SEAGRASS RELOCATION

The environmental permit required removal of and relocation of benthic flora and fauna found within the dredging and pier footprint. Prior to relocation, the area to be dredged and the relocation sites were defined by an extensive, continuous
10 x 10 m grid system (D).
The grid system made it possible to remove and reattach organisms systematically since divers were able to clear the area in visible units. The system was classified (both in theory and on the ground), in order to facilitate underwater navigation and reporting.

The diving activities were organized into four teams and executed by local divers. A reaping team carefully detached corals using hydraulic chain saws, disc saws, chipping hammers and wire brushes and placed corals in transportation baskets. The transport team packed the detached colonies in mesh baskets and floated them sub-surface from the reaping area to the planting area using lift bags (E).



The planting team was responsible for the attachment of corals using epoxy or cement and in some cases, pins as well as pneumatic drills and compressors (F and G). An environmental team collected data on gridding and tagging progress, addressed scientific issues as they presented themselves and assisted the three teams when necessary. By April 2010, 147,947 corals were relocated making it the largest coral relocation program in the world, known to date.

PROJECT ENVIRONMENTAL SUCCESS

The biological success of the relocation exercise was determined by photographing colonies in October 2009, at the end of the relocation activities (2010), and a year later (2011). The results showed that some colonies were lost due to storm damage but preliminary results showed a high total survival rate of 86% and a small number of colonies showing total colony mortality (4%). Environmental monitoring showed that the mitigating measures implemented during the works were successful and no major impact on the environment was recorded.
The experience in Falmouth proves that a close partnership between governmental organizations, dredging contractor and scientists can lead to an environmentally friendly execution of a project in a sensitive marine environment.

E Transport of coral colonies guided by divers
F Relocated coral colonies planted in a unit
G Successful relocated colony of Elkhorn coral

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