

APPENDICES

**with the advisory review of the
additional information to the
environmental impact statement
Tidal Inlet Cartagena, Colombia**


(appendices 1 to 6)

APPENDIX 1

Letter from DGIS dated 8 October 1996, in which the Commission has been asked to submit an advisory review of the additional information to the EIS

Ministerie van Buitenlandse Zaken

Bezuidenhoutseweg 67
Postbus 20061
2500 EB 's-Gravenhage
Telefoon 070 - 3 48 64 86
Telex 31326

	Commissie voor de m.e.r. OS
ingekomen:	10 OKT 1996
nummer:	105-96
dossier:	024-SS
kopie naar:	Sh/Sc/Pres/btd

Commissie voor de m.e.r./OS
t.a.v. de heer drs. J.J. Scholten
Postbus 2345
3500 GH Utrecht

Directoraat-Generaal
Internationale Samenwerking

Datum: 8 oktober 1996

Onderwerp: Cartagena Tidal Inlet Kenmerk: DML/MI-545/96
Act. nr. WW92850
jrc nr. 93/381

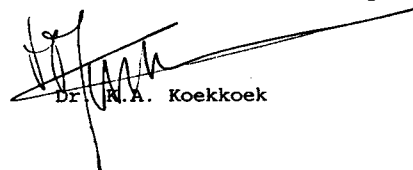
Onder verwijzing naar mijn verzoek om toetsing en uw toetsingsadvies m.b.t. het Milieu Effect Rapport van het project TIDAL INLET CARTAGENA, moge ik u verzoeken de reeds separaat naar u toegestuurde aanvulling op het Milieu Effect Rapportage te toetsen. Zoals u reeds bekend, bestaat bij CARDIQUE, waarmee door de Commissie een gezamenlijke toetsing van het Milieu Effect Rapportage is uitgevoerd, de wens om ook de aanvulling op het Milieu Effect Rapportage gezamenlijk te toetsen, waarbij deze keer Nederland de plaats van handeling zou kunnen zijn.

Ik sta daar positief tegenover en kan mij voorstellen dat er van de gelegenheid gebruik gemaakt wordt om, en marge van de toetsing, enkele bezoeken te brengen aan voor CARDIQUE in dit kader relevante instellingen in Nederland.

Mocht voor deze onvoorziene aanvulling de oorspronkelijk begroting voor de toetsing aangepast moeten worden, dan ontvang ik graag het programma en bijbehorende begroting, zoals gebruikelijk.

DE MINISTER VOOR ONTWIKKELINGSSAMENWERKING,
Voor de Minister,
De Directeur Milieu en Ontwikkeling

hc



Dr. A.A. Koekoek

APPENDIX 2

Project information

Proposed Activity: An ORET grant (Ontwikkelingsrelevante Export Transacties/Export Transactions relevant for Development), requested by the Dutch consulting engineers and architects company (HASKONING), has been approved to support an export transaction. The export transaction involves the design of a so called stabilized tidal inlet in Cartagena, Colombia and supervision during its construction. The possibility exists that the execution of works for the tidal inlet will be supported by an ORET grant, in case a Dutch contractor obtains the contract for these works. The ORET-desk (DPO/BL) has requested HASKONING to prepare an Environmental Impact Statement of a decision on the execution of the works. In Colombia, the construction of the stabilized tidal inlet will be the responsibility of the Ministry of Transport, division river infrastructure.

Categories: dredging and filling, DAC/CRS-code 71210

Project numbers: WW92850 JRC nr. 92/381, Commission for EIA: 024

Progress:

letter with request to submit an advisory review: 6 March 1996

advisory review submitted: 27 June 1996

letter with request to submit an advisory review on additional information: 8 October 1996

advisory review on additional information submitted: 19 November 1996

Composition of the working group of the Commission for EIA:

Mr J.D.G. van Duijne

Mr T.A. Nauta

Mr J.W. Kroon (chairman)

Mr A.M. Schakel

Composition of the working group of CARDIQUE:

Mr J.L. Penereiro

Mrs R. Díaz de Paniagua (coordinator)

Mr J. Manjarrés

Mrs C. Sierra

Mr A. Cabarcas

Mr F. Camacho

Technical secretary: Mrs I.A. Steinhauer.

APPENDIX 3

Letter from Haskoning dated 16 September 1996, announcing the availability of the additional information to the EIS

024-53



HASKONING

Ingenieurs- en
Architectenbureau

Barbarossastraat 35
Postbus 151
6500 AD Nijmegen
Telefoon (024) 328 42 84
Telefax (024) 323 93 46

Ministerie van Buitenlandse Zaken
Directoraat Generaal Internationale Samenwerking (DGIS)
T.a.v. mevrouw ir A. Wevers, DST/ML
Postbus 20061
2500 EB DEN HAAG

Uw referentie : -- Nijmegen, 16 september 1996
Onze referentie : 15605.B0991.21/B4086/RN/yh/MaVe
Doorkiesnummer: (024) 3284222

Betreft : MER-studie Tidal Inlet - Supplement

Geachte mevrouw Wevers,

Met genoegen doe ik u hierbij toekomen twee kopieën van bovengenoemd document, voorbereid naar aanleiding van het door de MER-commissie, in samenwerking met CARDIQUE, opgesteld evaluatierapport. Conform ons telefonisch overleg sturen wij separaat kopieën naar de MER-commissie te Utrecht, CARDIQUE te Cartagena en het Colombiaanse Ministerie van Transport. Tevens zal ik een exemplaar ter informatie toezenden aan H.M. Ambassade te Bogotá.

Tijdens mijn laatste bezoek aan Colombia, begin augustus, heb ik het verzoek gekregen van de heer Jorge Penreiro, projectcoördinator namens CARDIQUE, om ook de evaluatie van het nu opgestelde supplement gezamenlijk met de MER-commissie uit te voeren. Het voorstel van CARDIQUE is om deze tweede evaluatie te doen plaatsvinden in Nederland als logisch vervolg op het eerdere bezoek van de MER-commissie aan Colombia.

Het voorstel lijkt mij, gezien de enthousiaste wijze waarop tot nu toe is samengewerkt door CARDIQUE en de MER-commissie, een uitstekende mogelijkheid om deze Nederlands-Colombiaanse samenwerking op milieugebied voort te zetten. Ik verzoek u dan ook na te gaan of CARDIQUE door DGIS uitgenodigd kan worden in Nederland voor deze evaluatie.

Met vriendelijke groeten,
HASKONING

René Noppeney

Bijl.

cc MER-commissie: Ineke Steinhauer

H.K.O.

HASKONING B.V. is ingeschreven in het Handelsregister Nijmegen onder nr. 10145588
Groepsmaatschappij van Koninklijke HASKONING Groep B.V.



Bureau lid ONRI
Architecten lid BNA

APPENDIX 4

Working programme of Mr Jorge Luiz Penereiro, deputy director of CARDIQUE

Sunday 10 November	11.45 hrs.	Arrival at Schiphol Airport, transfer to Hotel Smits in Utrecht
Monday 11 November	09.00 hrs.	Visit to the offices of the Commission for EIA, preparation for the meeting in the afternoon
	14.00 hrs.	Meeting with the Dutch members of the working group on the Tidal Inlet, Cartagena
Tuesday 12 November	09.00 hrs.	Meeting with Mr J.J. Scholten, director of the Commission for EIA
	14.00 hrs.	Visit to the offices of Haskoning in Nijmegen, meeting with Mr R. Noppeney, introduction to their activities
	15.00 hrs.	Visit to a sewerage treatment plant in Nijmegen
Wednesday 13 November	10.30 hrs.	Lecture in The Hague by Mr R. Glaser, working at the department of International Environmental Affairs of the Ministry of Housing, Spatial Planning and Environment on environmental licences and enforcement.
	12.30 hrs.	Lunch with Mr E. Creemers of BKH-consultancies, who has been involved in EIA-training on request of the Colombian Ministry of Environment
	14.00 hrs.	Meeting with Mr R. Lander and Mrs L. Verbeek of the Environmental Programme at the Ministry of External Affairs, Directorate General International Cooperation in The Hague
Thursday 14 November	10.00 hrs.	Visit to the Department of Public Works, Zuid-Holland, meeting with Mr J. Kuijpers. Introduction on the EIA for the Haringvlietsluizen and the environmental impacts of the Stormvloedkering in the Nieuwe Waterweg (location Hoek van Holland)
	14.30 hrs.	Final meeting in Utrecht of the working group of the Commission for EIA, CARDIQUE and Mrs A. Wevers and Mr J. Kok of the Directorate General International Cooperation and Mr R. Noppeney of Haskoning
Friday 15 November	08.00 hrs.	Visit to the Department of Public Works, Zeeland, meeting with Mr D. de Jong. Introduction in Middelburg on the EIA for the Veerse Meer and visit to the area (flying-trip if the weather conditions are good).

APPENDIX 5

Additional information on eutrophication, prepared by Haskoning in November 1996

BOCANA ESTABILIZADA EN LA CIÉNAGA DE LA VIRGEN CARTAGENA, COLOMBIA

Reaction to remark 3a of the comment of the EIA-committee (T.A. Nauta) of October 14 1996 on the EIA-Colombia.

1 System parameters

1.1 Available nutrients

The seawater near the coast of Cartagena has a Nitrate content (N) fluctuating between 0,002 and 0,015 mg/l. The Phosphate content (P-tot) fluctuates between 0,002 and 0,073 mg/l. An estimation has been made of the availability of nutrients in the Ciénaga with the two-dimensional model (see *Suplemento-Anexos*). The results of this estimation for Nitrate and Phosphate are shown in the table below.

The table shows that the concentrations of N and P will drop after the implementation of the project (alternatives 2a and 3a). In the future these concentrations can only be kept at low levels if the Master Plan will be executed too. In the case a *Planta* will be build (alternatives 1b, 2b, 3b), the future concentrations of N and P will arrive again at their actual levels. In case an *Emisario* will be constructed, the concentrations of N and P will continue to stay at lower levels (alternatives 1c, 2c 3c). even when the project will not take place. The N-P ratio will increase compared to the autonomous development (alternative 1), in case the project will be executed (alternatives 2 and 3).

alternative	Nitrate (mg/l)			Phosphate (mg/l)		
	without Master Plan	with Master Plan		without Master Plan	with Master Plan	
	1995	2025		1995	2025	
	a	Planta b	Emisario ¹ c	a	Planta b	Emisario ² c
1	0,021	0,03	0,018	0,23	0,46 ²	0,10
2	0,018	0,023	0,016	0,12	0,25	0,05
3	0,018	0,023	0,016	0,12	0,25	0,05

Research from Clovis Teixeira and J.G. Tundisi published in 1981³, shows that under tropical conditions in seawater a Nitrogen limited situation exists for phytoplankton growth. Enrichment with Phosphorus of water containing phytoplankton appears not to increase the production of chlorofyll- α . Also in seawater samples with low phosphate concentrations (0,02 mg/l), enrichment with phosphorus does not show any effect on the production of chlorofyll- α . Hence the authors conclude that in seawater Nitrate is the major limiting factor for phytoplankton biomass production.

With respect to the situation in the Ciénaga de la Virgen after the project, it is presumed that the Nitrate content of the water will be at a level which is natural for seawater. In that case Nitrate will be the major limiting factor, whether Phosphate concentrations will decrease or not. Only in the case no *Emisario* will be constructed, there is a possibility that the Nitrate concentration will exceed the "natural concentrations" and that consequently the primary production will accrue.

1.2 Light

The photic zone, that is the zone in the water where enough light is available to make photosynthesis possible, is determined by the transparency of the water. It is assumed that in the alternatives 2 and 3 the turbidity of the water of the Ciénaga will decrease. The availability of light will increase and the photic zone will be extended to a greater

depth. This may result in an increase of primary production, if sufficient nutrients are available in the lagoon.

However, measurements of the concentration of Dissolved Oxygen in the lagoon have revealed that even just above the bottom Oxygen concentrations of over 100% do occur. In the present situation, with its turbid waters, sufficient light seems to be available to make photosynthesis possible in a great part of the water column of the Ciénaga de la Virgen. Therefore the reduction of the turbidity will not likely result in a large rise of primary production in the lagoon.

1.3 Oxygen

On cloudy days the high B.O.D. and the respiration of algae lead sometimes to extremely low Oxygen concentrations in the water of the lagoon. The probability of the occurrence of suchlike situations will largely be reduced in the alternatives 2 and 3. On the one hand the quantity of organic material in the water will strongly be reduced, on the other hand fresh water, rich in oxygen, will be supplied through the *Bocana*.

1.4 Salinity

The fluctuations in the salinity of the water in the Ciénaga de la Virgen are considerable. During the rainy season the salinity may fall to 11‰, while in the dry season when *la Boquilla* is closed, hypersalinity may occur due to evaporation of water from the lagoon; salinity levels of over 48‰ have been reported. These high levels of salinity may cause acute mortality of algae and macrophytes. Moreover, the dead organisms will contribute to the B.O.D. what may lead to low oxygen levels in the water.

In the alternatives 2 and 3 the yearly fluctuations in salinity will be reduced by the daily flushing with seawater that will buffer the extremes in the levels of salinity in the Ciénaga. In these alternatives the salinity of the lagoon will therefore never again rise above that of the seawater.

2 Changes in the Ecosystem of the Ciénaga as a consequence of alterations in system parameters.

2.1 Algae

When estimating the effects of a certain level of eutrophy on the ecosystem of the Ciénaga de la Virgen, the natural richness in nutrients of estuaries and lagoons into which rivers discharge, has to be kept in mind. Such lagoons will never constitute an oligotrophic environment. In the case of the Ciénaga de la Virgen, the water is not only enriched in nutrients as a result of the discharge of domestic waste water in the lagoon, but as well by the inflow of river water charged with nutrients from manure and fertilizers originating from the upstream agricultural areas.

Production of phytoplankton increases if the supply of nutrients increases, under the condition that the available quantity of light is not limiting. As discussed in § 1.1, Nitrogen is the major limiting factor for phytoplankton in seawater and the same applies to macrophytes in coastal waters. The growth of macroalgae, like *Cladophora* and *Enteromorpha*, both who live in the Ciénaga de la Virgen, depends strongly on the available Nitrate and Ammonium. The present situation in the lagoon is characterised by a high nitrogen supply due to the discharge of waste water and by a hampered flushing of nutrients to the sea. These conditions permit the development of a thick layer of algae on the floor of the lagoon. However, besides the nutrient supply, the production of macroalgae, and green algae in particular, depend on the availability of sufficient light. Only on these shallow places where enough light touches the bottom,

macroalgae are able to develop. In the deeper and darker parts of the lagoon the primary production is entirely taken care of by the phytoplankton.

Usually, phytoplankton dominates the primary production of the open water, while macroalgae and vascular plants give an important contribution to the primary production in the shallow coastal lagoons. In case the photic zone reaches to the bottom of the lagoon (see §1.2), the primary production will be dominated by macrophytes.

Also in a natural situation light would be an important limiting factor for primary production for a part of the year. During the period the north-east trade wind blows, the transparency of the lagoon is strongly reduced due to the turbidity of the water. Even though nutrients are sufficiently available during that time, they still can not be utilised for primary production by lack of light.

After the realisation of the project, in general the water quality of the lagoon will improve and consequently the transparency of the water as well. The increased transparency will mainly be caused by a reduction of the quantity of floating organic material, one of the main sources of nutrients in the lagoon. Furthermore if the bottom of the lagoon receives more light the possibilities for colonisation of the bottom by macrophytes will increase. Finally, the macrophytes will be in competition with the phytoplankton for the nutrients that will become more scanty.

A macrophyte vegetation, characteristic for the protected environment of coastal lagoons with a soft bottom, constitutes of sea grasses (part of the vascular plants). Regional *Thalassia testudinum* is the most common species. In the Bahía de Cartagena, located directly south of the Ciénaga de la Virgen, *T. testudinum* and *Syringodium filiforme* can be found.

Figure 1 shows the situation in the Bahía de Cartagena. The vegetation in the tidal zone along the waterside consists of the mangrove species *Rhizophora mangle* and *Laguncularia racemosa*, while at places that are permanent flooded the vegetation consists of the sea grass species *T. testudinum* and *S. filiforme*. In the future an open connection between the Ciénaga de la Virgen and the Bahía de Cartagena will be created, making colonisation of the Ciénaga by sea grass from the Bahía probable.

2.2 Expected effects

On the basis of the above-mentioned it is expected that as a result of the project the production of macrophytes in the lagoon will increase on the expense of the phytoplankton production. This will strengthen the natural character of the lagoon. However, the occurrence of a situation in which algae die massively, called "crises dystrophiques" or "malajges" in the French Mediterranean, seems improbable. Periodical dying of the algae, bringing about catastrophic consequences for the water quality, can only be provoked by stress factors like strong rises in temperature. In the tropics however, the water temperature shows only minor periodic fluctuations. Hypersalinity, an actual stress factor in the Ciénaga de la Virgen, will not occur anymore after the implementation of the operations proposed by the project (see §1.4)

Fields of sea grass in general accommodate a great diversity of animal species. They constitute important breeding grounds for fish and *Crustacea*, including significant fishery resources like the shrimps belonging to the *Penaeidae* family that lives in the study area. The development of the fields of sea grass in the Ciénaga de la Virgen is desirable. First because they naturally do belong in this environment and can accommodate a rich fauna, second because of their economic importance in relation to the production of fish and shrimps. The colonisation of the lagoon by sea grass may be

expected within some years after the quality of the water has been improved as result of the activities of the project.

2.3 Monitoring

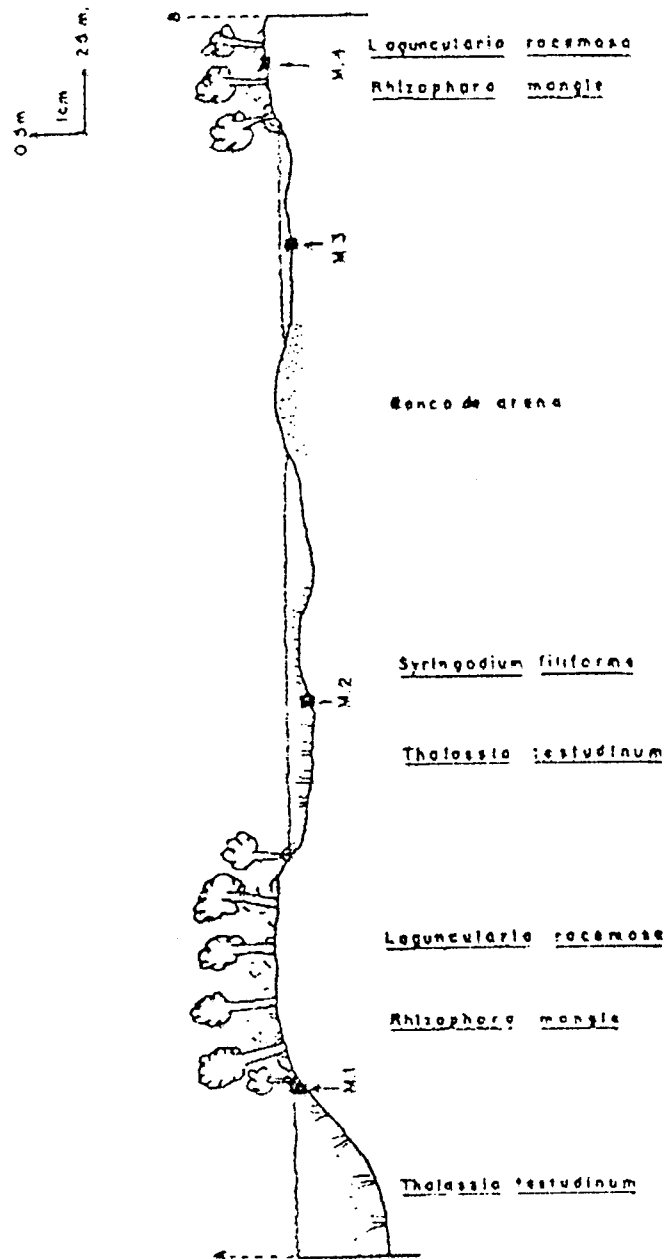
It is of importance that the proposed environmental monitoring program (see *Diagnostical*) ought to be extended with a number of biological parameters. Essential parameters are composition and primary production of the phytoplankton. Also a periodic inventory of the macrophyte population (species and abundance) is elementary. In case the results of the monitoring adventitiously indicate undesired developments in the lagoon ecosystem, the project offers enough flexibility to positively influence ecological processes, e.g. through the control of the supply of seawater. Furthermore, if the periodic inventories of the vegetation show that the natural colonisation process by the sea grass does not proceed quickly enough, planting the Ciénaga de la Virgen with grass from nearby lagoons might be considered.

¹ estimated with the calculation of the Cartagena sewage effluent composition in *Suplemento-Anexas*.

² estimated with the phosphate balance in *Suplemento-Anexas*.

³ Teixeira, C. & Tundisi J.G. (1981) *The effects of Nitrogen and Phosphorus enrichments on Phytoplankton in the region of Ubatuba, Brazil*. Buletin Instituto Oceanografico, S Paulo, 30 (1): 77-86, 1981.

Figuur 1. Vegetatietypen: transversale doorsnede van Punta Arena naar Tierra Bomba in de Baai van Cartagena (Quirós en Vernetto, 1980)



APPENDIX 6

Letters of different organisations in Cartagena, indicating the current status of the Sewerage Masterplan, Plans of the Municipality concerning spatial planning of certain areas near the Ciénaga and the current status of the Vía Perimetral



Gerencia del Programa de Acueducto y Alcantarillado

Cartagena de Indias, D.T. y C., Noviembre 07 de 1996

ACUC-749-96

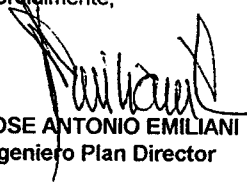
Señor
JORGE LUIZ PENEREIRO
Coordinador Proyecto Bahía de Cartagena
CARDIQUE
Cartagena

Respetado Señor:

De acuerdo con su solicitud, adjunto estoy enviando los documentos del Plan Maestro de Alcantarillado de Cartagena de Indias, elaborados por Aguas de Cartagena S.A., E.S.P. y relacionados a continuación:

1. Resumen Ejecutivo del Plan Maestro
2. Presentación del Plan, elaborada por los Ingenieros Benjamín Alvarez y Francisco Castillo.
3. Plano que contiene los sistemas de Alcantarillado existente y proyectados para la población del año 2.025 de Cartagena de Indias.

Cordialmente,


JOSE ANTONIO EMILIANI
Ingeniero Plan Director

Anexo: Lo anunciado

Copia:- Ing. Benjamín Alvarez Martínez - Gerente del Programa
- Ing. Francisco Castillo - Director Area Alcantarillado
- Consecutivo



Nov 06/96
CARDIQUE
SUB DIRECCION
GESTION AMBIENTAL
RECIBIDO



No. _____
Cartagena de Indias, D.T. y C.
2.1

Señores
CORPORACION AUTONOMA REGIONAL DEL CANAL
DEL DIQUE-CARDIQUE
Att. Dr. Jorge Luis Penereiro
Sub-Director de gestión Ambiental
Cartagena

Ref: Planes Zonales

Estimado Doctor:

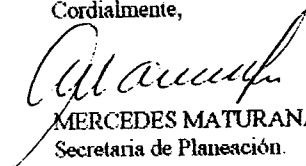
Adecuar las actuales circunstancias de desarrollo de la Ciudad a una racionalidad en el uso del suelo urbano en términos de una mejor eficiencia y articulación con los servicios públicos, para lograr una estrategia que racionalice el proceso de toma de decisiones en cuanto a la incorporación de nuevas áreas, ampliación, extensión y mantenimiento de los servicios y el equipamiento urbano, es la razón de ser de una de las políticas contenidas en el acuerdo 020 de junio 12 de 1.995 por el cual se adopta el plan de desarrollo del Distrito de Cartagena de Indias 1.995-1.997.

La Alcaldía de Cartagena a través de la Secretaría de Planeación y con el propósito de cumplir esta meta ha iniciado la elaboración del plan de ordenamiento de las comunas 4-5-6 y 7 que forman la zona sur oriental; asentamiento que constituye uno de los bordes de la Ciénaga de la Virgen.

Es para esta administración de gran interés poder coordinar acciones inter-institucionales que permitan lograr el desarrollo integral de estas comunidades.

En esta dinámica, estamos vinculando a los actores sociales, buscando la sostenibilidad de los procesos.

Cordialmente,


MERCEDES MATURANA ESQUIVIA
Secretaria de Planeación.

BOCANA ESTABILIZADA EN LA CIENAGA DE LA VIRGEN

Cartagena, 6 de noviembre de 1996

Doctor
JORGE LUIZ PENEREIRO
Subdirector de Gestión Ambiental
CARDIQUE
Ciudad

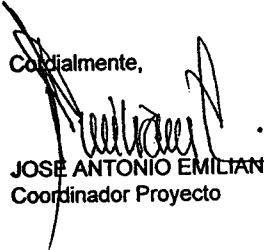
REF: PROYECTO BOCANA DE MAREA ESTABILIZADA.

Estimado doctor Penereiro:

Adjunto le estamos enviando para su información y conocimiento los siguientes documentos síntesis del proyecto Vía Perimetral Ciénaga de la Virgen:

- Copia del Acuerdo No. 074/95 del Honorable Concejo Distrital de Cartagena de Indias, en el cual se incluye en el Plan de Desarrollo la construcción de un tramo equivalente al 50% o sea 7 kilómetros de construcción de la Vía Perimetral. (1 hoja).
- Resumen Ejecutivo (texto y planos) de la Vía Perimetral de la Ciénaga de la Virgen elaborado por la firma Cartagenera de Ingenierías S.A. - CARINSA . (12 hojas).
- Copia presentación elaborada por el ingeniero José Enrique Rizo Pombo del Proyecto Vía Perimetral de la Ciénaga de la Virgen. (10 hojas).

Cordialmente,


JOSE ANTONIO EMILIANI
Coordinador Proyecto

cc: Ing. R. Noppeney, Gerente Proyecto
Ing. J. H. Rizo Pombo, Presidente-CARINSA

HASKONING - CARINSA
Manga, Calle del Bouquet No. 25-116
Cartagena