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Stabilized tidal inlet, Cartagena, Colombia

ORET/MILIEV {94/95}

For the Ministry of Foreign Affairs, Directorate-General for International Cooperation (DGIS)

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P.O. Box 4175
3006 AD Rotterdam
The Netherlands
K.P. van der Mandelelaan 11
3062 MB Rotterdam

Telephone: +31 10 453 88 00
Telefax: +31 10 452 36 60
Telex: 25490 NECIN NL

Executive summary

A Netherlands consulting engineering and architects bureau has applied for financing under the ORET programme (Development Relevant Export Transactions) for the design and supervision during the construction of a stabilized tidal inlet in Cartagena, Colombia.

The project itself concerns not only the design and supervision during the construction, but also the construction itself of a stabilized tidal inlet in Cartagena, Colombia. The main object of the project is to increase the auto-regenerating capacity of the lagoon Ciénaga de la Virgen by the construction of a permanent opening between the Caribbean Sea and the Ciénaga de la Virgen. The result will be an improved water quality of the Ciénaga.

The implementing agency is the Colombian Ministry of Transport, Division River Infrastructure, in Bogotá, although responsibility of the project may be transferred to the just founded Ministry of Environment.

Assessment of the commercial viability of the project shows that the project is commercially non-viable; the commercial rate of return is negative. The accumulated cash-flow is -10,972 million Pesos after 10 years.

The financial IRR of the project is 9.3 percent if the dredged material, to be used for land reclamation, is sold at a price of 30,000 Pesos per cubic meter (this price corresponds to a price of 90,000 Pesos per square meter reclaimed land). It has been assumed that the cleaning costs of polluted sediments amount to 15 percent of these revenues of land reclamation. Prices for newly reclamated land on comparable locations in Cartagena vary between 75,000 and 125,000 Pesos/m^2. In order to guarantee the technical sustainability of the project, the supervising ministry will have to assume responsibility for the maintenance of the tidal inlet during its life-time.

The quantified economic benefits which can be associated with the project are the revenues from dredged material used for land reclamation, the additional fishery revenues and the avoided health costs. If the period of evaluation is set at 20 years, the overall economic IRR appears to be 39.1 percent. This means the project is economically viable.

In addition to positive environmental effects on the water and air quality, employment and poverty alleviation will be positively affected by the project. The effect on the position of women is slightly positive.

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1 Introduction

A Netherlands consulting engineering and architects bureau applied for financing under the ORET programme (Development Relevant Export Transactions) for the design of and supervision of the construction of a stabilized tidal inlet in Cartagena, Colombia. The application was received by the Netherlands Ministry of Foreign Affairs, Directorate-General for International Cooperation (DGIS) on July 4, 1994. The Netherlands Economic Institute (NEI) received the request to appraise the application on November 15, 1994.

The analysis contained in this report has been undertaken by drs. J.T. Booij, economist at NEI. A technical evaluation has been undertaken by Delft Hydraulics.

For the evaluation of the project the following information has been used:
- ORET application form.
- Haskoning, *Misión de Evaluación de los Planes para el Saneamiento de Cartagena de Indias*, Novembre 1993.
- Haskoning, *Propuesta para servicios de consultoria, La bocana estabilizada en la Cienaga de la Virgen: Cartagena, Colombia*, Julio 1994.
- Republica de Colombia, Departemento Nacional de Planeación, *Plan de accion ambiental para el distrito turistico y cultural de Cartagena de Indias*, Septiembre de 1994.
- Groot, R.S. de, *Functions of Nature*, Groningen, 1992.
- World Health Organisation, *Our planet, our health: report of the WHO commission on health and environment*, Geneva, 1992.
- World Bank, *World Development Report 1993: Investing in Health*, Washington D.C., 1993.
- Additional information supplied by Haskoning.
- Additional information supplied by the economic consultant who joined the Dutch mission in 1993.
- Technical recommendations prepared by Delft Hydraulics.
- World Bank, *Trade Policy Reform in Developing Countries since 1985: A Review of the Evidence*, World Bank Discussion Papers, no. 267, Washington D.C., 1994.

2 Description of the transaction

2.1 The supplier

The supplier of the services is Haskoning BV in Nijmegen, the Netherlands. The supplier is a consulting engineers and architects bureau. Ultimo 1993 Haskoning BV had 622 employees. Haskoning BV has gained much experience with shore related activities like tidal inlets. Haskoning BV has worked in Colombia before, for example in Barranquilla. This project concerned the supervision of the construction of river training works for the improvement of the access channel to the port of Barranquilla. Haskoning BV has gained experience in other Latin American countries as well, for example in Venezuela and Ecuador.

2.2 Implementing agency (end user)

The implementing agency is the Colombian Ministry of Transport, Division River Infrastructure, in Bogotá. Based on a decree, issued on the fourth of January 1984, the Ministry of Public Works at that time, the Ministry of Transport nowadays, has to execute the works related to the construction of hydraulic works in the Ciénaga de la Virgen, including the inlet and dredging activities, to restore the water quality of the Ciénaga. Besides, the Ministry will perform the technical inspection of all works.

2.3 Goods and services to be supplied

The transaction includes the design and supervision of the construction of a stabilized tidal inlet in Cartagena, Colombia. It concerns a services transaction.

2.3.1 Description

The following primary activities are foreseen:

1. program of site investigations;
2. mathematical model studies to optimise the stabilized tidal inlet;
3. environmental impact assessment study;
4. elaboration of the concept of the stabilized tidal inlet in a broader framework;
5. design and formulation of tender documents of stabilized tidal inlet works;
6. design and formulation of tender documents of a bridge over the planned stabilized tidal inlet works;
7. cost estimates of all works;
8. prequalification documents of all works;
9. assistance during prequalification and tender procedures of all works;
10. supervision during construction.

The transaction is divided into two phases, the design phase (items 1-9) and the supervision during construction phase (item 10).

2.3.2 Technical quality assessment

The overall philosophy of the proposal is supported by the technical consultants (Delft Hydraulics). However, they have some comments on the mathematical model studies (see annex A). The proposal does not yet provide a description of the mathematical models, how they are operated, calibrated and verified and whether they are applicable for this project. Moreover, no detailed description is given of the measuring programme and the programme for transfer of technology with respect to the mathematical models. In the proposal, starting point of the design activities is a one-dimensional mathematical model to come to a selection of size and location of the tidal inlet. The design will be optimized by using a two-dimensional mathematical model. Since measurements are already started (carried out by a local consultant), the supplier assumes that there will be enough data to start with the two-dimensional mathematical model immediately, as suggested by Delft Hydraulics[1].

The success of flushing the Ciénaga will strongly depend on the location and orientation of the opening, its length and its detailed lay-out, all meant to achieve the optimum exchange between the two waterbodies. According to the technical consultants, detailed mathematical model studies are indispensable. The effectiveness of the technical solution also depends on the longer term impacts of the opening on the morphodynamics within the Ciénaga and the morphological developments of the coastal area in front of the opening. So, the proposed two-dimensional model should not cover only the Ciénaga and its opening, but also part of the coastal area.

2.4 Sources and origin of the product

The services supplied by Haskoning BV can be divided in two components, design and supervision during the construction of the stabilized tidal inlet. Haskoning BV will be assisted by a local consulting engineering bureau, Carinsa in Cartagena. The transaction value of the design component originates from within the Netherlands for approximately 63 percent. The remaining 37 percent of the transaction value originates from the local consultant Carinsa. The component supervision during construction originates for approximately 58 percent from the Netherlands and has a local consultancy part (Carinsa) of 42 percent. If both components are taken together, the transaction value originates approximately 61 percent from within the Netherlands. The remaining 39 percent of the transaction value originates from the local consultant Carinsa.

2.5 Pricing by the supplier

The transaction price is divided into two parts, the contract price for the design phase and the price for the follow-up phase, supervision during the construction of the stabilized tidal inlet.

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1 The technical consultants do not see the benefits of starting with a one-dimensional mathematical model approach.

The breakdown of the contract price of the design phase is given in table 2.1.

Table 2.1 Contract price design phase

phase: design	Dutch consultancy (in Dutch Guilders)	person years	Colombian consultancy (in Dutch Guilders)	person years
labour costs	1,143,000	3	431,000	8.8
other costs	656,000		632,000	
total	1,799,000	3	1,063,000	8.8

The itemization of Dutch labour costs in the design phase can be found in table 2.2.

Table 2.2 Labour costs, Dutch consultancy, design phase

Labour costs (Dfl), Dutch consultancy, design phase	person month NL	person month Col.	fee[b] A1/ month	fee[b] B1/ month	fee[b] C2/ month	total (Dutch Guilders)
project director	0.75	1.00	39,149	42,433		71,795
project manager	0.00	8.33			32,575	271,354
expert on modelling	1.00	0.00	33,689			33,689
hydraulic and morphologic engineer	2.00	7.00	20,213	21,990		194,357
environmental expert	0.00	3.25		28,299		91,971
expert on sanitation technology	0.00	1.75		38,763		67,835
expert on maritime works	0.50	4.50	33,689	36,670		181,860
construction engineer	0.00	1.00		24,083		24,083
expert on documents	0.50	1.25	25,976	28,299		48,362
inspection manager	0.00	0.75		32,485		24,363
diverse experts	0.00	2.00		38,763		77,526
total[a]	4.75	30.83				1,087,195

a) exclusive 5.10 percent contingencies (55,447 Dutch Guilders).
b) DGIS fees (average fee: 30,556 Dutch Guilders/month).

The cost component 'other costs, Dutch consultancy' consists of the items mentioned in table 2.3.

Table 2.3 Other costs, Dutch consultancy, design phase

Other costs (Dfl) Dutch consultancy, design phase	unit	unit price (Dutch Guilders)	quantity	total (Dutch Guilders)
international trips	trips	7,846	21	164,766
add. travel costs	trips	400	21	8,400
overweight luggage	trips	785	21	16,477
DSA Cartagena	days	329	684	225,241
DSA Netherlands	days	389	60	23,232
accommodation	months	2,000	9.25	18,500
DSA project manager	months	2,596	8.33	21,624
int. communication 1	months	1,000	9.25	9,250
int. communication 2	months	500	4.75	2,375
1-D math. model				25,000
2-D math. model				110,000
total[a)]				624,865

[a)] exclusive 5.00 percent contingencies (31,243 Dutch Guilders)

Table 2.4 gives the itemization of the labour costs for the Colombian counterparts in the design phase

Table 2.4 Labour costs, Colombian consultancy, design phase

Labour costs (Pesos) Colombian consultancy, design phase	person months	unit price (Pesos)	total (Pesos)
Colombian counterparts:			
project co-ordinator	10.00	3,180,000	31,800,000
ecologist	3.50	2,950,000	10,325,000
hydraulic engineer/system expert, Colombia	5.00	2,720,000	13,600,000
hydraulic engineer/system expert, Netherlands	2.00	5,200,000	10,400,000
maritime works engineer	5.00	2,950,000	14,750,000
structure engineer 1	3.00	2,950,000	8,850,000
structure engineer 2	2.50	2,720,000	6,800,000
civil/cost engineer	8.25	2,720,000	22,440,000
soil engineer	2.00	2,720,000	5,440,000

expert on documents	2.50	2,950,000	7,375,000
subtotal	43.75		131,780,000
support personnel:			
secretary (2)	18.25	1,350,000	24,637,500
draughtsmen (3)	15.50	820,000	12,710,000
administrator	9.25	870,000	8,047,000
employee	9.25	510,000	4,717,000
guardian	9.25	510,000	4,717,000
subtotal	61.50		54,830,000
total[a)]	105.25		186,610,000

[a)] Exclusive 5 percent contingencies.

Table 2.5 gives the breakdown of the other costs to be made by the Colombian consultant in the design phase.

Table 2.5 Other costs, Colombian consultancy, design phase

Other costs (Pesos) Colombian consultancy, design phase	unit	unit price (Pesos)	quantity	total (Pesos)
office rent, operational costs	month	9,150,000	9.25	84,637,000
office materials	month	430,000	9.25	3,977,500
vehicles, Sedan	vehicle month	2,562,000	25.00	64,050,000
additional transport	month	122,000	9.25	1,128,500
communication 1	month	975,000	9.25	9,018,750
communication 2	month	490,000	4.75	2,327,500
reproduction				6,100,000
topographic measurements 1				13,500,000
topographic measurements 2				4,500,000
depth measurements 1				27,450,000
depth measurements 2				9,100,000
registration water level				12,200,000
waves measurements				6,100,000
flow measurements				1,200,000
water quality tests				1,053,000
study of the soil				27,000,000
total[a)]				273,342,750

[a)] Exclusive 5 percent contingencies.

The contract price for supervision during the construction of the tidal inlet is given in table 2.6.

Table 2.6 Contract price supervision phase

phase: supervision during construction	Dutch consultancy (in Dutch Guilders)	person years	Colombian consultancy (in Dutch Guilders)	person years
labour costs	941,000	2.8	423,000	6.7
other costs	594,000		396,000	
total	1,364,000	2.8	990,000	6.7

Table 2.7 shows the breakdown of the Dutch labour costs during the supervision phase.

Table 2.7 Labour costs, Dutch consultancy, supervision phase

Labour costs (Dfl), Dutch consultancy, supervision phase	person month NL	person month Col.	fee[b] A1/ month	fee[b] B1/ month	fee[b] C1 or C2/ month	total (Dutch Guilders)
project director	0.53	0.70	39,149	42,433		50,256
	0.23	0.30	39,864	43,161		21,918
project manager	0.00	1.40		41,735		58,430
	0.00	0.60		42,433		25,460
expert on maritime works	0.00	1.40		36,670		51,338
	0.00	0.60		38,763		23,258
inspection manager	0.00	8.13			27,055	220,067
	0.00	3.49			28,814	100,447
inspection assistant	0.00	9.10			16,227	147,666
	0.00	3.90			17,774	69,318
rock expert	0.35	0.88	35,596	38,763		46,376
	0.15	0.38	37,025	40,280		20,659
diverse experts	0.00	1.40		38,763		54,268
	0.00	0.60		40,280		24,168
total[a]	1.25	32.87				913,630

a) Exclusive 3 percent contingencies (27,409 Dutch Guilders).
b) DGIS fees (average fee: 26,777 Dutch Guilders/month).

Table 2.8 gives the itemization of the Dutch other costs during the supervision phase.

Table 2.8 Other costs, Dutch consultancy, supervision phase

Other costs (Dfl) Dutch consultancy, supervision phase	unit	unit price (Dutch Guilders)	quantity	total (Dutch Guilders)
international trips	trips	8,081	20	161,628
add. travel costs	trips	475	20	9,500
overweight luggage	trips	808	20	16,162
DSA Cartagena	days	339	251	85,066
accommodation	months	2,400	26.00	62,400
DSA inspection manager	months	2,205	11.62	25,623
DSA inspection assistant	months	1,838	13.00	23,899
int. communication	months	1,000	13.00	13,000
total[a]				397,278

[a] Exclusive 6.50 percent contingencies (25,823 Dutch Guilders).

The labour costs by the Colombian consultant are given in table 2.9.

Table 2.9 Labour costs, Colombian consultancy, supervision phase

Labour costs (Pesos) Colombian consultancy, supervision phase	person months	unit price (Pesos)	total (Pesos)
Colombian counterparts:			
project co-ordinator	13.00	3,885,000	50,505,000
supervisor (2)	20.00	3,605,000	72,100,000
supervisor (2)	20.00	3,321,000	66,420,000
topograph	12.00	3,321,000	39,852,000
subtotal	65.00		228,877,000
support personnel:			
secretary	13.00	1,667,000	21,671,000
draughtsmen	3.00	1,002,000	3,006,000
subtotal	16.00		24,677,000
total[a]	81.00		253,554,000

[a] Exclusive 6.50 percent contingencies.

The breakdown of the other costs by the Colombian consultancy are given in table 2.10.

Table 2.10 Other costs, Colombian consultancy, supervision phase

Other costs (Pesos) Colombian consultancy, supervision phase	unit	unit price (Pesos)	quantity	total (Pesos)
vehicles, Sedan	vehicle month	3,815,000	27.00	103,005,000
vehicles, 4 WD	vehicle month	1,950,000	13.00	25,350,000
additional transport	month	182,000	13.00	2,366,000
equipment	month	1,350,000	13.00	17,550,000
communication	month	1,300,000	13.00	16,900,000
reproduction				4,200,000
total[a)]				169,371,000

[a)] Exclusive 6.50 percent contingencies.

The contract price for the transaction has been set without competitive bidding.

The construction of the stabilized tidal inlet itself is not included in the present transaction, but the estimated price has to be taken into account here, to be able to compare the supervision and the construction costs. In the proposal the costs for the construction itself are estimated at 13.2 million Dutch Guilders[2] (in 1992 prices). If the costs for design and supervision during the construction are compared to these construction costs in 1992 prices, they appear to be unbalanced to a certain extent (40% of the construction costs). Actualization of the construction costs to 1996 (construction year) prices, together with considering services during the construction phase as part of the construction works, reduces the ratio between consultancy plus support and construction to about 13 percent. Such a percentage seems fair, especially since transfer of technology and training of the counterpart are included. However, a reduction of a few persons months in the design phase seems possible according to the technical consultants, since the two-dimensional models are more or less standard. The technical consultants have doubts about the continuous character of the works. They advise to verify if there will indeed be worked nearly continuously in shift works. Due to the shift works there is a considerable input of supervisors in the construction phase, with 25 person months for the Dutch consultants (inspection manager and assistant) and 40 person months for the Colombian supervisors (see table 2.7 and 2.9). The fees seem right, being DGIS fees. DSA is meant for 'short termers', accommodation for 'long termers'. The 60 days DSA in the Netherlands is intended for a member of the Colombian counterpart organisation. The person in question will stay in the Netherlands for training purposes. The technical consultants noted that the explicit input of a coastal morphology expert in the design phase is lacking. Only a hydraulic and morphologic engineer is mentioned. According to the task description, this person shall have background in the processes of hydraulics and morphology and in

[2] Of which 5.28 mln Dutch Guilders is proposed to be granted from the ORET programme under a separate request.

mathematical modelling of these processes, including the processes of water quality. So, the CV of this person should be in accordance with this broad range of disciplines.

2.6 Organisation of the transaction

A provisional contract has been signed. Actually, it is a direct contract between the Colombian Ministry of Transport and the supplier, included in an agreement between the Colombian Ministry of Transport and the Dutch Ministry of Transport. Such an arrangement is needed since a direct agreement between the Colombian Ministry and a foreign private company is not allowed. But the Dutch Ministry has no actual responsibilities; only the supplier can be held responsible. The supplier is responsible for the performance of all activities mentioned in section 2.3.1.

The Ministry of Transport in Colombia has commissioned the transaction. This is conform a decree, issued on the fourth of January 1984: the Ministry of Public Works at that time, the Ministry of Transport nowadays, has its duty to execute the works related to the construction of hydraulic works in the Ciénaga de la Virgen, including the inlet and dredging activities, to restore the Ciénaga.

After implementation the responsibilities will eventually be handed over to the just founded Ministry of Environment. At the moment this has not been decided yet.

The terms of payment are as follows:
- 15% down payment;
- monthly payment based on monthly invoices;
- term of payment 2 months after submission of invoice.

The grant will be passed on to the end user, the Ministry of Transport (Division River Infrastructure) in Bogotá, Colombia.

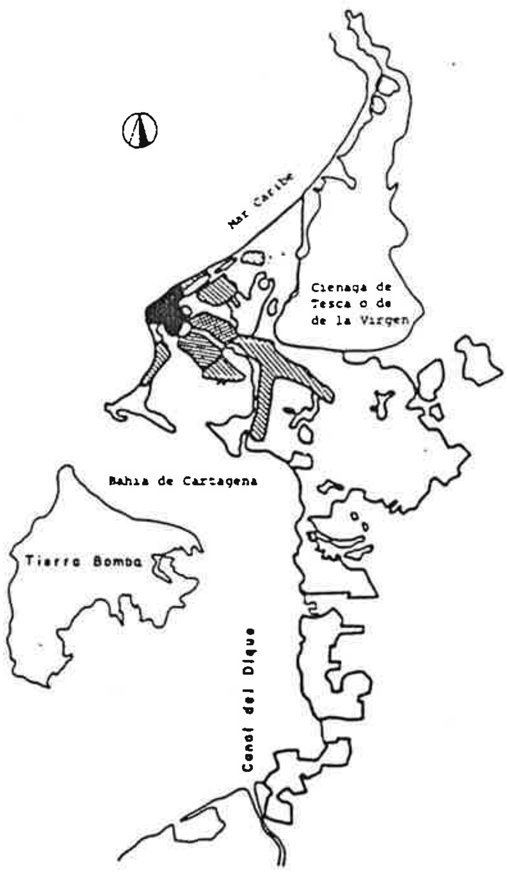
NCM credit insurance will be available and utilised when the transaction will be executed.

3 Description of the project

3.1 Background and project definition

Cartagena is a city with a population of 675,000 people, situated between the Ciénaga de la Virgen and the Bahía de Cartagena (figure 3.1). The Ciénaga is a lagoon separated from the Caribbean Sea by a bar. The lagoon has a surface of 22 square kilometres and a volume of 26 million cubic meters. Sewage water and waste are dumped directly into the water. During the last two decades the water quality has deteriorated rapidly. The water is not able to absorb the increasing volume of dumped material, due to the fast expansion of the city. Besides, there is no permanent open connection between the sea and the Ciénaga which prevents flushing into and out of the Ciénaga. As a result, the auto-regenerating capacity of the Ciénaga is limited and environmental and health problems have been emerged.

Figure 3.1 Cartagena and the surrounding area



The National Planning Department in Colombia has developed several investment plans to resolve the pollution problems in the area of Cartagena. One of the components of the Integral Sanitation Plan of Cartagena is the rehabilitation of the Ciénaga de la Virgen. The other two principal components of the Integral Sanitation Plan are the rehabilitation of the canals and lagoons around Cartagena and the Sewerage Master Plan. This Sewerage Master Plan concludes upgrading the existing sewage systems and the construction of water treatment plants. A pipe from the water treatment plant into the sea is a supplementary option.

In 1993 a Dutch mission visited Cartagena to assess the water problems in the area of Cartagena. One of the actions the mission has recommended to the Colombian government is to implement a stabilized tidal inlet in the Ciénaga de la Virgen. A stabilized tidal inlet is a permanent open connection between the Ciénaga and the sea. It will improve the water quality in the Ciénaga. The project subject to appraisal in this report, is the design and construction of such a stabilized tidal inlet. This project can be treated separately, be it that the project will have more impact if the other projects mentioned above are implemented as well. Construction of water treatment plants - one of the plans mentioned earlier - alone, will not substantially reduce the water pollution in the Ciénaga. The Ciénaga is contaminated so badly, that treating sewage water is not enough. Besides, the Ciénaga consists of dead water. A tidal inlet, therefore, allows for flushing of the Ciénaga. In other words, the auto-regenerating capacity of the water can be restored. Due to the mixing between the initially non polluted sea with the Ciénaga, the levels of contamination in the Ciénaga could be reduced to acceptable levels. The tidal inlet will be designed in such a way that the connection between the Caribbean Sea and the Ciénaga remains permanently under the influence of tidal movements, without the need for significant technical interferences in the future. This is called a stabilized tidal inlet. The yearly maintenance costs of such a system are low. Other options, relying on e.g. pump systems, would require intensive maintenance. Besides, these systems require energy.

3.2 Project objectives

The main objective of the present project is to increase the auto-regenerating capacity of the Ciénaga de la Virgen by the construction of a permanent opening between the Caribbean Sea and the Ciénaga de la Virgen. The main result will be an improved water quality of the Ciénaga.

3.3 Project activities

The project entails the design and construction of a stabilized tidal inlet. The principal components of the **design phase** of the stabilized tidal inlet are the following:

1. program of site investigations;
2. mathematical model studies to optimise the stabilized tidal inlet;
3. environmental impact assessment study;
4. elaboration of the concept of the stabilized tidal inlet in a broader framework;
5. design and tender documents of stabilized tidal inlet works;
6. design and tender documents of the bridge over the planned stabilized tidal inlet works;
7. cost estimates of all works;
8. formulation of prequalification documents of all works;
9. assistance during prequalification and tender procedures of all works.

The mathematical model studies mentioned under item 2 of the design phase are applicated at two distinct levels of detail. Initially a one-dimensional mathematical model will be prepared. Thereafter a two-dimensional mathematical model will be developed. The duration of the program of site investigations (item 1) and the one dimensional mathematical model studies mentioned under item 2 is estimated at 3 months. After these initial activities the real design activities can start. This concerns the two-dimension mathematical model of item 2 and the items 3 to 7. These activities are supposed to last 6 months. The estimation of the duration of the prequalification (items 8 and 9) is 8 months, partially parallel to the real design activities. The total duration of the design phase is estimated at 15 months. The intention is to start the project on the first of january 1995.

The **construction phase** of the stabilized tidal inlet consists of dredging, the construction of wave absorbers and supervision of these activities. This phase has an estimated duration of 12 months.

After dredging in the construction phase, dredging is not needed anymore. The dredged material is to be used for land reclamation: the city of Cartagena is experiencing a very high land pressure. About one-fifth of its centre is already built on reclaimed land. In the mission report the total volume to be dredged is calculated at 200,000 m^3. This material could be used for reclamation of 57,300 m^2 of additional land.

The technical lifetime of the stabilized tidal inlet is between 40 and 50 years.

3.4 Project organisation and management

The responsibility for implementing the project lies with the Colombian Ministry of Transport, Division River Infrastructure, in Bogotá. The supplier is assisted by a local engineering bureau. It has been agreed that the Colombian government has the intention to install a counter part staff to participate in the project.

3.5 Key assumptions of the project

3.5.1 Financing of the project

The project is defined as the design, construction and operation of the stabilized tidal inlet. The construction of the tidal inlet itself is not included in the present transaction, although it should be noted that an application for ORET financing is forthcoming for that part of the project. There have been already negotiations between the supplier and the Netherlands Ministry of Foreign Affairs, Directorate-General for International Cooperation (DGIS) on financing the construction of the stabilized tidal inlet under the ORET programme.

The costs for design and supervision during the construction of the stabilized tidal inlet are 2,371 million Pesos (Dfl. 5.2 million)[3]. The grant under the ORET financing scheme is 40 percent of the transaction value. The figures for the two phases of the transaction are given in detail in table 3.1 and 3.2 respectively.

Table 3.1 Phase: design

phase: design	Dutch guilders	%
Colombian government	1,718,599	60
ORET grant	1,142,642	40
total transaction	2,861,241	100

Table 3.2 Phase: supervision during construction

phase: supervision during construction	Dutch guilders	%
Colombian government	1,414,014	60
ORET grant	941,038	40
total transaction	2,355,052	100

The costs for the construction itself are shown in table 3.3.

Table 3.3 Phase: construction

phase: construction	Dutch guilders	%
Colombian government	7,920,000	60
ORET grant	5,280,000	40
total transaction	13,200,000	100

3.3.2 Prices of outputs and inputs

The dredged material could be used for land reclamation. Selling the dredged material for this purpose is a realistic option to generate project revenues. In the mission report the dredged material used as landfill is valued at 50,000 Pesos per square meter land[4]. This is a very cautious estimation. 90,000 Pesos per resulting square meter land is also a reasonable price[5]. A considerable part of the city has been conquered from the lagoon through land reclamation in the past. In 1993 the most expensive areas were sold for 120,000 Pesos per m², for hotels and boutiques, other areas commanded a price of 75,000

3. The costs for the construction of the stabilized tidal inlet are estimated at 6,000 million Pesos (Dfl. 13.2 million). More detailed cost estimations are part of the design fase.
4. Mission presumed that 3 cubic meters dredged material can fill 1 square meter land.
5. According to the economist who joined the mission to Cartagena in 1993.

Pesos/m². 50,000 Pesos per m² is the average land price directly along the coast of the lagoon at present.

Inputs to the project will, in addition to the investment costs, include operating costs. Maintenance of the stabilized tidal inlet represents the primary operating cost component. These costs are estimated at 1.25% of the construction costs of the stabilized tidal inlet per annum.

3.5.3 Output and input volumes

As mentioned in section 3.3, dredging of some 200,000 m³ is required for the construction of the stabilized tidal inlet. This material can be used to fill 67,000 m² of land. The technical consultants expect the existing bar between the Ciénaga and the sea to consist of sand mainly, and the Ciénaga soils to be silty and polluted. They presume that the sandy material can be used for land reclamation purposes immediately, whereas the silty polluted material has to be cleaned first. In the project evaluation we presume that the cleaning costs amount to 15 percent of the revenues of land reclamation. In case cleaning of the dredged material will result in waste, an environmental friendly solution will have to be found for storing or processing this waste.

3.6 Costs and revenues

The costs include the design, construction and operation of the tidal inlet. The dredged material revenues are taken as financial revenues of the project, although it is not sure that the dredged material can all be sold indeed. The dredged material revenues are derived by multiplying the (non-recurring) output by the average proceeds per square meter of reclaimed land. Financial operating costs consist of the maintenance costs of the tidal inlet.

NEI

4 Commercial viability

4.1 Definition of commercial viability

Commercial viability is defined in the OECD Arrangement on Guidelines for Officially Supported Export Credits on *eligibility of trade related concessional or aid credits* (nr. 8):

"This sub-paragraph does not apply to concessional or aid credits whether tied or partially untied with a value of less than SDR 2 million or to those where the concessionality level is 80% or more, except for concessional or aid credits or grants that form part of an associated (mixed) credit package, which remain subject to the provision of footnote 12 of the Arrangement. In any case, derogation from these rules will be possible if THE PARTICIPANTS agree through a common line procedure (6).

i) Tied and partially untied concessional or aid credits, except for credits to LLDCs, shall not be extended to public or private projects that normally should be commercially viable if financed on market or Arrangement terms.

The key tests for such aid eligibility are:

- whether the project is financially non-viable, i.e. does the project lack capacity with appropriate financing determined on market principles, to generate cash flow sufficient to cover the project's operating costs and to service the capital employed; or
- whether it is reasonable to conclude, based on communication with other participants, that it is unlikely that the project can be financed on market or Arrangement terms.

The above tests are intended to describe how a project should be evaluated to determine whether it should be financed with such aid or with export credits on market or Arrangement terms. Through the consultation process, a body of experience is expected to develop over time that will more precisely define, for both export credit and aid agencies, *ex ante* guidance as to the line between the two categories of projects.

ii) There shall be no tied or partially untied concessional or aid credits to countries whose per capita GNP would make them ineligible for 17 or 20 year loans from the World Bank."

4.2 Accumulated Cash Flow, Internal Rate of Return and sensitivity analysis

From the pattern of investment and operating costs and operating revenues a net cash flow as well as the internal rate of return (IRR) can be computed for the project period; this IRR is called the commercial internal rate of return (cIRR). If the cIRR is higher than the Commercial Interest Reference Rate, represented by the long term cost of capital in the Netherlands (8.55 percent at present), the project is regarded as being commercially viable.

There are only revenues from dredged material in the first year and these revenues are lower than the investment costs. Even if the price for dredged material is set 100 percent higher, the commercial IRR is still not above the cut-off rate of 8.55 percent.

Another approach to determine the commercial viability is to look at the accumulated cash flow after financing. Financing in this context is defined as a commercial loan on the total investment sum, with a repayment period of ten years. If the accumulated cash flow in year 10 is positive, then the project should be judged commercially viable. Both approaches should lead to a similar conclusion.

It appears that accumulated cash balance at the end of the 10 year period is negative: -10,972 million Pesos. Only a price for reclaimed land of 245,000 Pesos per m^2 changes the sign of the accumulated cash balance at the end of the 10 year period. This price is not realistic in view of the fact that the highest price offered (for tourist purpose) is 125,000 Pesos per m^2.

4.3 Conclusion on commercial viability

Taking into account the above presented results, it can be concluded that the project is commercially not viable.

5 Testing development relevancy

5.1 Expected project impact

The primary purpose of the project is to improve the water quality in the Ciénaga de la Virgen. Consequently, the project will have very positive environmental impacts. One of the main points is improvement of the public health standards, especially in terms of a reduction of the cases of diarrhoea and enteritis. Furthermore, fishing activities are expected to increase, there will be a positive influence on the tourist industry, the value of the areas near the Ciénaga is expected to increase and land reclamation becomes a possibility (by using the dredged material).

5.2 Technical issues and sustainability

The technical assessment of the transaction and its position in the project has been made by Delft Hydraulics. Their conclusions are annexed to this report (annex A) and can be summarized as follows:

- A stabilized tidal inlet is a relatively safe and sustainable solution, with low maintenance costs compared to other options relying on e.g. pump systems, which require energy and intensive maintenance etc. Therefore, the overall philosophy of the project is supported.
- In the proposal, starting point of the design activities is a one-dimensional mathematical model to come to a selection of size and location of the tidal inlet. Subsequently, the design will be optimized by using a two-dimensional mathematical model. The technical consultants do not see the benefits of a one-dimensional mathematical model approach. Since measurements have already started (carried out by a local consultant), the supplier assumes that there will be indeed enough data to start with the two-dimensional mathematical model immediately.
- Based on the information in the proposal, the suggestion of the technical consultants was to divide the transaction into two phases: first a feasibility study to determine the optimum solution for flushing the Ciénaga with the aim to improve the water quality (solution may be one or even two tidal inlets, possibly in combination with the dredging of channels) and a second phase for the design and the supervision of the construction. Since there have already been made exploring one- and two-dimensional computations, it is already proved that the proposed solution is feasible.
- The success of flushing the Ciénaga will strongly depend on the location and orientation of the opening, its length and its detailed lay-out, all meant to achieve the optimum exchange between the two waterbodies. According to the technical consultants, detailed mathematical model studies are indispensable. The effectiveness of the measure also depends on the longer term impacts of the opening on the morphodynamics within the Ciénaga and the morphological developments of the coastal area in front of the opening. So, the proposed two-dimensional model should not cover only the Ciénaga and its opening, but also part of the coastal area.

- The technical consultants strongly recommend an extra mathematical model to judge the various considered mitigating measures in relation to each other. This should be an overall mathematical model covering the entire Cartagena area with the Bahia, the Caños and Laguna's, the Ciénaga and part of the adjacent coastal waters.
- Measurements to determine some basic properties of the silty and probably polluted dredged material from the Ciénaga should be carried out on a short term.
- The technical consultants recommend to achieve some cost savings by streamlining the set-up of the study.

The technical consultants expect the water to be changed in a few days. However, the tides will dislodge polluted sediments from the bottom of the lagoon. This will pollute the water temporary. In that case the Ciénaga is expected to be clean within a few months to a year.

5.3 Financial sustainability

If part of the foreign investment component (40%) is to be financed by a grant under the ORET-programme[6], the capital costs of the stabilized tidal inlet would decrease from 8,371 million Pesos to 5,027 million Pesos. The period of evaluation is set at 20 years[7].

The dredged material revenues can be derived by multiplying the (non-recurring) output by the average proceeds per cubic meter dredged material. It has been assumed that the cleaning costs of polluted sediments amount to 15 percent of these revenues of land reclamation. Assuming that the price for the dredged material is 30,000 Pesos per cubic meter[8], the financial internal rate of return (fIRR) is 9.3 percent (see annex B.2). This is slightly above the cut-off rate of 8.55 percent (Commercial Interest Reference Rate of October 1994). Prices for newly reclamated land on comparable locations in Cartagena vary between 75,000 and 125,000 Pesos/m^2.

It should be noted that, although this notion of satisfactory financial return of invested capital is of interest to economists, the financial sustainability from a managing point of view should be judged differently. Theoretically, the revenues from the reclaimed land could be used to pay for the maintenance costs of the tidal inlet, although the project does not generate any financial revenues after the investment phase. However, the receipts from the land sales will not necessarily be set aside and used for the maintenance of the tidal inlet. Therefore, financial (and technical) sustainability from a management point of view depends entirely on the availability of a proper and recurrent maintenance budget for the tidal inlet at the supervising government body.

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6 We assume that 40% of the construction costs of the tidal inlet (no part of the transaction, but part of the project) is to be financed by a grant under the ORET-programme as well.

7 The technical life of the works is between 40 and 50 years.

8 This price per cubic meter corresponds to the price of 90.000 Pesos per square meter reclaimed land.

5.4 Economic viability

The economic benefits of the project include the revenues from the dredged material (presuming these revenues reflect the discounted present value of the activities that will be executed and attributable to this land), the additional fishery revenues and the avoided health costs. The fishing benefits are obtained by multiplying the average annual income out of fishery by the number of additional families to live of fishery; the better water quality will result in an increasing fish stock[9]. This generates an income out of fishery for 70 additional families in comparison to the present situation. The average annual income per family is estimated at 960,000 Pesos. The improved public health standards generate also important benefits, but these are not quantified in the mission report. In the present study we have estimated the health benefits in a rough and incomplete way, just to have an indication[10]. Only the reduction in health costs is taken into account here. But there exist also other avoided costs, like the costs caused by the incapacity to work due to health problems. This means, taking into account all benefits would result in a higher valuation. Since the Ciénaga is expected to be clean in a few months to a year, the benefits in the first year after completion of the construction are halved.

The costs and revenues of the project are presented in annex B. The period of evaluation is set at 20 years.

In annex B.3 the economic IRR has been calculated. We assume the economic threshold rate for Colombia to be 10 percent. As can be seen in annex B.3 the overall eIRR is 39.1 percent. This means that the project is economically viable.

Other benefits of the project, not taken into account in the eIRR are:
- positive influence on the tourist industry;
- increasing value of the area near the Ciénaga (see section 5.5).

Taking into account these (non-quantified) benefits would result in an even higher eIRR.

5.5 Aspects of poverty and employment and aspects of women and development

Employment and poverty alleviation will be positively affected by the project. The improved water quality in the Ciénaga de la Virgen is supposed to have a positive impact on the fish stock. Therefore, an increase in the fishing activities is expected in the Ciénaga. Cleaner water will reduce the bad smell at the border of the lagoon, resulting in increased land prices. In particular 5 kilometres of the south-east coast, at the moment mainly populated by lower income groups, will witness an increase of land

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9 Besides, the freshwater fish stock changes into a salt-water fish stock.

10 According to the mission report there will be health benefits for 33 percent of the population of Cartagena. The average family consists of 6 persons. The reduction of health costs in the influenced area is estimated at 70 percent (World Bank, 1977). The average income of a fishermans family is taken as standard. According to the World Development Report 1993 (World Bank) health costs in Colombia from 7 percent of household consumption.

prices by about one-third. Depending on the property of the land, this may result in a benefit to the lower income groups of up to 20 billion Pesos[11].

The project will not have a major and special impact on the position of women, but the effects of the increased health situation of children will indirectly reduce work load for mothers. The project will certainly not deteriorate the position of women.

5.6 Environment

The project concentrates on improvement of the environment. The Colombian Ministry of Environment has included the project in the Environmental Action Plan for Cartagena for the period 1994-1999. Besides, in Colombia the Ministry of Environment is responsible for the control on environmental effects of, among other things, infrastructural works. Public nor private institutions can start the implementation of an infrastructural work without a license granted by the Ministry of Environment. So, the Ministry of Transport can only start the construction of the tidal inlet after that consent is given by the Ministry of Environment for the definitive design inclusive the description of the environmental effects. Therefore, the design phase includes an environmental impact study. This study will be carried out by the environmental expert of the supplier in cooperation with the ecologist of the counterpart and other team members, including the expert on sanitation technology. The study will be carried out on the base of requirements by the Colombian Ministry of Environment.

The most important environmental impact of the project will be the improvement of the water quality in the Ciénaga de la Virgen. At the moment, its BOD[12] is at least 18 mg/l. This should be less than 6.5 mg/l. An improvement of the water quality will improve the public health of the people living near the Ciénaga and will cause an increase in the fish stock. In general, a stabilized tidal inlet is a relatively safe and sustainable solution.

The technical consultants presume that the sandy material from the existing bar between the Ciénaga and the sea is not polluted. They expect the silty material in the Ciénaga to be polluted. It is necessary to study the basic properties of the sediments on the short term. The results of this study might induce costs for correct handling of the contaminated soil. It should be noted, however, that the pollution of the lagoon is not chemical, but biological of nature. Furthermore, about one-fifth of the centre of Cartagena has come about by land-reclamation from the Ciénaga de la Virgen. Therefore, it is not expected that the results of the analysis of the sediments will lead to modifications in the project that will jeopardize its viability.

[11] Presuming a land surface of 1 km^2 and an estimated average land price of 60,000 Pesos/m^2 in that particular region.

[12] BOD stands for the biodegradability of the total organic matter dissolved or suspended in water (De Groot, R.S., *'Functions of Nature'*, Groningen, 1992.)

6 Conclusions

The project itself is defined as the design, construction and operation of the stabilized tidal inlet. The transaction includes only the design and supervision during the construction. Calculations are based on the assumption that the construction itself will take place and will be granted under the ORET programme.

Assessment of the commercial viability of the project shows that the project is commercially non-viable; the commercial rate of return is negative. The accumulated cash-flow is -10,972 million Pesos after 10 years.

The financial IRR of the project is 9.3 percent if the dredged material, to be used for land reclamation, is sold at a price of 30,000 Pesos per cubic meter (this price corresponds to a price of 90,000 Pesos per square meter reclaimed land). It has been assumed that the cleaning costs of polluted sediments amount to 15 percent of these revenues of land reclamation. Prices for newly reclamated land on comparable locations in Cartagena vary between 75,000 and 125,000 Pesos/m^2. In order to guarantee the financial sustainability of the project, the supervising ministry will have to pay the cost of maintenance of the tidal inlet, also after the project period.

The quantified economic benefits which can be associated with the project are the dredged material revenues (to be used for land reclamation), the additional fishery revenues and the avoided health costs. If the period of evaluation is set at 20 years, the overall economic IRR appears to be 39.1 percent. This means the project turns out to be economically viable.

In addition to positive environmental effects on the water and air quality, employment and poverty alleviation will be positively affected by the project. The effect on the position of women is slightly positive.

Annexes

Annex A
Report by technical consultant

Note

Recommendations on a proposal for consultancy services, design and supervision for a stabilized tidal inlet near Cartagena, Colombia

Recommendations prepared by
DELFT HYDRAULICS

Z894, December 1994

Contents

1 Introduction

By letter BOO/IS QS4229br1 of 2 December 1994, NEI Rotterdam asked DELFT HYDRAULICS to comment on a proposal made by HASKONING in the framework of the ORET-program for the Dutch Government (DGIS). The proposal of HASKONING covers consultancy services, technical design and supervision of the construction of a stabilized tidal inlet near Cartagena, Colombia, in order to improve the water quality of the Tesca Lagoon (Cienaga de la Virgin) and its surroundings. NEI asked DELFT HYDRAULICS to comment in particular on the following aspects:

- the effectiveness of the proposed measures
- the set-up of the studies
- the proposed use of possible polluted sediments for landreclamation purpose
- time and costs.

NEI provided DELFT HYDRAULICS with the following documents:

- Misíon de Evaluacíon de los Planes para el Saneamiento de Cartagena de Indias, HASKONING, Noviembre 1993, [1]
- La Bocaña Estabilizada en la Cienaga de la Virgin, Cartagena-Colombia; Propuesta para Servicios de Consultoria, HASKONING, Julio 1994, [2]
- Plan de Accion Ambiental para el Distrito Turistico y Cultural de Cartagena de Indias, República de Colombia, Departamento Nacional de Planeacion; Documento Regional 2 - Minambiente-DNP-UPRU-UPA, Santafé de Bogotá, Septiembre de 1994, [3].

Based on these documents, the present note contains DELFT HYDRAULICS opinion on HASKONING's proposal.

2 General Considerations

Document [1] presents a comprehensive analysis of the environmental problems of the Cartagena area, including hydraulic, sanitary, water quality and ecological, as well as financial and economical considerations.
The document leads to the following recommendations:

a) Middle Long Term Actions
   - Set-up of an Integral Plan for the management of the waters of the Cartagena area, including the construction and implementation of a mathematical model system to assist the management and decision making by showing the impacts of the various considered mitigating measures.

b) Short Term Actions
   - upgrading the existing sewage systems, while maintaining the outfall into the Bahia de Cartagena
   - redesign the collecting system at the northern embankments, while avoiding the intake of polluted waters
   - collect and prevent the disposal of solid waste into the waters
   - design and construct a stabilized, permanent open connection between the sea and the Cienaga de la Virgin to improve its water quality.

The latter action is the subject of the present considerations.

Regarding the various levels of pollution, with the Cienaga de la Virgin being the most contaminated water body in the Cartagena area, it can be certainly justified to first tackle the problems of the Cienaga. We support HASKONING's conclusion to mitigate this area via a permanent open connection with the sea, rather than other suggested measures like e.g. transporting 100% of treated effluents into the Cienaga (see page 2 of [1]).

Principally an open connection allows for flushing into and out of the Cienaga. Due to the mixing between the initially non polluted sea with the Cienaga the levels of contamination in the Cienaga could be reduced to acceptable levels. Such a measure can be achieved by constructing a stabilized inlet yielding a relative safe and sustainable solution, with low maintenance costs (compared with other options relying on e.g. pump systems, which require energy and intensive maintenance etc.).
The optimum design and construction of a permanent open connection between the sea and the Cienaga can be achieved by executing the type of studies described in HASKONING's proposal [2]. DELFT HYDRAULICS detailed comments on the proposed studies will be presented in the next sections. However an additional general comment should be made here. Although we support the present suggested Short Term Action Plan we strongly recommend to start with the set-up of the overall mathematical model system as part of the Middle Long Term Action Plan as soon as possible. Such an overall model which should cover the entire Cartagena area with the Bahia, the Caños and Laguna's, the Cienaga and part of the adjacent coastal waters gives the necessary framework to judge the various considered mitigating measures in relation to each other. Such a model is an indispensable tool for achieving the optimum mixture of longer term solutions. Preferably the setup of the overall model should start parallel to the setup of the studies for the design and construction of the inlet.
Another general comment is that the description of the proposed methodology does not include much technical detail. For instance no description is given of the mathematical models, how they are operated, calibrated and verified and whether they are applicable for this project. Moreover no detailed description is given of the measuring programme and the programme for transfer of technology with respect to the mathematical models. Consequently, DELFT HYDRAULICS has not been able to comment in detail on these aspects.

3 Effectiveness of the proposed measures

In principle the proposed permanent open connection between the sea and the Cienaga can be effective, as described in the previous section. Although the tidal elevations are relative small (less than 0,5 m) the volume of the Cienaga is just about 22.10^6 m^3, meaning that theoretically this volume will be flushed every 4 up to 5 tidal cycles.
The success of flushing the Cienaga will strongly depend on the location and orientation of the opening, its length and its detailed lay-out, all meant to achieve the optimum exchange between the two waterbodies. Detailed mathematical model studies are indispensable.
The effectiveness of the measure also depends on the longer term impacts of the opening on the morphodynamics within the Cienaga and the morphological developments of the coastal area in front of the opening.

Due to the changed hydrodynamics both areas will tend to new equilibriums which may differ from the initial situations with the open connection. In addition some redistributions of (polluted) fine sediments within the Cienaga and between the Cienaga and the adjacent sea may take place.

These aspects have to be assessed also with detailed mathematical model studies.
Although at this stage it seems that a tidal inlet may be successful to improve the water quality of the Cienaga, it has not been proved. Therefor it would be more practical to divide the study into two phases; namely first a feasibility study to determine the optimum solution for flushing the Cienaga with the aim to improve the water quality (solution may be one or even two tidal inlets, possibly in combination with the dredging of channels) and a second phase for the design of works and their supervision.

4 Set-up of the Studies

To achieve a most effective solution by the proposed measures detailed considerations are required on the relevant phenomena: tidal currents, transport of pollutants and sediments and erosion and deposition processes.
In view of this we suggest to put more emphasis on the detailed two-dimensional mathematical model studies. We don't see, at this stage the benefits of a one-dimensional model approach. Therefore we suggest to start immediately with two-dimensional computations.
In view of the new hydrodynamic conditions within the Cienaga, reshaping and redistribution of tidal channels will occur, while the morphology of the coastal area in front of the inlet will be affected too due to the interaction between the in- and outflowing flows with the existing littoral processes. This means that the proposed two-dimensional model should cover not just the Cienaga and its opening but also a part of the coastal area.
Further we note that in the proposed set-up (Cuadros No. 2 + 3 of [2]) the explicit input of a coastal morphology expert is lacking. Due to the processes mentioned above the success of the proposed measure also strongly depends on the longer term morphological developments of the Coastal area in front of the inlet.
According to the task description, the "experto hidraulico morfologico" shall have background in the processes of hydraulics and morphology and in the mathematical modelling of these processes including the processes of water quality. The CV of this expert should be in accordance with this task which includes a relatively broad range of disciplines.

5 Proposed use of possible polluted sediments for land reclamation purposes

From [1] we conclude that the existing bar between the Cienaga and the sea consists mainly of sand, whereas we expect the Cienaga to be silty and polluted. Initially we presume that the sandy material can be used for land reclamation purposes, whereas the silty polluted material is not appropriate. To assess the possibilities of using the sediments more field data is required. Even when the sediment is not used for reclamation purposes, measures may be required for a correct handling of the contaminated spoil. Measurements to determine some basic properties of the sediment should be carried out on a short term, because the results strongly affect the financial feasibility of the project.

6 Time and Costs

We note that the costs for the construction of the stabilized inlet are estimated as US \$ $7.5.10^6$ (page 7 of [3]).
The proposal of HASKONING presents a required budget of Dfl. $5.2.10^6$ for consultancy services and support during the design and construction stage, which is about 40% of the costs for the works. If we consider the services during the construction phase as part of the works and restrict ourselves to the services provided in the design stage, the ratio between consultancy plus support and construction reduces to about 20%, which is still a considerable one.
We observe that there is a considerable input of supervisors in the construction phase (Cuadros 4 + 5 of [2]) with over more than 25 manmonths for the International consultants (Jefe de Inventoria + Assistente) and their Colombian counterparts with 40 manmonths. They contribute, including their direct costs to almost Dfl. $1.10.^6$ to the project.
Further we note the large amount of international travels.

In general we conclude that initially the costs for consultancy services plus support appear to be to a certain extent in unbalance. Justification of the investments however can be found in the importance of the present proposed project which has a strong "PR"-impact by showing environmental improvements on a short term and by the strongly adopted transfer of technology policy.
By making this project successful from the very beginning we believe that the adoption of the other components of the Short Term Action Plan and the Middle Term Integral Plan will be facilitated considerably.

As a conclusion we recommendate to achieve some savings by streamlining the set-up of the study and by implementing some suggestions as given above, but we support the overall philosophy of HASKONING's proposal.

Literature

[1] Misíon de Evaluacíon de los Planes para el Saneamiento de Cartagena de Indias, HASKONING, Noviembre 1993.

[2] La Bocaña Estabilizada en la Cienaga de la Virgin, Cartagena-Colombia; Propuesta para Servicios de Consultoria, HASKONING, Julio 1994.

[3] Plan de Accion Ambiental para el Distrito Turistico y Cultural de Cartagena de Indias, República de Colombia, Departamento Nacional de Planeacion; Documento Regional 2 - Minambiente-DNP-UPRU-UPA, Santafé de Bogotá, Septiembre de 1994.

telefax

postadres
postbus 177
2600 mh delft

bezoekadres
rotterdamseweg 185
delft

telefoon
(015) 569353

telefax
(015) 619674

waterloopkundig laboratorium | WL

NEI
T.a.v: Mevr.Drs. Hanneke Booij
ROTTERDAM

uw brief / telefax

uw kenmerk

telefax nummer
010 4530768

in behandeling bij
Ir. A. Roelfzema

onderwerp
Tidal Inlet Colombia

ons kenmerk
Fax5383.95/34903.10/eb

datum
5 april 1995

Geachte Mevrouw Booij,

Naar aanleiding van de toegezonden correspondentie van 29 maart j.l. zend ik u hierbij ons commentaar.

1. Fax HASKONING van 8 maart 1995

a) Modellering en Studie opzet; prima
b) Ontwerp fase
De door HASKONING gevolgde redenering is in beginsel correct, hoewel men vraagtekens kan zetten bij het vergelijken van kosten in verschillende jaren; (studiekosten zijn prijspeil 1994, constructiekosten 1996). We constateren dat het aandeel van overdracht van technologie en training veruit dominant is ten opzichte van het doen van aanbevelingen t.a.v. een integraal waterbeheeringsplan; dit is in deze fase zeker te verdedigen. Overigens vinden wij dat de tweede alinea van deze paragraaf ("op de eerste plaats worden de kosten ......etc") niet a priori een rechtvaardiging inhoudt voor de verhouding ontwerp uitvoering. Per definitie werkt men voor een "uitgekiend " ontwerp en dit moet dan ook immer tot een redelijke verhouding tussen ontwerp en uitvoering leiden. In dit licht is het huidige onderwerp niet letterlijk "uniek". Wij denken dat, vanuit onze ruime WL modellervaring de modellering "strakker" kan (reductie van enkele mensmaanden) omdat het hier toch min of meer standaard 2D modellering betreft.
c) Uitvoeringsfase
Wij zetten vraagtekens bij het continue karakter van het werk; zal er inderdaad met meerploegen diensten nagenoeg continu gewerkt worden; dit zal vooraf moeten worden geverifieerd omdat hier de zware begeleiding direct van is afgeleid.

In het totaal aantal tickets (41), zitten 8 tickets onvoorzien. Ons inziens is dat onderdeel nog steeds "aan de ruime kant"

totaal aantal pagina's

Gespecialiseerd advies van beleidsondersteuning tot ontwerp en technische assistentie.

waterloopkundig laboratorium | WL

2. Fax DGIS van 20 maart 1995

a) eerste alinea: invloed van schoner water op visvangst moet onderdeel zijn van voorgestelde studie.
b) tweede alinea: MER studie; mee eens
c) laatste alinea: uiteraard is de PR-functie van het project niet afhankelijk van aantal manmaanden en reizen; wat hier wordt bedoeld is dat intensievebegeleiding en transfer/trainings aspecten van belang zijn voor de PR-functie en de follow-up van het project en daarom een relatief zwaardere ontwerpfase rechtvaardigen. Het lijkt verder inderdaad nuttig om advies te vragen bij RWS of bij (een) aannemer (s) in verband met de constructieve aspecten.

Wij hopen u hiermee voldoende te hebben geholpen. Onze eind conclusie is nog steeds zoals ook aangegeven in onze notitie van december j.l. dat het project zinvol/relevant is, met inachtneming van bovenstaande opmerkingen.

Met vriendelijke groet,

Andries Roelfzema
Hoofd Markt- en Productontwikkeling
Sector Estuaria en Zeeën

Annex B
Tables of calculations

ANNEX B

MAIN ASSUMPTIONS:		
Output:		
Dredged soil	200,000	cbm dredged soil
Land reclamation with dredged soil	67,000	sqm land
Price of reclaimed land	90,000	Pesos per sqm
Price of dredged soil	30,000	Pesos per cbm
Investment costs design tidal inlet:		
- Foreign component	2.86	mln HFL
- Local component	0.00	mln Pesos
- Taxes & duties	0.00	mln Pesos
ORET/MILIEV grant	1.14	mln HFL
Investment costs supervision during construction:		
- Foreign component	2.36	mln HFL
- Local component	0.00	mln Pesos
- Taxes & duties	0.00	mln Pesos
ORET/MILIEV grant	0.94	mln HFL
Investment costs construction tidal inlet:		
- Foreign component	13.20	mln HFL
- Local component	0.00	mln Pesos
- Taxes & duties	0.00	mln Pesos
ORET/MILIEV grant	5.28	mln HFL
Sanitation costs (15% of revenues dredged soil)	900	mln Pesos
Operating costs as percentage of construction costs	1.25%	per annum
Exchange rate Pesos/HFL	0.0022	
Exchange rate USD/HFL	1.90	
Commercial Interest Reference Rate (CIRR)	8.55%	
Standard Conversion Factor (SCF)	1.00	

RESULTS:		
Commercial IRR	–	10 yrs, constant prices
Financial IRR	9.3%	20 yrs, constant prices
Economic IRR	39.1%	20 yrs, constant prices

ANNEX B.1 Analysis of Commercial viability (prices in constant mln Pesos)

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
NON FINANCIAL OPERATIONS																
CASH INFLOW:																
Production (cbm)		200,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Revenue for dredged soil		6,000														
Subsidy O&M			75	75	75	75	75	75	75	75	75	75	75	75	75	75
Revenues		6,000	75	75	75	75	75	75	75	75	75	75	75	75	75	75
CASH OUTFLOW:																
Investment costs:																
- Design tidal inlet	1,300															
- Supervision during construction		1,073														
- Construction tidal inlet		6,000														
Working capital		0														
Sanitation costs dredged soil		900														
Operating & maintenance costs			75	75	75	75	75	75	75	75	75	75	75	75	75	75
Total Costs	1,300	7,973	75	75	75	75	75	75	75	75	75	75	75	75	75	75
CASH BALANCE, before financing	(1,300)	(1,973)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RESULT:																
Commercial IRR	--	10 yr, constant prices														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FINANCIAL OPERATIONS																
CASH INFLOW:																
Foreign loan (LT) plus ORET/MILIEV gran	3,345															
Domestic loan (LT)	8,373															
CASH OUTFLOW:																
Foreign loan:																
- Interest payments (LT) a)		286	257	229	200	172	143	114	86	57	29					
- repayments		335	335	335	335	335	335	335	335	335	335					
Outstanding loan	3,345	3,011	2,676	2,342	2,007	1,673	1,338	1,004	669	335	0					
Domestic loan:																
- interest payments (LT) a)		716	644	573	501	430	358	286	215	143	72					
- repayments		837	837	837	837	837	837	837	837	837	837					
Outstanding loan	8,373	7,535	6,698	5,861	5,024	4,186	3,349	2,512	1,675	837	0					
- interest payments (ST) a,b)		0	0	0	0	0	122	275	433	596	764	938	1,018	1,105	1,200	1,303
CASH BALANCE, after financing	10,418	(4,146)	(2,074)	(1,973)	(1,873)	(1,773)	(1,794)	(1,848)	(1,905)	(1,968)	(2,036)	(938)	(1,018)	(1,105)	(1,200)	(1,303)
Accumulated cash balance	10,418	6,272	4,198	2,225	352	(1,421)	(3,216)	(5,063)	(6,968)	(8,936)	(10,972)	(11,911)	(12,929)	(14,034)	(15,234)	(16,537)

a) applied interest rate equals Commercial Interest Reference Rate (CIRR)
b) calculated as a debet interest on negative accumulated cash balance

ANNEX 8.2 Analysis of Financial sustainability (prices in constant mln Pesos)

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
NON-FINANCIAL OPERATIONS																					
CASH INFLOW:																					
Revenues (sludge & subs.O&M)		6,000	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
CASH OUTFLOW:																					
Investment costs:																					
- Fixed Assets a)	782	4,245																			0
- Working capital		0																			
Sanitation costs dredged soil		900																			
Operating & maintenance costs		0	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
Taxes		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Costs	782	5,145	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
CASH BALANCE, before financing b)	(782)	855	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RESULT:																					
Financial IRR	9.3%	20 yr, constant prices																			
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
FINANCIAL OPERATIONS: b)																					
CASH INFLOW:																					
Foreign loan (LT)	0	0																			
Domestic grant (nat.subsidy)	0	0																			
Domestic loan (LT)	0	0																			
CASH OUTFLOW:																					
Foreign loan: c)																					
- interest payments (LT)			0	0	0	0	0	0	0	0	0	0									
- repayments			0	0	0	0	0	0	0	0	0	0									
Outstanding loan		0	0	0	0	0	0	0	0	0	0	0									
Domestic loan: d)																					
- interest payments (LT)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- repayments		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Outstanding loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
- interest payments (ST) c)		63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CASH BALANCE, after financing	(782)	792	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Accumulated cash balance	(782)	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

a) excluding costs financed through ORET/MILIEV grant
b) financing refers only to loan operations
c) calculated as a debet interest on (negative) accumulated cash balance; interest rate is ..... (real)

Interest on foreign loan	7.0%
Interest on domestic loan	7.0%
Interest on negative accumulated cash balance:	8.0%

ANNEX B.3 Analysis of Economic viability (prices in constant mln Pesos)

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
COSTS:																					
Investment costs:																					
- Fixed assets																					
foreign cost component	1,300	7,073																			
local cost component		0																			
- Working capital		0																			0
Sanitation costs dredged soil		900																			
Operating & maintenance costs		0	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
Total costs	1,300	7,973	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
BENEFITS:																					
Benefits (output)																					
- dredging material		6,000																			
- addt. fishery income			34	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67	67
- avoided health costs			873	1,746	1,746	1,746	1,746	1,746	1,746	1,746	1,746	1,746	1,746	1,746	1,746	1,746	1,746	1,746	1,746	1,746	1,746
Total benefits		6,000	907	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814	1,814
NET BENEFITS	(1,300)	(1,973)	832	1,739	1,739	1,739	1,739	1,739	1,739	1,739	1,739	1,739	1,739	1,739	1,739	1,739	1,739	1,739	1,739	1,739	1,739
RESULT:																					
Economic IRR	39.1%	20 yr, constant prices																			