

PROJECT SHEET

SAFER FAIRWAYS TO THE PORT OF GOTHENBURG
GOTHENBURG, SWEDEN

GENERAL INFORMATION

Gothenburg turns around some 34 million tons of cargo annually, including 700,000 TEU (containers), and is unique in the region. With regard to the variety and frequency of calls from inter-continental liner trade the port is outstanding in Sweden. The port can be reached from the sea via two different channels: Torshammen Fairway and Böttö Fairway.

From a navigational point of view both channels needed to be deepened and widened at a number of places. Thus there were two good reasons to enhance the fairways: securing the port's future as the premier port for liner trade and creating safer navigation. This resulted into a major dredging contract which was awarded in June 2002 to Boskalis Westminster Dredging Company.

CONTRACT SPECIFICATIONS

The contract called for deepening /widening of the outer part of Torshammen channel to about 20.5 meter waterdepth as the Böttö channel and inner part of Torshammen channel had to be deepened to about 14.2 meter waterdepth. In total this project involved the removal of a gross quantity of 12 million m³ of soft to stiff clay which material had to be dumped into a designated disposal area at sea. Moreover 375,000 m³ of solid rock had to be drilled and blasted. The quantity of one million m³ removed broken rock was partly dumped at sea, partly used for filling works and partly used to create an artificial reef (to stimulate fish life). An uncertain factor was the possible presence of boulder clay on top of the rock. Strict environmental monitoring was part of the contract specifications.

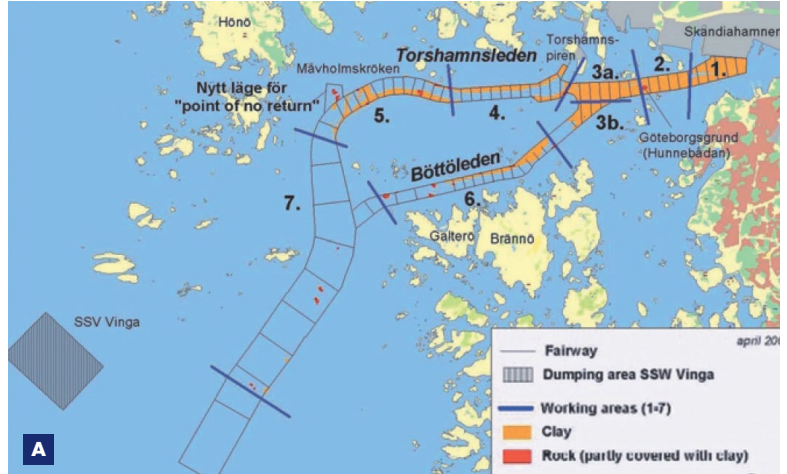
DREDGING ACTIVITIES

For the execution of the dredging works various Boskalis operating companies were involved to provide plant and personnel resources: Boskalis



FEATURES

Client	Swedish Maritime Administration
Location	Gothenburg, Sweden
Period	January 2003 to February 2004



- A** Location map
B Overview from bridge of Coastway

bv from the Netherlands, Boskalis Sweden AB from Sweden and Terramare Oy from Finland. The Dutch company provided the hopper dredger expertise for dredging the clay and the two Scandinavian companies provided drill barges, a large backhoe and dump barges.

The Boskalis engineering company Hydronamic provided the expertise to implement the environmental monitoring. Though the contract was signed in July 2002, actual start of the works at the project site was only by January 2003. The reason being that ample time was needed for project preparation. Most of the time was needed for setting up the environmental monitoring program and writing the software for a proper Environmental Data Base. Furthermore, in October 2002 the dredger Coastway was utilized to execute a few days of trial dredging in the clay. This resulted in certain improvements to the dragheads to be used during the clay dredging. Finally, an existing drilling pontoon (Rockbuster) was completely converted in Finland.

PLANT UTILIZED

Mid January 2003 the clay dredging was commenced with the hopper dredger Coastway (4,900 m³) as the drill barge Rockbuster commenced with drilling/ blasting operations. The Coastway was mainly utilized to dredge some inner shallow parts of the channel. For the removal of boulder clay and broken rock the backhoe Nordic Giant was mobilized from Finland together with four dump barges. Immediately also the large ploughing barge TP1 was employed. This barge was equipped with a 20 ton heavy plough. Under tow from a large tugboat the ploughing assured a continuous flat surface for the clay-dredging by the hoppers as also the initial movement of the clay layer to be dredged resulted into a less stiffer clay thereby increasing the hopper production. The Coastway left the site mid February to be replaced by the 13,250 m³ hopper dredger Seaway. This hopper remained on site until

November 2003, except for a short break in the summer.

As the rock proved to be much more difficult to be drilled and blasted, it was decided in April 2003 to mobilize a second drilling barge from Finland, the Pora Pekka 5.

ENVIRONMENTAL MONITORING

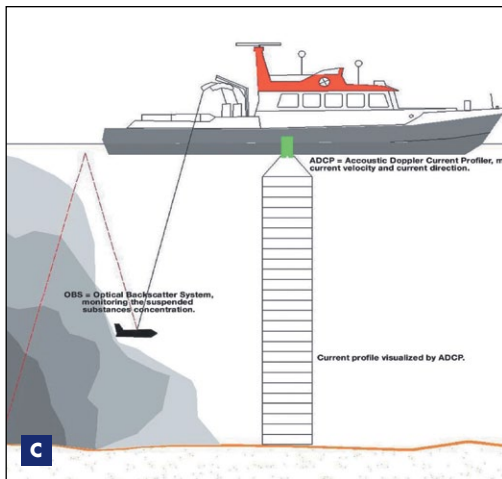
The project was designed to comply with very stringent environmental specifications to be followed throughout the extensive dredging and blasting works, notably:

- Strict control of suspended substances concentration in the water;
- Restrictions on the range of work(ing hours), especially during the summer time ;
- Protection of sensitive habitats such as eelgrass, mussels and soft-bottom fauna.

Ecological boundary conditions were translated by the authorities into site-specific physical requirements to be adhered to during the project's execution. This all resulted into a Project Environmental Monitoring Program. The Boskalis team worked very closely together with the Client's environmental specialists and advisors.

The primary monitoring task was the measurement of suspended substances' concentration (SSC) and the velocity and direction of the water currents at a distance of 1 km from the works, as well as at the disposal area at sea.

The optical backscatter system (OBS) was used for



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monitoring the SSC, and the velocity / direction of the currents over the whole water column was monitored by utilizing the acoustic doppler current profiler (ADCP). Measurements of turbidity, noise and vibration were also taken, together with the weather conditions at the working site.

All acquired data were stored into an environmental data base together with the data on the quantities dredged and blasted. In case the values of certain SSC parameters would exceed certain limits, the works would have to be interrupted. As a result of a very detailed and careful planning of the works, such a situation never occurred and the works continued normally, even in summertime. The break of the hopper Seaway in the summertime was a programmed part of the planning for the works and proved to be necessary.

The environmental monitoring gave the client and the public confidence on the limited impact of the dredging works to the environment. Questions from the public were easily answered by the client due to the nearly realtime access to the environmental database.

First results of a long-term monitoring program by the client did not show any impact of the dredging works on the measured water quality parameters. The client's monitoring program, covering a wide area around the entrance channels, started before proceeding of the works and will last for several years.

CONCLUSION

The long period of preparation for the works together with the detailed planning resulted in a successful completion by February 2004, three months ahead of the contractual completion date.

The authorities were very appreciative that the environmental parameters had continuously been adhered to and that no complaints had been raised.

A large dredging project was completed by Boskalis, in good co-operation between the various operating companies involved and the engineering company Hydronomic.



- C** Diagram showing environmental monitoring system. In addition to the parameters shown in the diagram, the database also includes noise, vibration and the weather conditions, together with the amount of dredged and blasted material.
- D** Environmental monitoring vessel
- E** Backhoe Nordic Giant

Royal Boskalis Westminster N.V.
PO Box 43
3350 AA Papendrecht
The Netherlands
T +31 78 69 69 000
F +31 78 69 69 555
royal@boskalis.com
www.boskalis.com