Cover:

With both the channel and the port of Brisbane adjacent to environmentally sensitive areas, the Port Authority must pay close attention to the public’s concerns for the natural habitat.

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EDITORIAL

Although the economic climate is a bit shaky at the moment, nonetheless research and development in the dredging industry continues at a rapid pace. As it must. For R&D forms the foundation of the industry’s ability to successfully meet the challenges of the 21st century. Therefore the exchange of ideas and information about R&D is a high priority and without a doubt much of this takes place at conferences. It is no surprise then that this issue of *Terra et Aqua* contains two papers presented at the PIANC conference in Sydney, Australia last September, a conference which generated a great deal of excitement.

In that context, a number of noteworthy meetings have recently taken place or are about to. These include the IAPH conference in Durban, South Africa, the WEDA Conference in Chicago, Illinois, and “Dredging Today” in Puerto de Avilés, Spain organized by the port authority with the support and participation of IADC and member companies. In addition, the EuDA (European Dredging Association) will be celebrating its 10th Anniversary this autumn on October 29th. And in November, at the CEDA Dredging Days held during Europort in Amsterdam, CEDA will be celebrating its 25th Anniversary with a “Reunion Reception”. The focus of the CEDA conference will be “Specialist dredging techniques inspiring dredging solutions” and an IADC Award will be presented to a young researcher/author.

Also important for the spread of substantive knowledge about dredging is the IADC Seminar for Dredging and Reclamation, which has been held at IHE in Delft for a decade, and will be reprised in October in Dubai, UAE. This is the first presentation of the seminar in the Middle East, although it has been held in Singapore frequently as well as in Buenos Aires. An outgrowth of this seminar and of the IADC/CEDA Guides “Environmental Aspects of Dredging” is a new seminar focussing on the interface of dredging and the environment (see pages 16-17). This seminar is of utmost importance in today’s world. It marks a major step forward in efforts to address a complicated issue and to improve communications between the industry and those it serves.

Robert van Gelder
President, IADC Board of Directors
The Port of Brisbane: Operating a Port in an Area with High Environmental Values

Abstract

The Port of Brisbane, close to the rapidly growing city of Brisbane, is the third busiest container port in Australia. Given that both the channel and port facilities are within, or adjacent to, areas of high environmental value, the Port of Brisbane has recognised that a demonstrable commitment to environmental management is required to operate in an environmentally sensitive area. Ports in such situations must place a high emphasis on the environment, if they are to be sustainable and increase their trade. This approach, while resulting in initial increased internal costs, is far more cost effective in the long term than an approach that relies on impact remediation and restoration activities.

Environmental policies, management systems, monitoring, reporting, and community consultation have become essential for a successful port to be able to effectively accommodate and promote the increase in trade associated with globalisation.

Introduction

The Port of Brisbane Corporation manages the third busiest container port in Australia on the shores of Moreton Bay adjacent to the rapidly growing city of Brisbane (Figure 1). Trade through the port is increasing markedly and, in 2002, the port had a container throughput of nearly 500,000 teus and a total tonnage of 23 million tonnes. Key trade products moving through the port’s eight deep-water container berths and three deep-water bulk berths include oil, coal, cereals, meat products, fertilisers, cement, cotton, chemicals, transport equipment, motor vehicles, timber, and building products.

Shipping access to the hub of the port’s activity, the Fisherman Islands complex at the mouth of the Brisbane River, is via a 90-kilometre shipping channel (dredged to a minimum of 14 metres) through a series of shallow sandbanks associated with Moreton Bay. Both the channel and port facilities are within, or adjacent to, areas of high environmental value.

Moreton Bay is a Marine Park, and contains populations of rare and endangered marine fauna, such as turtles, dolphins and dugongs, and wetlands of international significance recognised under the Ramsar Convention. The extensive areas of wetlands (mangroves and seagrass beds) are in good condition, and are protected from disturbance by legislation.

The public holds the environmental values of Moreton Bay in high regard, and any disturbance is considered to be of great concern. Additionally, the Bay has...
substantial use for recreational activities, and supports large and productive commercial and recreational fisheries. The Brisbane River also contains areas of environmental significance and is currently the subject of a broad range of environmental enhancement projects associated with an urban renewal trend along the riverfront.

The primary role of the Port of Brisbane Corporation is to provide the necessary port infrastructure within this environmental/social setting, to encourage trade growth through the planning and development of new facilities, and maintenance and management of existing facilities. The Corporation also leases and manages extensive areas of waterfront land (500 ha) along the Brisbane River for port-related purposes, such as container parks, distribution centres and bulk storage facilities. Over the past 20 years, over AUS$780 million has been invested in infrastructure and assets (Figures 2 and 3).

The Importance of Environmental Issues

As port managers, the Corporation has recognised that it now needs to take into account environmental issues.

Figure 1. The Port of Brisbane, located at Fisherman Islands at the mouth of the Brisbane River, is closer to the Asia-Pacific Rim than any other major Australian capital-city port, being up to five sailing days closer to Asia than the ports of Sydney and Melbourne.

Figure 2. Aerial view of Fisherman Islands, looking towards Moreton Bay.
with a rapidly increasing proportion occurring through the Port of Brisbane. Exports are anticipated to increase by 50% over the next eight years. Consequently, efficient port management and expansion is crucial in ensuring the growth and viability of the Australian economy.

KEY MANAGEMENT APPROACHES

The Corporation has recognised that environmental regulation is only likely to become more complex, and that ports need to become more accountable and must demonstrate a high level of environmental performance to ensure community support. Consequently it views environmental issues as an integral part of its day-to-day operation, aims to do more than meet government regulations, and seeks to stay ahead of any proposed legislation and community expectations. The key elements of the Corporation’s approach to operate successfully in an area of high conservation value include the following.

Environmental policy

The Corporation has clearly defined its environmental policy that guides its approach to business. It was formulated and adopted by the highest level of port management, and is updated regularly to account for technological and community changes. It describes how the Corporation aims to exceed legislative standards to a far greater extent than has occurred in the past, due to community, regulatory and business pressures. Community values and expectations, from an environmental perspective, have changed markedly over the past few decades, and at present a high level of importance is placed upon protecting the natural environment. The port’s operations now have significant potential to be constrained if perceived to be in conflict with those environmental and social values that the community associates with the Brisbane River and Moreton Bay.

Environmental and social issues are therefore now crucial to almost all aspects of the Corporation’s business. If such issues are not managed appropriately, they could limit current port activities, prevent port expansion (e.g. prevention of channel deepening resulting in ship draft restrictions), or result in a need for potentially unnecessary environmental monitoring.

Restrictions to port operations could be of great concern. Australia has a high reliance on ports considering its island status, reliance on export of bulk agricultural/mining products, significant distance from major trading partners, and high cost of airfreight. Inappropriate restrictions on port growth and operation would have major detrimental effects to both regional and national economies. Over 25,000 vessels visit Australia every year, carrying AUS$180B of trade, with a rapidly increasing proportion occurring through the Port of Brisbane. Exports are anticipated to increase by 50% over the next eight years. Consequently, efficient port management and expansion is crucial in ensuring the growth and viability of the Australian economy.

Figure 3. Aerial view of Fisherman Islands, looking back towards the city of Brisbane. In the foreground, the current reclamation area is divided into paddocks, where dredged material is pumped to reclaim land.
requirements and strive for “best practice” in all of its operations.

**Environmental Management System**

Under the EMS, all aspects of the Corporation’s operations are subject to an environmental risk assessment, and management actions are identified to address those of highest risk. Specific schedules, budgets and responsibilities are defined for each action. Activities of lesser risk are prioritised taking into account regulatory and budgetary issues.

The EMS was certified to ISO 14001 in May 2000, when the Corporation became the first port manager in Australia to be certified to this international standard. Since then, the Corporation has undergone regular independent external surveillance audits, which have verified our continuing adherence to the standard.

The presence of a benchmarked, independently audited EMS provides a level of confidence for regulators, the community and business partners. It provides a basis to ensure that any new development activities will be managed in an agreed manner, and that there is a system of “checks and balances” for regulators to be able to verify that appropriate management practices have indeed been implemented.

**Monitoring and reporting**

The Corporation places a considerable emphasis on monitoring the effects of its operations on the surrounding environment. Key monitoring activities relate primarily to water quality (e.g. stormwater, groundwater, dredging effects) considering the port’s proximity to the Marine Park, but also include the health of nearby wetlands, bird populations, energy usage, waste management, dust, and oil spills. The Corporation now holds detailed information on the environmental status of, and impacting processes to, environmentally significant areas within and adjacent to the port. Researchers and government regulators now come to the Corporation to seek environmental information on the port region. This situation clearly elevates the status and perceptions of the port, as well as providing the Corporation with the capacity to quickly identify any potential impacts before they become an issue.

In 1999, the Corporation was the first port manager in Australia to publish an Environmental Performance Report and, since then, it has continued to refine its environmental reporting process. These reports provide a basis on which the community can assess how the port is operating and the potential impacts of its operation, and enables the community, via an enclosed feedback card, to comment on the management achievements.

In 2002, the Corporation made its first formal foray into reporting on its triple bottom line, and believes that it now has tailored environmental, social and economic indicators that best reflect the particular performance demands of operating a seaport immediately adjacent to a Marine Park.

**Community consultation and port promotion**

Environmental issues over the past few decades have become of much greater interest to the community. Many changes in government regulations relating to port operations have arisen directly as a result of concerns raised by community/conservation groups. Community consultation, therefore, forms a key component of environmental management. Individual ports must develop local partnerships with the general public and community groups. Key Corporation initiatives to promote its environmental performance, and facilitate feedback on concerns and issues include:

- regular environmental presentations to external stakeholder and interest groups;

Figure 4. Fisherman Islands provide habitat for a range of birdlife. Left, Ospreys return to this nest on Fisherman Islands every year. Right, Pied Oystercatchers frequent the reclamation paddocks.
Environmental enhancement

The Corporation has initiated a series of environmental enhancement projects in conjunction with government regulators/conservation groups, which include:

- 12-hectare permanent roost site for migratory birds;
- construction of nesting platforms for raptors;
- a mangrove-transplanting project and sponsorship of revegetation projects;
- a Greenhouse Gas emission reduction project for the Corporation’s dredging and motor vehicle fleets;
- award-winning nature vegetation landscaping on port lands; and
- substantial funding of marine research being undertaken by universities.

Conclusions

The Port of Brisbane has recognised that ports in an environmentally sensitive area need to become more accountable and must have a demonstrable commitment to environmental management. The Port Corporation has successfully implemented policies to guide its approach to its business and these have been adopted at the highest levels of port management.

They include:

- a frequently updated environmental policy;
- an Environmental Management System (EMS) including risk assessment and ISO 14001 certification;
- monitoring and reporting including an Environmental Performance Report;
- community consultation and port promotion, including a Visitors’ Centre; and
- environmental enhancement projects.

These measures have been essential in shaping the Port of Brisbane into a modern port able to accommodate the increase in trade associated with globalisation.
In general, there is a lack of disposal sites and/or alternative treatment techniques for beneficial reuse of contaminated dredged material in the Flemish region of Belgium. On the other hand there are several sites in this region that, owing to former industrial activities, are contaminated and no longer have a commercial or industrial use. Some even have a negative value as a result of the present contamination and the needed sanitation before any further use. On top of this there is an urgent shortage of industrial areas in the Ghent region for the expansion of high technology oriented businesses and small- to medium-sized organisations.

In the late 1990s governmental organisations in the Ghent region were urgently seeking economical solutions for the disposal of contaminated dredged material. Several maintenance dredging operations were postponed because of a lack of disposal possibilities. Eventually several governmental organisations and private partners combined their expertise and developed the “Fasiver Project” which includes the sanitation of a black-point (surface of about 7 ha) and the redesign of a 42 ha large site by means of a sludge treatment centre (dewatering lagoons) and a confined disposal facility for contaminated dredged material. The final destination of the site is industrial area (approximately 30 ha) and a greenbelt (approximately 10 ha) on top of the sanitised black-point. The profits made by the selling of the grounds in the industrial area should cover the costs made for the sanitation of the black-point.

The site is located in the Ghent region, on the crossing of highways E17 and E40 and the waterways Upper Scheldt and a ring canal around Ghent. The installation and exploitation of the sludge treatment centre and the confined disposal facility are regulated and controlled by the Flemish Government. All necessary environmental and building permits are yet available. The design of the treatment centre and the confined disposal facility is in accordance with Flemish and European regulations, which means amongst other things that a double mineral liner or equivalent is installed at the bottom; several drainage layers are installed in order to collect the percolate and to control the impermeable liner; an isolating top layer minimises environmental impacts in the future. After filling the disposal site the area shall be used as an industrial site. The total capacity of the confined disposal site is estimated to 1.3 million cubic metres.

This article first appeared in the Proceedings of the PIANC Conference held in Sydney, Australia and is reprinted here in an adapted version with permission.

Introduction

In general, there is a lack of disposal sites and/or alternative treatment techniques for beneficial reuse of contaminated dredged material in the Flemish region of Belgium. On the other hand there are several sites in this region that, owing to former industrial activities, are contaminated and no longer have a commercial or industrial use. Some even have a negative value as a result of the present contamination and the needed sanitation before any further use. On top of this there is an urgent shortage of industrial area in the Ghent region for the expansion of high technology oriented businesses and small- to medium-sized organisations.

In the late 1990s governmental organisations in the Ghent region were urgently seeking economical solutions for the disposal of contaminated dredged material. Several maintenance dredging operations were postponed because of a lack of disposal possibilities. Eventually several governmental organisations and private partners combined their expertise and developed the “Fasiver Project” which includes the sanitation of a black-point (surface of about 7 ha) and the redesign of a 42 ha large site by means of a sludge treatment centre (dewatering lagoons) and a confined disposal facility for contaminated dredged material. The final destination of the site is industrial area (approximately 30 ha) and a greenbelt (approximately 10 ha) on top of the sanitised black-point. The profits made by the selling of the grounds in the industrial area should cover the costs made for the sanitation of the black-point.

The site is located in the Ghent region, on the crossing of highways E17 and E40 and the waterways Upper Scheldt and a ring canal around Ghent. The installation and exploitation of the sludge treatment centre and the confined disposal facility are regulated and controlled by the Flemish Government. All necessary environmental and building permits are yet available. The design of the treatment centre and the confined disposal facility is in accordance with Flemish and European regulations, which means amongst other things that a double mineral liner or equivalent is installed at the bottom; several drainage layers are installed in order to collect the percolate and to control the impermeable liner; an isolating top layer minimises environmental impacts in the future. After filling the disposal site the area shall be used as an industrial site. The total capacity of the confined disposal site is estimated to 1.3 million cubic metres.
Eventually several governmental organisations, including the Province of East-Flanders and the City of Ghent, and private partners, including Domo Service Gent NV and DEC NV, combined their expertise and developed the “Fasiver Project” which includes the sanitation of a black-point (surface of about 7 ha) and the redesign of a 42 ha large site by means of a sludge treatment centre (dewatering lagoons) and a confined disposal facility for contaminated dredged material. The net capacity for dewatered dredged material of the confined disposal facility is estimated to 1.3 million cubic metres.

The final destination of the site is industrial area (approximately 30 ha) and a greenbelt (approximately 10 ha) on top of the sanitised black-point and around the industrial area. The profits that will be made by the selling of the grounds in the industrial area should cover the costs for the sanitation of the black-point.

The Fasiver Project has provided a solution for the three problems mentioned above:
– An historical black-point with a great risk for the environment and human health is sanitised and controlled in an economical and environmentally safe way.
– Maintenance dredging operations in the Ghent region are restarted and can continue for over 10 years.
– An industrial area is created on a very favourable location near two major highways and waterways, so the needed expansion of the industry in the Ghent region can continue without developing new sites in residential parts of the city.

Situation

The site in question is located in the Ghent region, at the crossing of highways E17 and E40 and the waterways Upper Scheldt and the ring canal around Ghent (see Figures 1, 2 and 3).

Public Private Partnership

At first sight, public and private partners have contradictory interests. The private partner wants to reduce risks (insecurity of public policy and changing regulations) and increase financial return related to the investment, whereas the public partner wants to diminish financial risks and the financing volume and increase efficiency in execution. Through a public private partnership these opposing interests can be shared in common cooperation.

This common cooperation between public and private interests can be illustrated taking the redevelopment of a “brownfield” site as an example.
1. **Know-how**
The private partner has to take the technical risks (e.g. using new techniques, applying existing methodologies on a larger scale or under different conditions). The public partner is responsible for the planning and permit risks (e.g. delays in planning procedure, negative environmental impact assessment, failure to obtain construction permits).

2. **Efficiency**
While the private partner takes responsibility for the schedule risks (delays in execution, flexibility), the public partner is responsible for the regulatory risks (changing rules, political risks, expropriation).

3. **Finance**
Here, the private partner takes care of the commercial risks (cost calculation, budget control) and can pre-finance the project. The public partner has to take the final budget risk based on revenues from the brownfield site: the contamination cost has to be lower than the revenues.

During the study period of the Fasiver Project the following public and private partners combined their interests:

- Domo Service Gent as main owner of the site, including the black-point;
- DEC as environmental contractor for the sanitation of the black point and the exploitation of a sludge treatment centre and disposal facility;
- Vlaamse Milieuholding (VMH) as initiator of the project, in execution of the Flemish Government policy to prevent and recycle waste;
- The City of Ghent and the province of East Flanders as partners interested in the potential value of the site.

Through the use of a pull-out option, the public partners (VMH, City of Ghent and province of East Flanders) left the public private partnership after the study period, so that the private partners (owner and contractor) had to take the exploitation risks on their own. By giving a pre-purchase option (to the City of Ghent and the province of East Flanders), the public partners nevertheless remain involved with the project.

**Principle of Sanitation**

**Formulation of the problem**
A part of the site in question was formerly used as a disposal site for waste products coming from the production of viscose fibres on the other side of the Scheldt canal. In that time there was practically no legislation, knowledge or concern about the environmental impact of such activities. This way about 175,000 m³ of organic viscose sludge was dumped in five basins without any lining or control measures.

For over 50 years no measures were taken to minimise the threat to the environment of the present sludge.
basins. Due to the lixiviation of heavy metals and other contaminants present in the sludge the groundwater in the surrounding area is contaminated and forms a possible risk to the adjacent residential area on the southeast of the site.

Because of the historical character of the problem, the present owner of the site is a so-called ‘innocent owner’ and has no obligation whatsoever in order to sanitise this black-point. On the other hand due to the presence of the black-point the site has a negative value and cannot be sold or used. Only a global project – a so-called “brownfield” development – including a risk-based sanitation of the black-point and an economical revalorisation of the site, can supply a solution. Figure 4 shows an overview of the black-point.

**Proposed solution**

Because of the large volume of contaminated viscose sludge, excavation and ex-situ treatment and disposal of the treated sludge was not an economically viable solution. Therefore preference was given to in-situ stabilisation and isolation of the sludge basins, combined with in-situ groundwater remediation of the contaminated hot spots around the sludge basins.

For the stabilisation and immobilisation of the contaminated viscose sludge a series of laboratory tests was undertaken in order to define the best-suited recipe. Several binding agents and granulated materials were tested.

As the viscose sludge is a fluid-like, fibrous, organic material with practically no mechanical structure, a granulated additive is necessary in order to improve the structure and the ground mechanical characteristics of this material. Based on the laboratory tests, the use of steel slag as granulated material showed the best results. As the steel slag is a secondary by-product it is also an economically and environmentally good alternative for the use of raw materials. A second advantage of the use of steel slag is the presence of approximately 10% lime in this material, which ameliorates the immobilisation of the contaminants present in the viscose sludge. As binding agent a purpose-made additive mainly consisting of cement showed the best results, economically and mechanically.

The final tests showed that with this recipe, a shear strength of 10 kPa was easily attainable, already after seven days. Control measurements on site affirm these results. Figure 5 shows an overview of the stabilisation of the different basins on site.

On site the different additives (steel slag and binding agents) are first mixed in predefined quantities in a semi-mobile mixing plant. Then this mixture is transported to the different sludge basins where a long reach excavator equipped with a specially designed mixing bucket spreads and mixes the additives and the viscose sludge. Because of the presence of large parts of wood, bricks, concrete, steel, etc. in the sludge basin, a mixing technique without any rotating parts was deliberately chosen.
The actual isolation of the contaminated sludge volume will be performed by means of an impermeable cement-bentonite wall around the different basins. This cement-bentonite wall will be 30 metres deep below ground level and will reach a natural underlying impermeable clay layer. On top of the stabilised viscose sludge comes first a gas-drainage and second an impermeable HDPE-liner of 2.5 mm thick.

Finally the isolated area will be covered with over 2 metres of mould and arranged as a green area as buffer near the industrial zone.

**HEALTH AND SAFETY**

Because of the organic character of the viscose sludge and the presence and continuous production of \( \text{H}_2\text{S} \) gas in the sludge, many problems were expected during the handling of this type of sludge. An extensive safety plan was made, including personal \( \text{H}_2\text{S} \) gas detectors for all personnel working near the sludge basins. All the material that was used in the stabilisation operations was equipped with positive pressure cabins. An emergency plan was set up in order to evacuate the site in case of calamities.

During the laboratory tests – for the determination of the right recipe for stabilisation – also the \( \text{H}_2\text{S} \) gas concentration above the sludge surface was measured. There was even a pilot study on site where the \( \text{H}_2\text{S} \) concentration and odour production were measured during a simulation of the proposed stabilisation technique.

During these tests a few cases near the sludge surface (within a few centimetres) were measured with concentrations of up to 500 ppm. The MAC-value for \( \text{H}_2\text{S} \) gas is 10 ppm. Nevertheless because of the distribution in open air and the chemical reaction in the sludge (increase of pH) owing to the addition of cement, it seemed that concentrations within a few metres of the surface were limited below 10 ppm. Continuous measuring on site during the stabilisation operations confirmed these results.

Also the odour production because of the stabilisation operations stayed within the “normal” concentrations observed before the beginning of the project. Depending on the weather conditions, the typical odour of the viscose sludge could be observed in a perimeter of about 500 metres around the basins. During the stabilisation operations this perimeter is not significantly wider. A specialised panel of noses (a research group of the University of Ghent) is responsible for the follow up of the odour concentration around the sludge basins.

Once the viscose sludge is stabilised – and thus the pH increased – the \( \text{H}_2\text{S} \) gas in the sludge is actually immobilised and all the risks or inconveniences that go with the presence of \( \text{H}_2\text{S} \) gas disappear.

**SLUDGE TREATMENT CENTRE**

Next to the sanitation of the black-point, a large treatment centre for contaminated dredged material was installed on the site. About ten hectares of
“sand-bentonite-polymer liner” (Trisoplast®) of 7 cm thick with a permeability of maximum 10⁻¹¹ m/s. On top of the mineral liner comes a drainage layer of about 20 cm thick. This drainage layer will function as a control drainage layer in order to evaluate the isolating capacities of the upper impermeable liner.

The impermeable liner on top of the control drainage is a layer of compacted, dewatered, non-contaminated dredged material with a permeability of maximum 10⁻⁹ m/s. Upon that comes then the percolate drainage layer. This drainage layer consists of several types of drainage sand, gravel and a network of drainage pipes.

Finally the whole area will be arranged as a disposal site for contaminated dredged material. In this way the level of the area is brought from between +6 and +8 m TAW to a level of +13 m TAW, which is the level of the highway E40 along the site.

Quay wall
In order to maximise the supply by water, first a quay wall was installed along the Scheldt canal. The installed quay wall is 120 m long and consists of sheet piles and anchors (Figure 7).

All the drainage sand, gravel and about half of the construction sand needed for the installation of the dewatering fields and disposal site is brought over water. Naturally all the contaminated dredged material that will be treated on site is also brought over water.

Installation of dewatering field and disposal site
Figure 8 shows the structure of the dewatering fields and disposal site. The natural top layer at the site is a clay layer of about 3 metres thick. The presence of this layer and the permeability are examined in detail before the installation of the dewatering fields or disposal site is started. On these locations where the permeability is greater than 10⁻⁹ m/s or the natural clay layer is less than 3 metres thick an additional mineral liner is added.

This additional mineral liner consists of a layer of non-contaminated dredged material of about 30 cm thick and a permeability of maximum 10⁻¹⁰ m/s or a “sand-bentonite-polymer liner” (Trisoplast®) of 7 cm thick with a permeability of maximum 10⁻¹¹ m/s.

On top of the mineral liner comes a drainage layer of about 20 cm thick. This drainage layer will function as a control drainage layer in order to evaluate the isolating capacities of the upper impermeable liner. The impermeable liner on top of the control drainage is a layer of compacted, dewatered, non-contaminated dredged material with a permeability of maximum 10⁻⁹ m/s. Upon that comes then the percolate drainage layer. This drainage layer consists of several types of drainage sand, gravel and a network of drainage pipes.
The layer functions first as a collector during the dewatering phase and evolves to the percolate drainage layer for the disposed contaminated dredged material.

At the top of the disposed dredged material again a mineral liner is installed in order to isolate the whole site. This mineral liner will consist of a layer of non-contaminated dredged material of about 50 cm thick and a permeability of maximum $10^{-9}$ m/s. Finally the site is completed with a draining layer of about 30 cm and a soil layer of about 70 cm.

The capacity of the disposal site is estimated to be 1.3 million cubic metres. Within the first two years (2001 and 2002) of exploitation, 450,000 m$^3$ of dewatered dredged material will be disposed of.

**Exploitation of dewatering fields**

Once the dewatering fields are installed the supply of dredged material can start. Prior to the dewatering operations the physical and chemical quality of the dredged material is tested in situ. Depending on the results the dredged material is divided in several categories:

- material that can be used as mineral liner;
- contaminated material;
- material that can be used as top soil, and so on.

Depending on the category the dredged material is simply dewatered or treated to minimise the concentrations of contaminating substances.

First the dredged material is loaded in dumper trucks specially designed for the transportation of liquid material. In this way the dredged material is transported to the proper dewatering field.

In the dewatering field a continuous turning of the dredged material stimulates the evaporation and maximises the draining capacity of the bottom layer. The material is then placed in rigs. This allows the surface exposed to sun and wind to be maximised and rainfall can flow directly in the drainage layer. In a period of three to six months the dry matter content of the dredged material is brought from less than 40% (g/100 g) to over 65% (g/100 g). Figure 9 illustrates this dewatering process.

Depending on the chemical quality of the dredged material after the dewatering bioremediation and/or physical-chemical treatment of the material takes place. In order to minimise organic contaminants biodegradation is stimulated by adding proper nutrients and compost and a continuous aeration by turning the...
dredged material with special turning machines. Altering the pH in the dredged material (by adding compost for example) can eliminate heavy metals and other inorganic contaminants.

All the water (process water and rainfall) collected in the drainage layer of the dewatering fields is directed to a large buffer basin. The water runs then through a water purification plant, consisting of a sand filtration and an active carbon filter. Finally the water is discharged to the Scheldt canal.

**Final Destination**

The final destination of the site is an industrial area for high technology oriented businesses or small- to medium-sized organizations. On top of the sanitised black-point and within a strip of about 100 metres along the Upper-Scheldt, a green belt will function as a buffer between the industrial area and the adjacent residential area on the other side of the Upper Scheldt.

According to the planning the first 10 hectares of industrial area will be sold in 2004.

**Conclusion**

The combined expertise of the public partners, the Province of East-Flanders and the City of Ghent, and the public partners, Domo Service Gent NV and DEC NV, offered the solution to the several problems of the different partners.

Three major problems were solved: A historical black-point with a great risk for the environment and human health is being sanitised and controlled in an economical and environmentally safe way.

Maintenance dredging operations in the Ghent region of Belgium are restarted and can continue for over 10 years.

An industrial area is being created on a very favourable location near two major highways and waterways, so the needed expansion of the industry in the Ghent region can continue without developing new sites in residential parts of the city.
A New Seminar on the Environmental Aspects of Dredging

In today’s world, dredging and the environment are two subjects that are forever linked. While people in the dredging industry see their activities as a positive means to economic and social improvement, others outside the industry often question the wisdom of dredging or at least the methods that dredgers employ. A team of experts decided to provide an answer with well-researched information accessible to a broad audience. This resulted in a seven book series, *Environmental Aspects of Dredging*, which has now been used as the foundation to create a new seminar of lectures and workshops on the “Environment and Dredging”.

Objectives of the Seminar

A few years ago the International Association of Dredging Companies (IADC) and the Central Dredging Association (CEDA) organised the creation of some solid information for those outside the dredging industry or in related fields to make clear why we dredge and how we dredge and what consequences that has for the environment. The idea was to provide a balanced view of the whole subject; to lead the reader through the “state-of-the-art” environmental evaluation process; to provide a science-based source of knowledge on dredging and environmental matters; and to provide access to more detailed references for those interested.

Figure 1. Environmental dredging means considering the possible impacts on the ecosystem. These, of course, can also be caused by natural events such as storms.

The result was a series of seven Guides, the *Environmental Aspects of Dredging* (see IADC publication order form), each one produced by a separate group of authors, coming from a varied international background. This proactive initiative by the dredging industry presents a balanced view of dredging for legislators, with guidance for managers, engineers and environmentalists, as well as for those in developing countries. The structure was controlled by an Editorial Board and peer-reviewed.

Translating the written word of the Guides into an interactive Seminar was a logical next step. Building on the IADC’s experience with its Seminar on Dredging and Reclamation, a group of dredging professionals have adapted the books to a full-fledged powerpoint presentation aimed at reaching port authorities, government officials and others involved in the decision-making processes about dredging.

The IADC/CEDA Guides and Seminar do not prescribe specific controls for dredging works on a generalised basis. They are intended to be an aid and support to planners, engineers and environmental scientists when they are making their own individual assessments. Since each project has its own considerations, goals, and restrictions, these can only be evaluated on a case-by-case basis by the companies involved. Local conditions and sensitivities must always be taken into account. In principle, contractors/operators should be allowed to operate equipment in any reasonable manner that allows the environmental goals to be met.

The Seminar

The seminar begins with the most basic questions, “What is dredging and why do we dredge?” It addresses the fact that people do interfere with the environment, that there is a growing public awareness and concern, and the act of dredging and relocation of dredged material is an environmental impact, be it positive or negative, short or long term. It tries to identify the “players”, such as politicians, financiers, activists, contractors, consultants, administrators or standards institutes, owners and
The ultimate location of the dredged material is such an important factor that it must be addressed from the start of the project. Determining the properties of the dredged material and its possible beneficial use, or the options of open water or confined disposal and/or the treatment of dredged material is an integral part of the dredging process. The Lecture on this subject is then followed by a Task in which the group must determine the best disposal option.

These lectures and workshops are structured as modules to be used on their own, or as part of one or more day programmes at international conferences. Further information about them can be received from the IADC or CEDA (www.iadc-dredging.com).

Reference Sources

The Seminar and workshops are based on the books listed below, which can be ordered through the IADC:
The IADC-CEDA Guides
Guide 1 Players Processes & Perspectives
Guide 2 Conventions Codes & Conditions
Guide 3 Investigation Interpretation & Impact
Guide 4 Machines Methods & Mitigation
Guide 5 Reuse Recycle or Relocate
Guide 6 Effects Ecology & Economy
Guide 7 Frameworks Philosophies and the Future
Abstract

Based on demographic and economic projections, dredging will remain a necessity for the foreseeable future. The majority of the world’s populations live near coasts or rivers, and dredging provides protection for their homes and livelihoods. Waterborne transportation continues to be an efficient and environmentally safe alternative for transporting goods and dredging ensures that harbours remain accessible to shipping. Yet the public often does not appreciate the role that dredging plays in furthering economic prosperity. They do not see the many precautions taken by the dredging industry to control the dredging process and to minimise the influence on the environment. On the contrary, dredging is often considered to be a rather negative and environmentally unfriendly activity.

Clearly communication between the industry and the public needs substantial improvement. The dredging industry itself must bear responsibility for the betterment of its own image – for making clear its “Vision and Values”. This must be achieved by proactive initiatives, i.e., by providing adequate information to all parties, by educating a wide range of stakeholders and by sustainable development policies. A reactive policy, waiting and seeing, often results in “ostrich politics”, putting your head in the sand and hoping that controversy won’t occur. It is far better to be prepared, to network, to manage information and to meet the opposition with researched facts. Positive public relations – with open dialogues and transparent transactions – will ultimately benefit both the public and the industry.

Introduction

Dredging is a global industry and infrastructure projects involving dredging are numerous. Airports built on artificial islands, land-sea fixed connections such as in Scandinavia and South America, the reclamation of new land for container terminals in the Far East are as important for economic prosperity as the very many smaller and sometimes less spectacular projects elsewhere.

Research and development for new technologies combined with major investments by the dredging industry in environmentally sound dredging methods has led to a situation, where dredging has become part of the solution to many environmental problems rather than part of the problem itself. A major hurdle remains, i.e. the public perception of the problem is often quite the opposite.

The Need for Dredging

Demographic developments indicate that human involvement with water-related issues will continue to increase with the passage of time. At the moment almost 70% of the earth’s population of more than 6 billion lives within 80 km of a coastline or river system. This population is increasing at a rapid rate and, according
to predictions, by the year 2020 world population will grow by roughly 25 to 28%. This increase will lead in particular to further urbanisation and, even more importantly, will have its effect on a more than average contribution to over-population in many coastal zones. An increase in coastal populations will place a greater demand on residential, employment and recreational facilities, as well as on beach protection and other health and safety requirements (Figure 1).

The importance of waterborne transportation of goods will become more obvious and will make it imperative that ports and harbours are sufficiently accessible to the shipping industry. Waterborne transport has been proven time and time again to be cleaner than overland transport and it is economically viable. Dredging must therefore be an integral part of any infrastructure plan to ensure that ports and harbours, as well as residential and recreational areas, can adequately meet these growing demands (Figure 2).

**Dredging and the Environment**

No doubt, dredging has its effects on the environment. First of all, the creating of new land or the changing of

![Figure 1. Over-population creates a great demand for beach and coastal protection.](image1)

![Figure 2. The importance of waterborne transportation is growing because it is cleaner than land transport and economically viable.](image2)
access channels will implicitly have an influence on nature. Natural habitats will change, although these changes do not necessarily have to be negative in the long run. Secondly, dredging often presents problems in terms of making visible the pollution originating from both industrial and shipping activities. New techniques utilise DGPS and high accuracy dredging, in which the thinnest possible layers are dredged. This creates the least amount of disturbance and also the least amount of contaminated soils for disposal.

Joint research by the dredging industry and the government into confined disposal sites as well as treatment plants has also provided solutions for a real problem – what to do with contaminated dredged materials. Although the dredging industry uses highly accurate technologies and careful monitoring to find clean sand at sea and to build new land without damaging marine life, yet from Spain to New Jersey, protests still arise. The effects of dredging are potentially controversial. Dredging is therefore an area where an improved dialogue between the public and the dredging industry is essential.

Through continuing research and development, the dredging industry has striven to find technologies which are minimally invasive environmentally whilst maximising economic benefits. Unfortunately, this fact is often ignored or unknown to the public and to public organisations, as well as to pressure groups.

So what may seem as an obvious economic plus to the dredging activity – new ports, replenished beaches, new land for housing and commerce – is often perceived as threatening by the public. This is where the NIMBY reaction steps forward.

NIMBY

NIMBY ("Not In My BackYard") has become a familiar acronym to professionals in the dredging industry. The problems of contaminated sediments are real. As a result of rapid, industrial growth, chemicals and wastes have found their way into our rivers and streams. From pharmaceutical companies in Switzerland to General Electric in New York State, various industries have caused pollution problems, which affect drinking water, marine life and general health conditions. New (maritime) infrastructure is felt necessary by a major part of the population, as long as this new structure will not be built next to our house or may have an effect on social environment (Figure 3).

The resulting environmental hazards and changes in natural habitat have become a concern of society at large. It has become a concern of the dredging industry, although the dredging activity mainly is the result of a macro economic structural development for the benefit and prosperity of society. And even more, dredging often may offer solutions for environmental problems created elsewhere. And as part and parcel of these solutions, dredging projects adhere to proper licencing and strict monitoring.

Governmental regulatory agencies on local and national levels have established “Environmental Protection Departments”. On an international level, treaties such as OSPAR and the London Convention provide outside regulatory control. Especially in the more industrialised nations, heightened awareness has led to responsible environmental policies which have become a prerequisite to acceptable industrial and economic development.

The dredging industry has co-operated in trying to establish and enforce guidelines to protect the world’s oceans and rivers. In addition, they follow strict ISO and ISM safety standards to protect employees. The industry has continually sought to find a balance between what is environmentally and economically viable.

Why then does dredging continue to be viewed as the adversary? And why do they seem to become more often a victim of sometimes controversial actions by “representatives” of the population?

The Brent Spar Syndrome

"Bad Feelings Dredged up along with River Silt”.
"New Floods Resurrect Old Debate”.
“Troubled Seas”.
“One Person’s Dune is Another’s Obstruction”.

Figure 3. The dangers of chemical sand wastes in our water as a result of rapid, industrial growth are real. But dredging can be part of the remedy.
totally unprepared: The Austrian company Pioneer Saaten was taken by surprise when its genetically manipulated grains came under attack. The company’s position was that their products were extensively tested and registered. But did the public know this? Obviously not. And when the pressure groups engaged Pioneer Saaten in a dialogue they were far better prepared than was the company. The result was that the Austrian government enacted legislation restricting genetically altered foodstuffs (Lubbers, Sept. 9, 1998).

Such are the discouraging newspaper headlines which warn us away from human interference with nature and from dredging in particular (Figure 4). On the other hand, advertorials such as one that appeared in The New York Times in May 2001, sponsored by ExxonMobil, maintain that "Nature not only can coexist with human activities, but also flourish". Such paid-for corporate "advertorials" sometimes cause a reverse reaction and arouse scepticism. As Lord John Browne, the CEO of British Petroleum, remarked, surveys have shown that "only 16% of people questioned believe that large corporates are to be trusted. That means 84% of the population do not trust large corporations to act in the public interest".

Is there indeed an industrial conspiracy to deplete or pollute our natural resources? Is it ignorance or profit that drives modern companies to disregard the environment? Why is there so often a dichotomy between what the public perceives its interests to be, what government is attempting to implement, and what industry sees as the solution?

One of the recognised public relations debacles of the last decade has even been given its own name – "The Brent Spar Syndrome" (see Lubbers, Sept. 22, 1998). Royal Shell was clearly taken by surprise when Greenpeace launched a campaign against the sinking of an old drilling platform. Before Shell knew what had hit them, protesters barricaded their offices, and they were unable to dispose of the Brent Spar as planned (Figure 5). Though it later became apparent that Shell had done its homework, and that its method of disposal of the Brent Spar was environmentally the most acceptable one, it was too late. The company was forced to dismantle the platform on land – environmentally a less than optimal solution. As Lubbers writes, "The Oil Major’s first reactive measures have… become the perfect example of how not to do it". Re-action instead of pro-action resulted in the humiliation of this corporate giant.

But Shell is not the only example of underestimating the opposition or failing to communicate with the public. The food industry has also faced adversaries...
The controversy in New York State about dredging both its harbour in the lower Hudson and hotspots in the upper Hudson are two separate but equally frustrating situations. Years of debate about New York/New Jersey’s Port Elizabeth prevented desperately needed dredging. As the harbour silted up, New York lost its status as the world’s largest port, jobs in the shipping industry disappeared and finally large container shipping companies such as Maersk threatened to leave the port as their new vessels were unable to enter the shallow waters. All this despite the fact that the New York District Corps of Engineers scheduled a series of public meetings, presented a “Dredged Material Management Plan” for public consumption and discussion, and consciously emphasised and explained the public’s role in the decision-making process. Research scientists were employed and even the Environmental Protection Agency was on board, but not the public.

Even more confusing is the issue of the upper Hudson River where General Electric dumped PCBs from the 1940s to the 1970s. Since then GE has been fighting the government’s implementation of the widely accepted policy “the polluter pays”. One might think that given GE’s responsibility for the pollution the citizenry in the area would doubt GE’s word and political clout and welcome a dredging cleanup. Not so. GE has spent millions of dollars convincing the local population that dredging will not solve the problem. In fact GE maintains that dredging will cause more problems. And at least some people believe this. As one area resident said, “I’d be the first to say (the river) needs to be cleaned up…[but] I was always told the best thing to do with PCBs is just leave them there” (USA Today, August 17 2001).

With the opening of Hong Kong’s new airport, The New York Times (July 6, 1998) under the headline “A 6-hour Move and Hong Kong Loses a Thrill” reported the comments of one Hong Kong resident. “I feel sad about it [the old airport] closing... I’ve been using it since I was a boy”. This was the rather tepid reaction to the new airport despite the fact that when planes landed at the old airport he could “wave to the people in the windows” as they flew over his house – clearly a dangerous flight path and a noisy one as well. People didn’t want to change, even in a situation where the old situation is a sub-optimal one. People seem to be scared of new and better alternatives, and some organisations and press representatives seem to benefit from this phenomenon.

SaveTheArctic.com

Who is the opposition and why is the dredging industry unable to get its message across? Why is our credibility so in doubt?

Amongst other media, the effective use of the Internet has been clearly underestimated. Take for instance a US website to save the Arctic National Wildlife Refuge. Not that this is not a well-founded cause, but it is a good example of the expertise of pressure groups in rallying public opinion. At the website a letter (which the sender can personalise) is provided. This allows each sender to simply fill in a form and automatically email this standard letter to the person’s Congressional representatives. After filling in the form, the site then goes to a new screen in which the sender can give the email addresses of four other people who are then presumably contacted by this lobbying group via the Internet and so on and on. Think how quickly this message is being spread (Figure 6).

Other opposition to dredging often comes from the fishing industry, which has opposed dredging in various parts of the world – from Indonesia, to the U.S., to Spain. It is ironic then to read about a scientific study which reveals “that the corals are being ravaged by modern fishing techniques”. And not only tropical coral reefs, but especially cold-water reefs in eastern Canada, and Northern Europe although Australia and New Zealand are also showing wide-spread damage. “On sonar you can see the trawl tracks, like linear scars in the bottom” according to The New York Times (September 2000).

Formulating Positive Public Policy

When considering the case histories of dredging projects described above one fact becomes clear: Government involvement in initiating and regulating major infrastructure projects is supported by the
co-operation of the dredging industry. This public-private interaction provides an opportunity for providing clear and convincing documentation to the community prior to and during a project.

Given the enormous monetary investments and human resource commitments for building new harbours, airports, pipelines, and residential and recreational facilities, such endeavours require public support, both moral – from the community – and monetary –from government agencies. Clearly organisations such as the World Bank, the European Union (EU) and the International Monetary Fund (IMF) are not likely to provide funds for development unless they are assured of society’s need for and the financial feasibility of a project. Projects must be socially desirable and financially viable.

How can the industry make its goals and capabilities, its “Vision and Values” clear to the community? A number of suggestions are offered to help the dredging industry formulate a positive public policy and to facilitate the understanding of these policies by the public:

- joint efforts of industry and client to explain the technology and goals behind the technology;
- working with supra-national agencies such as the World Bank, EU and IMF;
- developing non-technical tools to inform the public on a general basis;
- listening to/ evaluating input from the public when a project is being planned;
- utilising the media (including the Internet) to explain the long-term and short-term impacts, social and economic, as well as environmental;
- utilising the media to inform the public during the planning stages as well as during the works of specific projects.

**Sustainable development**

A recent MeesPierson advertisement in the Dutch newspaper *De Telegraaf* announced, “Finding the balance between people, planet and profit. No bygone ‘hippie ideal’, but a concrete goal. More and more companies are incorporating sustainability in their enterprises’ goals. Profit is not the only target that is holy. It’s about the balance between economic, social and environmental interests”.

The dredging industry shares the common goals that benefit society as a whole. It has made large investments to discover technologies that reduce environmental impacts while increasing economic productivity. But professing environmental awareness is not enough. Only by providing information, by encouraging dialogue and by listening to the so-called opposition, will the industry be able to respond successfully. The industry must actively help shape a consensus in order to implement solutions.

It is essential to recognise that dredging does create a certain set of issues and these need to be addressed clearly. For instance, the cost-effectiveness of preventing and remediating beach erosion needs to be weighed. Building on the levees of the Mississippi turned into a disaster when the river did what the river always does at intervals, overflowing its banks. Native Americans avoided what is now known as the city of Los Angeles calling it with a name that meant “place of mist and smoke”, probably describing the naturally occurring phenomena of earthquakes and forest fires. We need to consider that as we build closer and closer to the water’s edge we may be foolishly putting our homes and ourselves at risk.

In a recent forum and publication, Burson Marsteller (June 2001) emphasises the importance of finding a balance between economic interests, ecological interests and social interests. This is what they call “sustainable development”: A number of organisations, all with websites, already exist to aid corporations and industries in meeting this challenge: Business for Social Responsibility, Coalition for Environmentally Responsible Economies (CERES), Global Reporting Initiative; Corporate Social Responsibility Forum, to name a few.

“Sustainable development” is a perfect opportunity for the dredging industry. Contrary to what often appears in the media, dredging is already a socially conscious and ecologically responsible industry. The aim of the Public Relations advocate is to make this clear to the outside world.

**Common Communication Efforts**

In recent years, several institutions such as the World Bank and the International Maritime Organisation (IMO) have created a forum to present balanced information and create responsible legislation for the global community. International treaties such as the London Convention 1972 and OSPAR Convention have ensured that the value of clean water and protection of marine life will not be underestimated. Other groups such as FIDIC and International Association of Dredging Companies (IADC) have designed contracts which promote fair trade practices and set widely accepted standards.

In addition, the International Association of Dredging Companies (IADC), PIANC, the US Army Corps of Engineers, the International Association of Ports and Harbours (IAPH) and the World Organisation of Dredging Associations (WODA) and its regional affiliates EADA, CEDA and WEDA have co-operated in a range of joint publications to explain the need for dredging and its environmentally sound methods. Seminars and conferences about dredging are conducted. But too often these are aimed only at people already on the inside of the industry, such as representatives of port authorities or other government agencies. The time
has come to cross the boundaries with such seminars to reach out into the mainstream of community life, to a non-technical target audience.

This could be realised through schools, beginning with primary and secondary as well as university level. One might consider the “Love Our Rivers” campaign launched by the Malaysian Government in 1993. Recognising how essential the rivers are to all living organisms, the Government launched a programme to promote awareness of the vital importance of clean rivers and encourage the active participation of local communities in achieving this. Amongst the various aspects of this campaign have been the “Adopt A River” competition and “River Watch” which measures water quality. These have resulted in the involvement of young and old, students and villagers, stimulating commitment and a sense of ownership to the improvement of Malaysia’s rivers, which has in turn improved hygiene, recreation and tourism. Such a far-reaching programme, which starts at a grass-roots level and works up, is a good model for the dredging industry to emulate (Figure 7).

The Internet as a means of education should also be considered. While at present this is not equally accessible to all levels of society, in the course of the coming decades it certainly will be. And as Shell learned the hard way, in terms of pressure groups, the Internet is the single most effective method of distributing information. Development of appropriate websites linked to local communities and regional educational authorities as a source of reliable information about dredging is an excellent, interactive public relations approach that is presently under-used. One recently developed source of information has been the newly launched www.dredgeline.net which provides a wide range of dredging documentation for both the scholarly researcher and the public.

Common Themes
A number of suggestions for themes to broaden understanding of the positive power of dredging should be considered. These include:

- The economic and environmental benefits of transportation by water;
- Planet Management versus Crisis Management;
- Caring for the coastline;
- Practical assistance in the creation of international environmental legislation;
- How developed countries can help developing countries prevent ecological disasters;
- The benefits of open markets and of free international competition.

Addressing such issues should help expedite the decision-making process for infrastructure projects and thus reduce costs and increase efficiency.

Given the growing shortage of personnel in the maritime industries in general, dredging as a career choice is also worthy of a promotional word or two. Having skilled and well-trained young people working as dredgers is an absolute necessity if the achievements of the industry are to maintain and exceed their present levels. Changing public perception of dredging also means being able to attract the best minds of the next generation to the industry.

Figure 7. In Brisbane, Australia a week-long Riverfestival stimulates populist pride in the river and responsible use and care of it as a resource.
Even if we were to take the most cynical approach, it is clear that good environmental policies are good business. To paraphrase Dr Allen Hammond, a senior scientist at the World Resources Institute, “…CEO’s… are not about to get labelled as environmentally bad companies because it will hurt them in the stock market, in recruiting talent and with their customers” (New York Times, January 13 2002).

Conclusions

Dredging is an essential part of infrastructure projects such as the enhancement of existing harbours/airports and creation of new ones, the remediation of rivers and other waterways, and the offshore industry. These are projects with long-lasting economic and social consequences.

Dredging technologies which reduce environmental impacts and simultaneously increase economic productivity are available. Although the public may not always believe it, the dredging industry certainly has the tools to improve the viability of our harbours, to help remedy flooding and destruction, and to protect our coastlines and the communities along riverbanks in a responsible way. It is incumbent upon the industry to explain that these tools exist and to make clear its Visions and Values.

Questions such as “Who Own the River?” — a headline in Time magazine, or “Is It Worth It to Rebuild a Beach?” — The New York Times — will continue to be asked, and rightfully so. The reality is that the dredging industry needs to be sure that they have environmentally sound, reasonable answers. Comprehensible to all stakeholders. And for that a proactive PR approach is imperative.

Some of the loudest voices against dredging can be found in the industrialised economies, and it is just these most advanced economies, which are actually the “greenest”. It is they which have experienced economic growth with the least intrusive environmental impacts. Ensuring that the public has a good understanding of the real role of dredging in promoting economic and social prosperity will ensure the continuation of responsible growth. It is imperative that the industry, by providing balanced information, conducts itself in such a way to increase public awareness and thus public trust.

Gary Guy who served as general counsel of the EPA under the Clinton Administration wrote recently, relating to the Hudson and the US, but applicable to dredging world-wide:

“…America’s modern environmental movement has demonstrated over the last 30 years that public health and environmental protections can be achieved without weakening the economy. This was true in the cleanup of polluted waterfronts across the country….The same will be true of the Hudson. The cleaner the Hudson, the greater the possibility that tourism, recreation and appropriate real estate development along its reaches will thrive”.

This is surely true of the Rhine, the Klang, the Yang-zte, of harbours in Rotterdam, Singapore, Taiwan, and Sydney. As an industry, the dredgers must make this message clear to the public at large.

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The Electronic Chart: Functions, Potential and Limitations of a New Marine Navigation System

Horst Hecht, Bernhard Berking, Gert Büttgenbach, Mathias Jonas and Lee Alexander

The electronic chart has been called the most significant development in marine navigation since the advent of radar over 50 years ago. Electronic chart systems introduce a new level of performance into navigation and are leading to major changes in maritime navigation. An electronic chart system is much more than a simple device to reproduce a conventional paper nautical chart on the screen. As a completely new and interactive navigation information system, it has the potential for displaying all necessary chart and navigation-related information required for the safe operation of a vessel. The book is written by experts in the field and is peer-reviewed by Adam J. Kerr. The publisher is that of Hydro International and other magazines.

The expert authors are:
Horst Hecht is Director of the Department "Nautical Hydrography" at the Federal Maritime and Hydrographic Agency (BSH), Hamburg and Rostock (Germany). He has been involved with ECDIS data and standardisation for many years.
Dr. Bernhard Berking is Professor for Navigation at ISSUS (University of Applied Sciences Hamburg) and Visiting Professor for Electronic Navigation Systems at the World Maritime University (Malmö/ Sweden). Gert B. Büttgenbach is Director of SevenCs GmbH, Germany. He is a graduate of the ISSUS and worked at ISSUS as technical co-ordinator of the German ECDIS trials. In 1992, he co-founded SevenCs.
Dr. Mathias Jonas is responsible for type approval of Integrated Navigation Systems at the Federal Maritime and Hydrographic Agency (BSH) of Germany. He is in charge of the international Colours & Symbols Maintenance Working Group of IHO.
Dr. Lee Alexander is an Associate Research Professor of Electronic Charting, University of New Hampshire, USA. Previously, he was a Research Scientist with the US Coast Guard and a Visiting Scientist with the Canadian Hydrographic Service.

The latest technical developments and all related disciplines have been taken up in the text. The book describes the basic components, functionality, and capabilities and limitations including:

- system configuration
- database and data structure for vector and raster data
- chart data updating
- data availability and data distribution
- ECDIS voyage planning and monitoring
- integration with GPS, radar, AIS and track Control
- Hydrographic basics
- liability, legal and economic aspects
- glossary of ECDIS and modern navigation

The book may be used for education and training, daily use onboard and familiarisation with this new navigation tool by hydrographic offices, maritime safety
administrations, shipping companies, maritime academies, universities, equipment manufacturers, and professional mariners amongst others. To enable the reader to experience the potential of ECDIS the book is accompanied by a CD with software offering demonstrations of the several systems described.

The publication of this book will hopefully enhance the acceptance of electronic charting technology and provide a significant source of technical information to the modern navigational professional. The use of ECDIS, like other modern tools such as radar and DGPS, will help improve safety and efficiency as well as cost-effectiveness for navigators.

**International Archives of Photogrammetry and Remote Sensing.**

GITC. 2002. Priced per item.

GITC is now the official distributor of the International Archives of Photogrammetry and Remote Sensing (ISPRS) Archives. The ISPRS Archives contain the proceedings (Part A) and the scientific and technical presentations (Part B) of each Congress, edited and distributed by the member organisation responsible for the Congress. The scientific and technical presentations at Technical Commission Symposia are published by each of the Commissions sponsoring members, also as volumes of the Archives. All Archives published from May 1994, including the Archives from the Amsterdam Congress, are distributed by GITC. Hardcopies and CDs may be purchased from GITC. Prices range from € 40.00 to 60.00.

**Hydro Sourcebook 2002**


The Sourcebook 2002 is the annual extra edition of Hydro International. The Sourcebook catalogues the variety of services, hardware and software products available in and for the hydrographic and oceanographic industries. It is the reference guide for the international hydrographic community, as well as for the contractors and principals in governments, universities and other organisations active in surveying, dredging, exploration, positioning, navigation, charting, cable-laying, oceanographic research, environmental monitoring and underwater operations. The Sourcebook contains over 2000 entries provided by more than 400 companies. All three publications are available from:

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**In Memoriam: Jan de Koning**

With his blazing white hair, Jan de Koning was one of the familiar faces in the dredging world. This April he passed away and he will be missed. Professor de Koning was born in Medemblik, The Netherlands along the IJsselmeer, into a dredging family. Naturally he gravitated to Technical University Delft, where in 1951 he finished his studies in civil engineering. After the disastrous floods of 1953 in the south of the Netherlands, he joined the ranks of engineers trying to keep Holland “dry” and was made manager of the St. Philipsburg dehydration project. Two years later he was asked to set up the research department at what would become Ballast Nedam Dredging (presently Ballast Ham). In 1971 he went to Japan to establish a joint venture for BND, and two years thereafter did the same in the United States.

In 1977 he was nominated by the Technical University Delft as a full Professor in the Faculty of Mechanical Engineering and Maritime Technology, in the Chair of Dredging Technology. He encouraged a generation of graduate students to make dredging a career and his students often joined him on practical field trips to Egypt, Singapore, Indonesia and other areas around the world. His scientific research led to 29 patents and innumerable publications and he remained at TU Delft until his retirement in October 1993. He was one of the founding members of CEDA and of the Board of Directors of the World Dredging Association (WODA). He lived through the tough decade in dredging, the recession from 1975 to 1985, but luckily also witnessed the “rebirth” in the 1990s, with Asia and especially Hong Kong booming.

Jan de Koning had the best of both worlds, the academic theoretical life of the university, combined with the hands-on practical commercial dredging world. He enjoyed the research capacity at the university, but always informed by the reality of practical application. In his farewell address at his retirement from TU Delft, he expressed his hope that “the studies and designs which have been achieved [at the university] will be an inspiration to the dredging industry to follow new paths...”.

Jan de Koning at his retirement ceremony from TU Delft in 1993.
Seminars/Conferences/Events

OI Americas 2003
Morial Convention Centre
New Orleans, Louisiana, USA
June 4-6 2003

After the success of Oceanology International in London in March of 2002, the marine science and ocean technology industries are now turning their attention to the Americas in the form of OI Americas, the Second Joint Ocean Forum. This follows the promising debut of Oceanology International Americas in Miami, Florida in 2001.

Moving the exhibition to New Orleans takes exhibitors straight to the heart of the US offshore oil industry, close to survey, charting and mapping companies. It also opens the convention to emerging South American shipping and port development sectors. In addition, a full programme of technical and scientific conferences and workshops will run alongside the OI, coordinated by The Oceanography Society.

For further information contact:
Craig Moyes
tel. +44 20 8949 9879
craig.moyes@spearhead.co.uk

Sheila Ramaiya
tel. +44 20 8949 9820
sheila.ramaiya@spearhead.co.uk

WEDA XXIII & TAMU 35 Dredging Seminar
Hilton Suites Hotel & Drury Lane Convention Centre, Oakbrook, Illinois, USA
June 10-13 2003

The twenty-third Western Dredging Association Annual Meeting and Conference and the thirty-fifth Texas A&M Dredging Seminar will be held in June 2003 at the Hilton Suites Oakbrook, 18 miles west of Chicago. The conference will provide an in-depth technical programme based on the theme, “The Dredging Contractor” and will provide a unique forum for discussions between dredging contractors, port authorities, government agencies, environmentalists, consultants, academicians, and civil and marine engineers.

Topics of interest include but are not limited to:
dredging contractors, dredging systems and techniques;
new dredging equipment; surveying; cost estimating;
dredging and navigation; project case studies;
amination; inland dredging; contaminated sediments;
numeric modelling; geo-technical aspects; beach nourishment; beneficial uses; and wetlands creation and restoration.

For further information contact:
Dr. Ram K. Mohan
Blasland, Bouck & Lee, Inc., Annapolis, MD
tel. +1 410 295 1205, fax +1 410 295 1209
e-mail: rkm@bbl-inc.com

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Mr. Stephen Garbaciak, Jr.
Blasland, Bouck & Lee, Inc.
tel. +1 312 674 4937, fax +1 312 674 4938
e-mail: sdg@bbl-inc.com

Dredging Today
Puerto de Avilés, Spain
June 19-20 2003

An international seminar on dredging “Dredging Today” is being organised by the Port Authority of Avilés and the Ports and Coasts Technical Association of the PIANC Spanish Section. Subjects will include: Public awareness on dredging; emergency dredging; recent dredging works in the world; presence of dredging in daily life; obtaining sand from the sea bottom for coastal environmental purposes; current dredging equipment and future trends; special equipment; dredging work costs structure; hydrography navigable draughts; up-to-date environmental recommendations. A debate table will be held. The seminar will be in English and Spanish.
**Coasts and Ports Australasian Conference**  
*The Hyatt Hotel, Auckland, New Zealand*  
*September 9-12 2003*

This is the 16th Australasian Coastal & Ocean Engineering Conference and 9th Australasian Port & Harbour Conference. The theme of the conference is “Coastal Development – A Quest for Excellence” and the issues it covers include: models for “good” coastal development; change in port infrastructure and efficiency; costs of regulation and compliance; managing conservation and development; assessing impacts of coastal structures on the natural system; and changes in science and technology in modelling and monitoring coastal change.

For further information contact:  
The Conference Managers  
The Conference Company  
PO Box 90040  
Auckland, New Zealand  
tel. +64 9 360 1240, fax +64 9 360 1242  
e-mail: coasts and ports@tcc.co.nz

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**International Conference on Port and Maritime R&D and Technology**  
*Singapore*  
*September 10-12 2003*

The 2nd International Conference on Port and Maritime R&D and Technology will be held in Singapore in September. It is organised by a broad base of universities, technological institutes and maritime academies from Singapore, as well as the Association of Consulting Engineers Singapore, and supported by the Maritime and Port Authority of Singapore as well as many international organisations such as the IMO, IAPH, PIANC, EADA, IHO and IALA.

The theme of the conference is “Challenges for the Next Decade” and papers will be presented on: Port development, management and operations; coastal/hydraulics engineering; marine environment; innovative ship designs and operations; and navigation and maritime training.  

In conjunction with the conference, an exhibition featuring the latest R&D and technological products, systems and services in the port and maritime industries will take place.

For further information contact:  
The Conference Secretariat  
Ace:Daytons Direct (International) Pte Ltd  
2 Leng Kee Road #04-02, Thye Hong Centre  
Singapore 159086  
tel. +65 6379 5251/ 6475 9377  
fax +65 6475 2077/ 6475 6436  
e-mail: admin@acedaytons-direct.com  
www.mpa.gov.sg/homepage/conferences/RDT/main.html

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**COPEDEC VI**  
*Colombo, Sri Lanka*  
*September 15-19 2003*

The theme of the sixth International Conference on Coastal and Port Engineering in Developing Countries (COPEDEC) will be “Engineering the Coastal Environment”. Subjects include: Port and harbour infrastructure engineering in developing countries; port and infrastructure planning and management in developing countries; coastal sediments, hydrodynamics and control; coastal zone management in developing countries; and coastal and port environmental aspects. At this conference an IADC Young Authors Award will be presented to the best paper by an author younger than 35 years of age recommended by the Paper Committee.

For further information contact:  
The Local Organising Secretariat COPEDECVI-COLOMBO 2003  
c/o Ace Travels & Conventions (Pvt) Ltd.  
315, Vauxhall Street, Colombo 02 Sri Lanka  
tel +94 1 300 589/300 590, fax +94 1 331 816  
e-mail: acetravels@aitkenspence.lk  
www.copedec.lk

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**International Conference on Remediation of Contaminated Sediments**  
*Palazzo del Cinema, Venice, Italy*  
*September 30-October 3 2003*

Contaminated freshwater and marine sediments are a significant environmental problem worldwide.  
Since disposal of contaminated dredged materials can be a major financial issue, further research for better technologies, and practicable and cost-effective sediments-management practises must be designed.  
To provide a forum for understanding the nature of contaminated sediments and for finding potential solutions, Battelle, with the support of 12 international organisations active in management and remediation of sediments, organised a conference in October of 2001.  
Based on the positive response to that event, Battelle is organising a second conference focussing on all aspects of remediation and management of contaminated sediments.
For further information on the technical scope of the programme or registration or other matters please contact:
Marco Pellei, Batelle-Geneva Research Centre
fax +41 22 827 2094
e-mail: sedimentscon@battelle.org
or visit the website: www.battelle.org/sedimentscon.

Ports India 2003
Mumbai, India
October 8-11 2003

The conference “Trade, Shipping and Port Strategy” will focus on transport efficiency and infrastructure development, which are the key to India’s trade sustainability. The event will also include a one-day conference on ship-building and finance and a two-day conference on dredging. The conference is being organised in conjunction with the International Maritime Exhibition (INMEX) and the Eastern Dredging Association (EADA)-India.

For further information contact:
Millennium Conferences International Ltd.
Chantry House, 156 Bath Road,
Maidenhead, Berkshire SL6 4LB, UK
tel. +44 1628 580 246, fax +44 1628 580 346
e-mail: INDIA2003@millenniumconferences.com
www.millenniumconferences.com

INMEX
Mumbai, India
October 8-11 2003

INMEX (Maritime Exhibition-India International Maritime Expo) is India’s premier maritime exhibition featuring state-of-the-art equipment available for shipping, shipbuilding, port development, dredging and offshore industries. It will showcase various material components for effective maintenance of existing fleets, both defensive and commercial.

During the exhibition a Dredging Symposium is being organised EADA (see above).

For further information about the EADA Seminar contact:
Tebma Shipyards, Ltd.
III Floor, Khaleeli Centre
149 Montieth Road, Egmore
Chennai 600 008, India

For further information about INMEX contact:
Yogesh Srinivasan, PDA Trade Fairs
PDA House, no. 32/2, Spencer Road
Freather Town, Bangalore – 560005, India
tel. +91 80 554 7434, fax +91 80 554 2258
e-mail: pdaexpo@vsnl.com
www.pdatradefairs.com

Europort 2003
RAI International Exhibition Centre
Amsterdam, The Netherlands
November 18-22 2003

The Europort Exhibition is one of the largest trade shows for the international maritime industry and is held every two years in Amsterdam. The trade exhibition covers all sectors of the maritime industry such as seaborne shipping, inland shipping, the offshore industry, dredging and ports. Many countries have once again made arrangements for national pavilions where their companies can join forces and exhibit together. Various maritime trade associations such as IRO (Dutch Association of Suppliers to the Oil and Gas Industry), KNVTS (Royal Dutch Association of Naval Architects), KVNR (Royal Association of Netherlands Shippers), VNSI (Netherlands Shipbuilding Industry Association) and VIV (Association of Importers of Combustion Engines) are organising their (annual) meetings and seminars at Europort. As is customary, the CEDA Dredging Days will also be held during Europort 2003 (see below).

For further information contact:
Farouk Nefzi, Europort 2003, RAI
P.O. Box 77777, 1070 MS Amsterdam,
The Netherlands
tel. +31 20 549 1212, fax +31 20 549 1889
e-mail: europort@rai.nl
www.europort2003.com

CEDA Dredging Days
RAI International Exhibition Centre
Amsterdam, The Netherlands
November 20-21 2003

“Specialist dredging techniques, inspiring dredging solutions” is the theme of the next CEDA Dredging Days to be held during the Europort Exhibition in November 2003. Dredging activities cover a wide range of applications, some of which are unfamiliar even to the well-seasoned dredging professional. The variety of dredging functions combined with the diversity of the natural environments provides the profession with new challenges and the need to develop specialised techniques.

Topics of interest include, but are not limited to: the use of specialised solutions in: coastal and flood protection; sea and river mining (sand and gravel,
Call for Papers

World Dredging Congress XVII
CCH - Congress Centrum, Hamburg, Germany
September 27-October 1 2004

Every three years leading experts meet in a different part of the world for the World Dredging Congress (WODCON). The congress is held under the auspices of the World Dredging Association which is comprised of the WEDA, CEDA and EADA. In 2004 it will take place in Hamburg, organised by CEDA on behalf of WODA, and co-sponsored by the Ministry of Economic Affairs, Free and Hanseatic City of Hamburg, and the Department of Port and River Engineering and the Shipbuilding, Machinery & Marine Technology International Trade Fair (SMM 2004) which will run simultaneously. The theme of the conference will be “Dredging in a Sensitive Environment”.

Prospective authors are requested to submit titles and abstracts (maximum 300 words) by October 1 2003. If possible they should be sent by email in either RTF, PDF or ASCII formats. If submitting hard copy five copies are needed. Authors will be notified by the Technical Paper Committee by December 1 2003 and final papers are due by July 15 2004.

The programme will consist of Technical sessions with high quality peer-reviewed papers and a special Environment Day focussed on environmental challenges and solutions. An Academic session, with contributions by young scientists, continues CEDA’s support of young professionals. Technical visits in and around Hamburg including views of the Port of Hamburg are planned.

To receive further information about WODCON XVII contact:
www.woda.org or
CEDA, P.O. Box 488, 2600 AL Delft, The Netherlands
tel. +31 15 278 3145, fax +31 15 278 7104
e-mail: ceda@dredging.org
www.dredging.org

Oceanology International 2004
ExCel, London, UK
March 16-19 2004

This is one of the largest and busiest international events in the global marine science and ocean technology fields. It has hundreds of exhibitors and attracts thousands of international visitors including policy makers, industrialists, government representatives, decision makers, researchers, directors, managers and manufacturers involved in every aspect of oceanography. They meet to address the present and future trends of the industry and to view the launch of new technologies, equipment and services.

It is sponsored and supported by the Society for Underwater Technology, European Oceanographic Industry Association, World Meteorological Organization, Intergovernmental Oceanographic Commission, The Hydrographic Society and Hydro International. The following disciplines are representative of the scope of OI:
- marine environmental science; ocean observing and modeling; measurement and instrumentation; data harvesting; marine survey and engineering; diving and ROV; navigation and remote sensing; marine pollution monitoring and control; hydrography; marine R&D; maritime defence; dredging and coastal engineering; renewable energy; resources from the sea; marine civil engineering and more.

For further information contact:
Spearhead Exhibitions Ltd
Apex Tower, High St, New Malden, Surrey, KT3 4DQ, UK
www.spearhead.co.uk

Lesley Ann Sandbach, Conference Director
e-mail: lesley-ann.sandbach@spearhead.co.uk
tel. +44 208 949 9637

Craig Moyes, Project Director
e-mail: craig.moyes@spearhead.co.uk
tel. +44 208 949 9840
### International Seminar on Dredging and Reclamation

**Place:** Dubai, UAE  
**Date:** October 11 - 15, 2003

This year the IADC is pleased to announce that its well-known seminar will be presented for the first time in Dubai, UAE. The course has been held for several years in Singapore, Delft and Buenos Aires with great success. Recent enquiries from the area about dredging have led the IADC to select Dubai as this year’s venue.

The intensive one-week seminar on dredging and reclamation will be held from October 11-15 2003. The costs are €3895.00 and include accommodation for six nights at the conference, hotel, breakfast and lunch daily, one special participants dinner, and a general insurance for the week.

The seminar includes workshops and a site visit to a dredging project. Highlights of the programme are:

**Day 1: Why Dredging?**  
The Need for Dredging/Project Phasing

**Day 2: What is Dredging?**  
Dredging Equipment/Survey Systems  
(includes a Site Visit)

**Day 3: Cost/Pricing and Contracts**

**Day 4: Preparation of Dredging Contract**

**Day 5: How Dredging?**  
Dredging Projects

Representatives of port authorities, companies, and individuals interested in attending are requested to complete the preliminary registration form below and return to:

IADC Secretariat, Duinweg 21,  
2585 JV The Hague, The Netherlands  
tel. +31 70 352 3334, fax +31 70 351 2654  
e-mail: info@iadc-dredging.com

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**International Seminar on Dredging and Reclamation**

(please print)

Please send this form and your deposit by cheque or credit card for €500 in order to guarantee your place at the seminar. Upon receipt of this form and your deposit your place in the seminar is confirmed. We will then send you further detailed information, final registration forms, and an invoice for the correct amount.

Without your deposit we cannot guarantee your place and accommodations at the seminar.

- □ A Cheque is enclosed.
- □ Please charge my credit card:
  - □ American Express  □ Eurocard/Master Card  □ VISA  □ Diners Club

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Membership List IADC 2003

Through their regional branches or through representatives, members of IADC operate directly at all locations worldwide.

Africa
Ballast Ham Dredging (Nigeria) Ltd., Ikeja-Lagos, Nigeria
Nigerian Westminster Dredging and Marine Ltd., Lagos, Nigeria

The Americas
ACZ Marine Contractors Ltd., Brampton, Ont., Canada
Ballast Ham Sucursal Argentina, Capital Federal, Argentina
Ballast Ham Dredging do Brazil Ltda, Rio de Janeiro, Brazil
Dragamex S.A de CV, Coatzacoalcos, Mexico

Asia
Ballast Ham Dredging India Private Ltd., Mumbai, India
Ballast Ham Dredging bv Singapore Branch, Singapore
Dredging International Asia Pacific (Pte) Ltd., Singapore
Hyundai Engineering & Construction Co. Ltd., Seoul, Korea
Jan De Nul Singapore Pte. Ltd., Singapore
TOA Corporation, Tokyo, Japan
Van Oord ACZ B.V., Dhaka, Bangladesh
Van Oord ACZ B.V., Hong Kong, China
Van Oord ACZ B.V., Singapore
Van Oord ACZ Overseas B.V., Karachi, Pakistan

Middle East
Boskalis Westminster M.E. Ltd., Abu Dhabi, UAE
Gulf Cobla (Limited Liability Company), Dubai, UAE
Jan De Nul Dredging, Abu Dhabi, UAE
Van Oord ACZ Overseas B.V., Abu Dhabi, UAE

Australia
Ballast Ham Dredging Pty. Ltd., Brisbane, QLD, Australia
Dredeco Pty. Ltd., Brisbane, QLD, Australia
Van Oord ACZ B.V., Victoria, NSW, Australia

Europe
ACZ Ingeniører & Entreprenører A/S, Copenhagen, Denmark
A/S Jehsens ACZ, Bergen, Norway
Atlantique Dragage S.A., Nanterre, France
Baggermaatschappij Boskalis B.V., Papendrecht, Netherlands
Ballast Ham Dredging bv, Rotterdam, Netherlands
Ballast Ham Dredging Ltd., Camberley, United Kingdom
Ballast Ham Nederland bv, Gorinchem, Netherlands
Boskalis B.V., Rotterdam, Netherlands
Boskalis International B.V., Papendrecht, Netherlands
Boskalis Westminster Aannemers N.V., Antwerp, Belgium
Boskalis Westminster Dredging B.V., Papendrecht, Netherlands
Boskalis Westminster Dredging & Contracting Ltd., Cyprus
B.V. Bedrijfsholding L. Paans en Zonen, Gorinchem, Netherlands

Draflumar S.A., Neuville Les Dieupe, France
DRACE (Grupo Dragados S.A.), Madrid, Spain
Dravo S.A., Madrid, Spain
Dredging International N.V., Zwijndrecht, Belgium
Dredging International (UK), Ltd., Weybridge, United Kingdom
Heinrich Hirdes GmbH, Hamburg, Germany
Jan De Nul N.V., Aalst, Belgium
Jan De Nul Dredging N.V., Aalst, Belgium
Jan De Nul (U.K.) Ltd., Ascot, United Kingdom

Mijnster Beheer B.V., Gorinchem, Netherlands
N.V. Baggerwerken Decloedt & Zoon, Oostende, Belgium
Sociedad Española de Dragados S.A., Madrid, Spain
Terramare Oy, Helsinki, Finland
Tideway B.V., Breda, Netherlands
TOA (LUX) S.A., Luxembourg

Van Oord ACZ B.V., Gorinchem, Netherlands
Van Oord ACZ Ltd., Newbury, United Kingdom
Wasserbau ACZ GmbH, Bremen, Germany
Westminster Dredging Co. Ltd., Fareham, United Kingdom