

II FEASIBILITY STUDY

2.1 FIRST STAGE PROJECT (HIGH PRIORITY PROJECT)

2.1.1 SEWERAGE SYSTEM IMPROVEMENT PLAN

(1) Population

As shown in the following, the sewer service population in each Sewerage District for 2000, 2005 and 2007 are estimated by the ratio of sewered population to the total inhabited population:

Sewer Service Ratios and Populations by District and Year

Sewerage District	2000		2005		2007	
Rafey	70 %	251,800	76 %	313,700	79 %	346,100
Cienfuegos	67 %	23,900	74 %	30,900	76 %	33,900
Los Salados	70 %	16,000	77 %	20,500	80 %	22,400
Embrujo	72 %	20,600	78 %	25,700	80 %	27,900
Zona Sur	74 %	24,000	83 %	31,200	86 %	34,200
Total		336,300		422,000		464,500

(2) Wastewater Quantities

For the hydraulic designs of the First Stage sewerage facilities, the design wastewater quantities for 2000, 2005 and 2007 are estimated. The average daily wastewater inflows and treated wastewater effluents quantities of the First Stage WWTP facilities are summarized in the table below:

Wastewater Inflows and Treated Effluents (m³/day)

Sewerage Districts	2000		2005		2007	
	Inflows	Treated	Inflows	Treated	Inflows	Treated
Rafey	43,490	25,000	79,900	35,800	97,910	35,800
Cienfuegos	5,740	0	7,820	7,820	8,740	8,740
Los Salados	3,910	0	5,290	5,290	5,880	5,880
Embrujo	4,540	3,300	5,920	4,700	6,550	4,700
Zona Sur	5,310	0	7,220	0	8,060	5,000
Total	85,140	28,300	113,460	52,210	127,140	60,120

(3) First Stage Sewerage Improvement Program

Under the long-term improvement program up to the year 2015 (Master Plan), the high priority improvement works have been selected for the immediate implementation under the First Stage Project. The First Stage Project thus selected plans to implement the rehabilitation and construction of sewers, pumping stations and wastewater treatment plants (WWTPs) in the high priority Sewerage Districts over the four-year period from 2003 to 2006.

Under the feasibility study, the First Stage Project system components have been further reviewed in more detail for its feasibility based on the results of field surveys, and economic and financial analyses. The review has concluded that the new lateral sewers construction be excluded from the present Project because the construction of such sewers is under housing developers and municipality's responsibility.

The First Stage project components thus selected include the rehabilitation works of Rafey, Cien-

fuegos, and Los Salados WWTPs; construction of Zona Sur WWTP; and laying of totally 14.6km sewer lines:

Component Facilities in the First Stage Project

District	Collection System	WWTPs
1. Rafey	Construction of 6.6km sewers of 12 to 48 inches, and rehabilitation of existing pumping stations.	Rehabilitation of 35,800 m ³ /day WWTP
2. Cienfuegos	Construction of 0.6km sewers of 18 inches in diameter.	Rehabilitation of 10,000m ³ /day WWTP
3. Los Salados	Construction of 4.2km sewers, ranging from 12 to 21 inches in diameter.	Rehabilitation of 10,000m ³ /day WWTP
4. Embrujo	Construction of 0.4km sewers 24inches in diameter.	---
5. Zona Sur	Construction of 2.8km sewers, ranging from 12 to 30 inches in diameter.	Construction of 5,000 m ³ /day WWTP

1) Wastewater Collection System

The City's predominantly hilly and sharp ground undulations make it difficult in some locations to place the sewers under the public right-of-ways parallel with the waterways, and as such, sewer laying in the riverbeds has been practices. If such sewers were allowed to place within the riverbeds they can easily collect and flow the wastewater by gravity.

In the Santiago Sewerage System, a portion of the collection system in the Los Salados Sewerage District has already been installed in the riverbeds, thus the upstream collector sewers could be conveniently connected to such existing sewers if the upstream sewers are placed in the riverbeds.

CORAASAN has a further plan to install the major collector sewers in the river reserves in the Rafey, Los Salados, and Zona Sur Sewerage Districts, to collect the wastewater from the nearby low-lying areas along the waterways.

An alternative study was therefore made on two sewer-laying cases; in riverbeds and public right-of-ways, to select the technically and economically optimum construction method for the First Stage Program. An alternative study on the collection system has shown that the riverbed installation (Collector No.10) is economically and technically feasible, particularly where no suitable public right-of-way exists near the waterway.

2) Wastewater Treatment Plants (WWTPs)

i) Rehabilitation Works

Refey, Cienfuegos, and Los Salados WWTPs are to be rehabilitated. For the Rafey WWTP, the rehabilitation works comprises the repairs and replacements of the existing equipment, whereas those for Cienfuegos and Los Salados WWTPs are the provision of new equipment and modification of existing civil works.

ii) Construction of Zona Sur WWTP

An oxidation ditch process WWTP with 5,000m³/day treatment capacity is to be constructed at the Zona Sur Sewerage District, comprising grit chambers, oxidation ditches, final sedimentation tanks, chlorine contact tank, sludge drying beds, mechanical and electrical equipment, controls, administration building, and other miscellaneous auxiliary facilities.

2.1.2 ORGANIZATION AND MANAGEMENT

The following principal organization and management reforms are proposed for CORAASAN:

- Creation of a Community Relations Section (CRS) in the Public Relations Office (PRO) to help address serious misuse of the sewerage system by the public. The PRO and CRS would launch a major public information, education and community relations program;
- Transfer of water quality control laboratories from Engineering Management to Operation and Maintenance Management (O&MM);
- Creation of a new 4-person unit (“Industrial Wastewater Quality Control Section”) in Environmental Sanitation Management (ESM) to control the quality of industrial wastewater entering the CORAASAN sewerage system from some 140 firms;
- Enlargement of small routine maintenance brigade in ESM and, in O&MM electromechanical workshops, separation of supervision and staff for ESM; and
- Transfer responsibility for pumping stations from WW Treatment Department to WW Network Maintenance Department (NMD). NMD to be significantly upgraded, technically and in staff numbers, to enhance the standard of maintenance in WW collection system;

The following capacity building measures are recommended:

- Creation of a Steering Committee and Project Management Office to plan and progress reforms and changes in staff numbers; and
- Design and implementation of a major training program for most staff levels which will need 6-12 months technical assistance from a Technical Training Advisor (TTA).

The following technical assistance is recommended – in addition to TTA:

- Setting up IWQCS: 3 person months;
- Investigating approximately 19,500 unpaid water and sewerage accounts: 84 person months at about RD\$5,000 a month; and
- Re-authorizing 140 firms to discharge into CORAASAN sewerage: about 47 person weeks.

2.1.3 IMPLEMENTATION PLAN FOR FIRST STAGE PROJECT

Project implementation plan is proposed assuming that the Project requires international funding for its implementation and will require an assignment of contractor(s) to be selected through international competitive biddings.

(1) Project Component and Contract Packages

The tenders are to be divided into two contract packages; “Wastewater Treatment Plant” and “Collection System.”

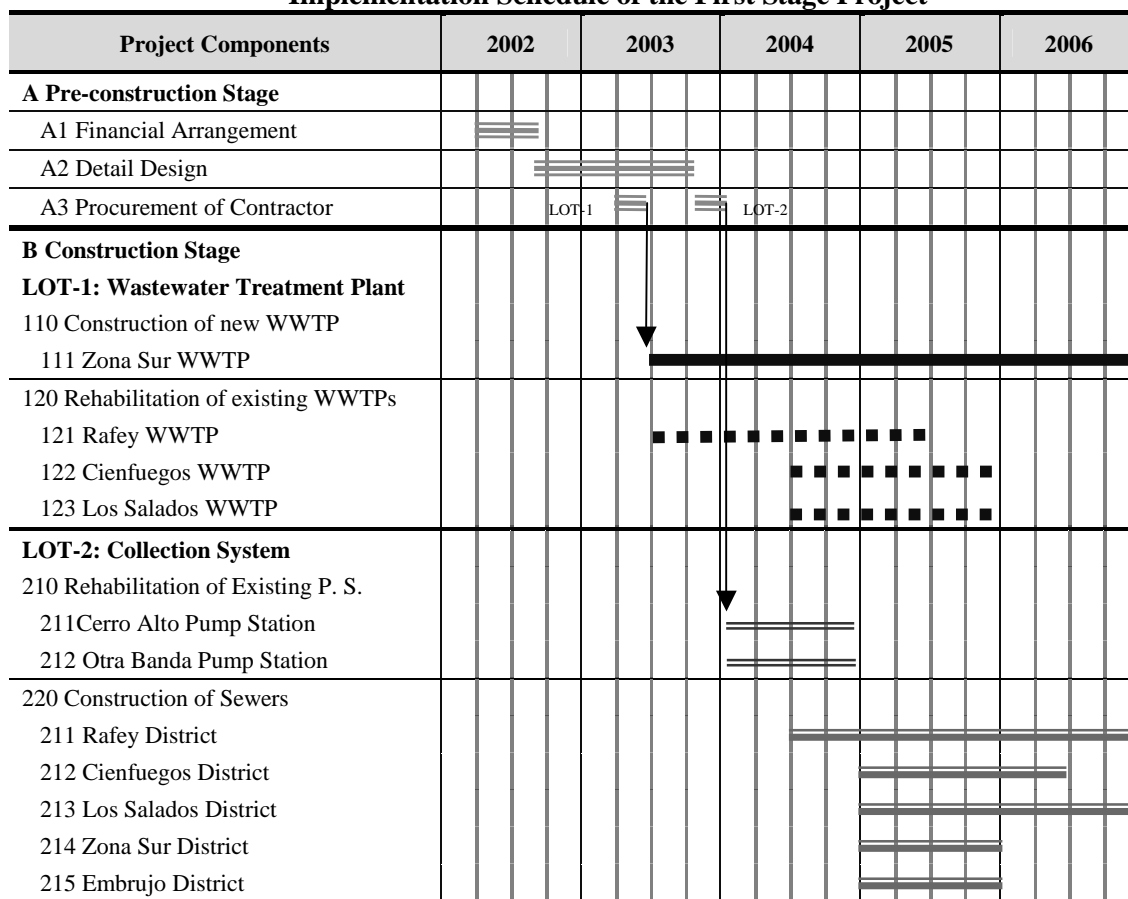
Proposed Contract Packages for the First Stage Project

Contract LOT-1: Wastewater Treatment Plants		Contract LOT-2: Collection System	
110: Construction of New WWTP		210: Rehabilitation of Existing Pump Station	
111	New Zona Sur WWTP	211	Cerro Alto Pump Station (Rafey)
		212	Otra Banda Pump Station (Rafey)
120: Rehabilitation of Existing WWTPs		220: Construction of Sewers	
121	Rafey WWTP	221	New Sewers in Rafey district
122	Cienfuegos WWTP	222	New Sewers in Cienfuegos district
123	Los Salados WWTP	223	New Sewers in Los Salados district
130	Supply of O&M Equipment	224	New Sewers in Zona Sur district
		225	New Sewers in Embrujo district

(2) Implementation Schedule

The implementation of the First Stage Project is schedule as shown in the following:

Implementation Schedule of the First Stage Project



2.1.4 PROJECT COST ESTIMATES

(1) Capital Costs Estimate

The capital costs are estimated by the price level at the end of October 2001. The capital costs comprise the following compositions:

- a) Direct Construction Cost
- b) Indirect Costs
 - Land Acquisition and Compensation
 - Administrative Expenses
 - Engineering Services
 - Physical Contingency
 - ITBIS (Value Added Tax)
 - Price Escalation

Most of the materials for the civil works are locally available with qualities generally meeting with internationally acceptable standards, whereas those for the machinery equipment are to be imported.

The capital cost has been estimated both for Foreign Currency (F.C.) and Local Currency (L.C.) portions, considering percentages for the different categories such as civil works, building, mechanical and electrical works.

1) Land Acquisition and Compensation

Land acquisition will be required only for the new Zona Sur WWTP site. Since there is no residential nor farmland exists in/around the site, no compensation is considered.

2) Administration Expenses

The administration cost for the project implementation is estimated at 3 % of the direct construction cost. Costs for setting up and initiating of CORAASAN's cost reduction program and investigating of unpaid account are accounted in the Administrative Expenses.

3) Engineering Services

The costs for engineering services are estimated at 10 % of the direct construction cost, including basic design, detail design, preparation of tender documents and construction supervision. Costs for technical assistance for institutional improvement, such as training program, are accounted in Engineering Services.

4) Physical Contingency

Physical contingency is estimated at 5 % of the direct construction cost, which is smaller ratio than cost estimate for the master plan, considering that future uncertainties should be mitigated by the deeper study and geotechnical investigation carried out after the study of the master plan.

5) ITBIS (Value Added Tax)

The ITBIS was estimated at 12 % of all the expense described above in accordance with Dominican Republic law.

6) Price Escalation

Annual price escalation is estimated at 2 % and 8 % for F.C. and L.C. portion respectively, referring to recent trend of consumer price index for G7 countries and Dominican Republic.

(2) Capital Cost

The wastewater facilities improvement works to be undertaken in the period from 2003 to 2006 will require an estimated total capital costs of approximately US\$ 47 million (at 2001 price levels) and US\$ 59 million (including future escalation), including those required for the project administration and engineering, in accordance with the proposed facilities and cost estimate presented in the following Table:

Summary of Capital Costs (Unit: US\$1,000)				
Cost Item		FC	LC	Total
Direct Construction Cost				
Contract LOT-1 Wastewater Treatment Plant				
110	Construction of New WWTP	4,126	2,868	6,994
120	Rehabilitation of Existing WWTP	4,784	1,123	5,907
130	Supply of Equipment	331	0	331
Subtotal of LOT-1		9,241	3,991	13,232
Contract LOT-2 Collection System				
210	Rehabilitation of Existing Pump Station	88	20	108
220	Construction of Sewers	6,657	15,534	22,191
Subtotal of LOT-2		6,745	15,554	22,299
Total of Direct Construction Cost		15,986	19,545	35,531
Indirect Cost				
301	Land Acquisition and Compensation	0	350	350
302	Administrative Expense	0	1,056	1,056
303	Engineering Services	2,842	711	3,553
304	Physical Contingency	800	977	1,777
305	ITBIS (Value Added Tax)	0	5,073	5,073
Total of Indirect Cost		3,642	8,177	11,819
Total Capital Cost at 2001 Price		19,628	27,722	47,350
306	Price Escalation	1,551	10,375	11,926
Total Capital Cost (Escalated Price)		21,179	38,097	59,276

(3) Operation and Maintenance Costs

CORAASAN's additional annual operation and maintenance costs for the First Stage Project are estimated for the conditions of 2006, considering increase or decrease of power consumptions, numbers of staffs and materials, as shown below:

O/M Cost Increment

Item	Quantity Increment from 2001	Cost increment from 2001 (US\$)
Staff Cost	74 persons	730,000
Power	6,000 kWh/day	782,000
Materials	120 kg/day (chlorine)	45,000
Others		50,000
Total		1,607,000

2.1.5 DISBURSEMENT SCHEDULE

The following table presents the costs of the First Stage Project components on an annual basis, in accordance with the construction schedule over the period up to 2006:

Disbursement Schedule for Capital Cost (Unit: in US\$ million)

	2002			2003			2004			2005			2006		
	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total
Direct Construction	0.00	0.00	0.00	0.32	0.08	0.40	3.61	2.32	5.93	8.07	10.54	18.61	3.99	6.61	10.60
Indirect Cost	0.28	0.11	0.39	0.87	0.80	1.67	1.03	1.40	2.43	0.83	3.67	4.50	0.63	2.19	2.82
Price Escalation	0.01	0.01	0.02	0.05	0.15	0.20	0.28	0.97	1.25	0.73	5.12	5.85	0.48	4.13	4.61
Total Disbursement	0.29	0.12	0.41	1.24	1.03	2.27	4.92	4.69	9.61	9.63	19.33	28.96	5.10	12.93	18.03

2.1.6 FINANCING PLAN

Evidently the US\$ 59 million-worth investment program far exceeds the financial affordability of CORAASAN. This inevitably led the agency in concern to the occasion of external borrowing from the alternatives of multi- (international) and bi-lateral financing institutions. The results of examination of various financing alternatives are summarized below.

CASE	All CORAASAN	Government + Borrowing		Government + CORAASAN + Borrowing		Government Grant + CORAASAN (O/M)
CORAASAN's Financial Burden (million US\$)						
CORAASAN	58.7	NA		10.0		NA
Debt Service + OM (during Project Period)	1.6 (OM)	Multi-6.6	Bi-4.1	Multi-5.6	Bi-3.6	1.8 (OM)
Financial Viability checked by the Incremental Revenue						
CE status quo 3.7 million US\$/yr	Not Relevant	X	X	X		
CE 82=>90% 4.3 million US\$/yr	Not Relevant	X		X		
CE 82=>95% 4.5 million US\$/yr	Not Relevant	X		X		

Note: : Possible, : Possible but difficult, X : Very Difficult

The proposed Project could be implemented only if:

- (1) US\$ 37 million of concessionary-loan from bi-lateral lending institutions is provided;

- (2) The government commits to budget allocation of US\$ 12 million for initial investment;
- (3) CORAASAN allocates that US\$ 10 million as equity investment;
- (4) CORAASAN enhances its tariff collection efficiency to 95 percent; and
- (5) CORAASAN realizes 60 percent revenue-hike in real terms over the 5-year period of to come.

2.2 PROJECT EVALUATION

2.2.1 TECHNICAL EVALUATION

The proposed Project will help alleviate existing adverse water quality and sanitary conditions in Santiago City and its surrounding areas, where the water environment and sanitary conditions have severely been contaminated and led to an overall deterioration in general public health through increasing incidences of water and sanitation-related diseases, as well as surface and groundwater contamination.

The recommended strategy is based on the maximum use of the existing and new sewers, which will convey the wastewater mostly by gravity to the WWTPs generally located at the peripheral areas of the Sewer Districts. The planned WWTP facilities are of the conventional activated sludge process and its modification that are sited in remote locations to minimize adverse impacts to the existing and future urban areas.

Each of the component facilities is evaluated and confirmed its appropriateness and soundness for implementation:

- (1) **Wastewater Collection System:** The sewer system is designed in principle to flow the wastewater by gravity, reducing to the maximum extent the energy need to pump up the wastewaters. Consequently, the operation and maintenance of the system is easy and costs are low. All the sewers are designed to have flow allowances of 30 to 100 percent of the pipe capacity during the peak flow rates, which will allow interior of sewers to supply sufficient ventilation thereby preventing the possible sulfide buildup.
- (2) **Wastewater Treatment Plants (WWTPs):** An oxidation ditch process is applied to the new Zona Sur WWTP, which is a modification of the conventional activated sludge process. The process is relatively easy to operate and manage the facilities compared with other activated sludge processes, yet high performance of the waste loads reduction is expected.
- (3) **Operation and Maintenance:** There is a lack of operational and maintenance experience for the wastewater systems. The preliminary engineering design prepared for the Project has therefore focused on the provision of simple and reliable components requiring minimal operational and maintenance experience. Nevertheless, extensive staff training courses will need to be implemented to ensure that the project facilities are correctly operated and maintained.
- (4) **Land Acquisition and Rights:** The new main sewers and pumping stations will be constructed within road reserves or on government-owned land. The new WWTP site has been selected at the vacant land in the Zona Sur Sewerage District so that no resettlement will be required, and any adverse environmental impacts avoided. The land site totaling about 3 hectares needs to be acquired.

The Project will provide the cost-effective wastewater collection and treatment facilities to service the most densely developed and severely degraded urban districts in Santiago City and neighboring areas, which are compatible with a long-term strategy to serve the entire Area.

From the foregoing facts and discussions, it is evident that the proposed First Stage Project is justi-

fied technically sound and will contribute to a large extent to the improvement of currently deteriorated sanitation and environmental conditions of the Santiago City and its surrounding districts.

2.2.2 FINANCIAL AND ECONOMIC EVALUATION

The financial viability are envisaged to reach Financial Internal Rate of Return (FIRR) of 10.9 percent and Net Present Value (NPV) of US\$ 4.3 million. With the current opportunity cost of capital prevailing in the Republic of Dominica standing at 9.5 percent, FIRR extensively outnumbers the real cost of capital, thereby making it possible to accept the concerned Project as financially viable. The positive figure of NPV also reveals financial soundness of the Project, with the discounted benefit exceeding discounted costs accrued over the project period of 35 years.

The major financial risks associated with the concerned project include lower Project benefit associated with sluggish demand for wastewater treatment, cost overrun during construction, and front-end delay in implementation. In this context, sensitivity analysis was carried out and as the result, the Project revealed marginal resiliency against those risks. Evidently the profitability is the most vulnerable risk factor.

Sensitivity Analysis on Financial Evaluation Indicators

	Base Case	Benefits -10%	Capital Cost +10%	Implementation one-year delay
FIRR	10.9 %	9.3 %	9.8 %	9.5 %
NPV	US\$ 4.3 mil.	US\$ -0.51 mil.	US\$ 0.96 mil.	US\$ 0.0 mil.

The economic viability is measured by Economic Internal Rate of Return (EIRR) and Economic Net Present Value (ENPV). Economic benefit is construed in two ways, which are (i) willingness to pay (WTP) based on the aggregate income of the household and business in the project area, and (ii) marginal cost pricing (MCP) based on the most efficient allocation of scarce resources.

Consequently the Project's EIRRs turned out to be 12.2 percent and 14.1 percent for WTP and MCP models, respectively. Likewise, ENPVs have been estimated at respective of US\$ 6.8 million and US\$ 11.6 million in the same alternative order.

Sensitivity analysis for variation in relevant parameters reveals resiliency associated with the Project against expedient downturn of economic value during the project period.

Sensitivity Analysis on Economic Evaluation Indicators

	Base Case	Benefits -10%	Capital Cost +10%	Implementation one-year delay
EIRR				
Willingness to Pay	12.2%	10.6%	11.3%	10.0%
Marginal Cost Pricing	14.1%	12.3%	13.1%	12.2%
ENPV (US\$ mil equivalent)				
Willingness to Pay	6.8	2.7	4.8	3.1
Marginal Cost Pricing	11.6	7.0	9.7	7.5

2.2.3 ENVIRONMENTAL CONSIDERATIONS

(1) General

Under the present study an environmental impact study has been conducted for the proposed Project and identified the present environmental conditions in/around the project site. Based on the survey results, the possible positive and adverse impacts due to the Project are identified, and the necessary mitigation and preventive measures to such adverse impacts are proposed.

(2) Economic and Social Impacts

The proposed sewerage system intends to receive portions of the industrial wastewaters with permissible qualities within the Sewerage Districts, to collect, treat and dispose of which in the safe manner. This will reduce the amount of industrial pollutants discharge to river and the ground, and reduce overall costs for smaller factories in comparison to on-site treatment.

The Project will improve the quality of water in the ground, thus reducing their role as a source of pathogens. The effectiveness of the Project in improving the health of the people of the Area will be greatly enhanced by combining a reduction in the source of pathogens with a reduction in the means of their transmission to humans. This is best achieved through a program of improved public health education and through enforcement of better environmental standards on factory premises and construction sites.

The Area also has an above average incidence of water-related diseases, which are felt most keenly by the lower income groups. Low-income families tend to live in streamside settlements a, and suffer from greater exposure to wastewater and poorer sanitation facilities. The Project will provide such low-income population with accessibility to sewerage, which will result in improvements in the currently poor environment.

(3) Negative Impacts

The treatment of the wastewater itself will generate a certain level of pollution in the form of noxious odors from settling tanks, sludge storage areas and in the form of noise pollution arising from the operation of the treatment plant. The site proposed for the new WWTP has been chosen so as to minimize the effects of pollution on the residents in surrounding areas.

The site is a wasteland located more than 300 meters away from current residential areas: however, there may likely to eventually be some urban encroachment in the future, when the area is developed as residential districts around the site. The wastewater treatment plant has, therefore, been designed to minimize noise and air pollution.

2.2.4 INSTITUTIONAL EVALUATION

The institutional recommendations of the First Stage Project are evaluated in terms of broad benefits, costs and main risks. Several tables are used for this, one for each area.

(1) Environmental Sanitation Management

ESM is the principal executing management [gerencia] for the project and therefore its organization and staffing have received particular attention from the Study Team.

ESM’s Proposed Changes: Benefits, Costs and Risks

Proposed change	Benefits	Costs, risks
1. Creation of Industrial Wastewater Quality Control Section.	Improved control of industrial wastewater discharged to sewerage. Less damage to sewers and WWTPs. IWQCS could be used for monitoring industrial effluent to the environment, if necessary.	Additional staff, expertise and facilities needed but premises adequate.
2. Create routine maintenance brigade on ESM payroll. Allocate O&MM workshop facilities, staff and supervisors between O&MM and ESM for other non-routine work.	Improved control by ESM of its own maintenance and repair work, both preventive/routine and emergency/breakdown. If this arrangement succeeds, no need for later separation of ESM facilities from O&MM facilities.	Cost of ESM maintenance should be billed to ESM. Risk that ESM emergency maintenance/repair could still suffer when O&MM heavily loaded, as potable water has priority.
3. Modify ESM organization structure: 1) Create Process Control Division. 2) Create Electromechanical Maintenance Division. 3) Transfer pumping stations to Network Maintenance Division. 4) Transfer premises connections from NMD to Engineering Management.	1) Improved control of laboratory work for monitoring CORAASAN process and industrial wastewater into sewerage. 2) See 2. above. 3) Improved control of wastewater collection. 4) Allows NMD to focus on its core responsibility of operating and maintaining the sewer system. Premises connections is more closely related to EM’s design and development work.	2) See 2. above. 3) The technical capacity of NMD must be upgraded by appointment of additional qualified staff and training of all other NMD staff (see 4. below).
4. Increased staff numbers and occasionally upgraded jobs in: 1) Wastewater collection. 2) WWTPs, needed to staff rehabilitated and new WWTPs.	1) Increased staff and revised NMD organization should significantly improve the quality and timeliness of current maintenance and repair quality, in respect of existing and new sewer lines. 2) Improved wastewater treatment.	1) Increased staff cost, but needed to achieve quality objectives. 2) Increased staff cost, but needed to achieve quality objectives.

(2) Engineering Management

Engineering Management changes proposed appear in the table below:

EM’s Proposed Changes: Benefits, Costs and Risks

Proposed change	Benefits	Costs, risks
1. Transfer water quality control laboratories to O&MM from EM.	Improved control of water treatment process by O&MM. Some additional capacity for EM management.	Nothing in particular
2. Transfer premise connections to EM from NMD.	Allows NMD to focus on its core responsibility of operating and maintaining the sewer system. Premises connections is more closely related to EM’s design and development work.	Nothing in particular

(3) Commercial Management

Commercial Management changes proposed appear in the table below:

Commercial Management’s Proposed Changes: Benefits, Costs and Risks

Proposed change	Benefits	Costs, risks
Speed up the check of 19,500 accounts unpaid for more than 8 months by recruiting an additional 14 persons for 6 months.	Quicker completion of investigation and therefore quicker control of vital connections and billing, and the related management information.	Cost of additional assistance might be funded by this project. Quality of checks might not be maintained with larger team.

(4) Capacity Building

Main capacity building actions proposed – in addition to establishing a Project Management Office, Steering Committee and action plan - appear in the table below:

Proposed change	Benefits	Costs, risks
1. Training: appoint Technical Training Adviser for 6 to 12 months in order to ensure, initially for sewerage and engineering: 1) Design of needed training plans and programs. 2) Development of O&M instruction manuals. 3) Selection/training of trainers. 4) Identification of appropriate external training courses.	Improved quality of O&M work and workforce, initially in ESM, later in O&MM, thus reducing downtime. Database of training course and audio-visual material within and external to CORAASAN. Trained trainers. O&M instruction manuals. Training methodology can be extended into all CORAASAN activities.	Major benefits justify the significant cost.
2. Establish in PR Office a Community Relations Section. 3. Design and develop a public information and education program.	Development of more systematic dialogue with customers and public. Better informed customers and public and therefore improved use of sewerage system. More demand for CORAASAN sewerage and sanitation services. Better resolution of customer complaints.	Significant effort required from CORAASAN to achieve benefits.

2.2.5 OVERALL PROJECT EVALUATION

- (1) The proposed First Stage Project forms the least-cost and short-term strategy plan for the Project Area up to 2006, and will service most of the built-up urban districts of the Sewer Service Area. The present sewered population of 336,300 (2000) will increase to 464,500 (2007).
- (2) The WWTPs improved under the First Stage Project would treat by the year 2007 the maximum daily wastewater of 60,120m³ in 2007, including the industrial wastewater. When all the WWTPs under the First Stage start their operation, an additional BOD₅ removal of 3,920kg/day is expected. Thus the present BOD₅ removal of 6,490 kg/day will be increased to about 10,400kg/day BOD₅, which would otherwise be discharged to the Yaque del Norte River.
- (3) The reduction of the waste loads reaching the Yaque del Norte River will significantly improve the quality of environment and life for those living in the area near the waterways and the River. Improving the disposal of industrial and domestic wastewater will also contribute to the improvement in the beneficial uses from the waterways, such as freshwater fisheries and aquaculture, and use of water for domestic, irrigation and industrial purposes.
- (4) Without the implementation of a comprehensive wastewater management program, further environmental degradation and deterioration in public health will be inevitable, and the economic development of the area will be slowed.
- (5) It will assist the Government in implementation of policy reforms comprising development of wastewater reclamation and reuse practices, strengthening financial management, tariff reform, improved wastewater management and more integrated planning of public sanitation. The Project will also support the economic development of the Province.
- (6) The Project will provide an affordable and technically sound solution to the current pollution problems resulting in substantially improved wastewater services for the communities and a noticeably cleaner environment. The Project represents a major step toward improving the environment in the Project Area, resulting in significantly improved water environment and sani-

tation conditions.

2.3 CONCLUSIONS AND RECOMMENDATIONS

2.3.1 CONCLUSIONS

- (1) The Study proposed the improvement of the WWTPs together with the installation of main/collector sewers to collect and treat the wastewater from the existing sewer areas. The proposed WWTPs employ conventional activated sludge and its modified process, which are presently best available biological treatments, and could treat the raw wastewater currently being discharged into the Yaque del Norte River to the levels meeting the effluent discharge quality requirements.
- (2) The Feasibility Study brought out the technical, economic, and environmental feasibility of the proposed Project; however, the Study revealed financial difficulty in the Project implementation. The initial investment cost for the Project is a heavy financial burden for the present CORAASAN's financial condition. Therefore, the Study evaluated the financial feasibility, premising the following financial and institutional supports from the Central Government (the Government):
 - Acceptance of the utilization of the Government guaranteed external loans;
 - Exceptional provision for the aforementioned repayment criteria; and
 - Application of a special subsidy to the Project.
- (3) As revealed in the Study, the sewerage system improvement is a heavy financial burden to CORAASAN. If the Project is left in the CORAASAN's initiative without any guidance and supports by the Government, no substantial progress could be expected.
- (4) As long as the affordability of CORAASAN remains not enough to develop its sewerage system by itself, the Government should take the initiative to realize the Government's policy. Therefore, the Study considers it justifiable to provide the support as tools of the Government initiative for the sewerage system improvement.

2.3.2 RECOMMENDATIONS

- (1) The Study concluded that the sewerage system improvements are economically and technically feasible. While the external financial support is essential, CORAASAN should take the first action to realize the Project. The first action would be to take a decision of the implementation of the Project. The Project would cause a heavy financial burden and limit the implementation of other new projects. Every effort is to be made to squeeze out the self-financing sources. Process and results of the efforts could be one of means to convince the Government to provide the financial support.
- (2) While it is a matter of fact that the Project could hardly be implemented without the external financial supports, it should be reminded that the Project is not started by the Government support but by the CORAASAN's initiative.
- (3) The Study proposed the options of financial plan by the financial arrangements. Availability of the foreign financial sources depends on the policy of both recipient country and financing agency. To start seeking for the possible financial source will be one of the CORAASAN's initiatives.
- (4) The Study considers that the Government's support in terms of financial and institutional assistance is essential for CORAASAN to implement the proposed Project, in view of the re-

quired project costs and CORAASAN's financial capability.

- (5) The Government is required to provide an arrangement for the Government guaranteed external sources, because terms of external loans without the Government's guarantee are far beyond the CORAASAN's affordability. Also, the Government is required to provide exceptions of repayment criterion that is one of conditions for the Government guarantee for external loans. As explained in the financial plan in this report, the Study proposed a sustainable financial plan that proves capability of CORAASAN to pay lease fee, which covers all the repayment amount and depreciation.
- (6) Furthermore, the Government should provide a subsidy that supplements a self-financing portion of the investment costs. Even if the CORAASAN could utilize the Government guaranteed external loan, CORAASAN would have a great difficulty in procuring the self-financing portion. A source of such subsidy may be quite limited in the Government budget. Therefore, the Government should have a plan to prioritize CORAASAN for the sewerage improvement program. The subsidy could work as a tool for the Government to exert the initiative for the sewerage improvement plan.