

CHAPTER 6

PROJECT EVALUATION

6.1 GENERAL

The existing sewerage system covers most of the urban built-up districts of Santiago and Tamboril Cities for the collection of domestic, commercial, institutional and industrial wastewater. However, because of the inadequate WWTPs capacities, together with the missing main/collector sewers, much portion of the raw wastewater has been discharged to the Yaque del Norte River.

There is an urgent need to implement a comprehensive program of the wastewater sewerage system to collect and treat all the wastewater in a manner that will meet the stringent discharge water quality standards set forth to public surface/ground waters.

In planning the sewerage system, several system options were selected and evaluated for technical, costs, economic, financial and environmental relevance.

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.

6.2 TECHNICAL EVALUATION

6.2.1 GENERAL

The technical soundness of the proposed wastewater management system project is examined with regard to the following viewpoints:

- Appropriate technology levels;
- Likely ease of project implementation; and
- Soundness of operation and maintenance required to run the proposed system.

6.2.2 PROPOSED FACILITIES

The proposed project up to the year 2006 represents the effective alternative plan meeting the Santiago City and its surrounding areas' wastewater and environmental management requirements, defined as the improved sewerage/environment for all the residents in the area. 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. This will allow interior of sewers to supply sufficient ventilation avoiding anaerobic conditions of the wastewaters in the sewers 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. By applying nitrification and denitrification process operation, the removal of nitrogen in the wastewaters could also be achieved. The whole excess sludge, after being stabilized, will be conveyed to the sand drying beds wherein the sludge will be dried and may be used for land application.

6.2.3 PROCUREMENT

Contract packaging proposal will be developed for the procurement. The project contracts are envisaged to be awarded through international competitive biddings for the rehabilitation and construction of wastewater collection, pumping stations and wastewater treatment plant facilities, while the construction of sewers may be planned under smaller contracts for local contractors.

CORAASAN may take steps to procure the services of consultants to prepare detailed designs, drawings and tender documents, under a budget allocation from international lending agencies' fund. Consulting services may be required for assistance in project implementation, and construction supervision.

6.2.4 IMPLEMENTATION SCHEDULE

It is envisaged that the implementation of the Project will proceed rapidly, since the major works will be carried out under several parallel works covering the construction of the wastewater collection, transfer, treatment and disposal facilities.

It is planned that the First Stage Project will be implemented over a period of four-year with full completion being achieved by the end of the year 2006. Interim commissioning of the project facilities is to be carried out during the First Stage period to enable earliest possible utilization of the new facilities and early introduction of cost recovery measures.

6.2.5 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 waste land in the Zona Sur Sewer District so that no resettlement will be required, and any adverse environmental impacts avoided. The land site totaling about 3 hectares (for the 10,000m³/day treatment capacity by 2015) needs to be acquired.

6.2.6 OVERALL 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 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 justified 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.

6.3 ECONOMIC AND FINANCIAL EVALUATION

6.3.1 FINANCIAL VIABILITY OF THE PROJECT

(1) Financial Viability by Financial Internal Rate of Return (FIRR) and Net Present Value (NPV)

As previously noted in Chapter 4, financial viability as borne out by the quantitative indicators, *vis-à-vis*, FIRR and NPV, in the light of the proposed investment plan with the accruable costs (base cost plus physical contingency) and benefit (incremental revenue) are envisaged to reach 10.9 percent and US\$ 4.3 million, respectively. With the current opportunity cost of capital prevailing in the Republic of Dominica standing at 9.5 percent, FIRR for the Project 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.

It would be worthwhile to note that both of the viability indicators reveal far negative work deliverables of uncountable FIRR and minus US\$ 34.6 million NPV, provided that the Project benefit assumed people's willingness to pay (WTP) revealed (RD\$ 17.6 per household per month) and the tariff currently paid (RD\$ 0.95/m³ in average) in Santiago.

(2) Sensitivity Analysis

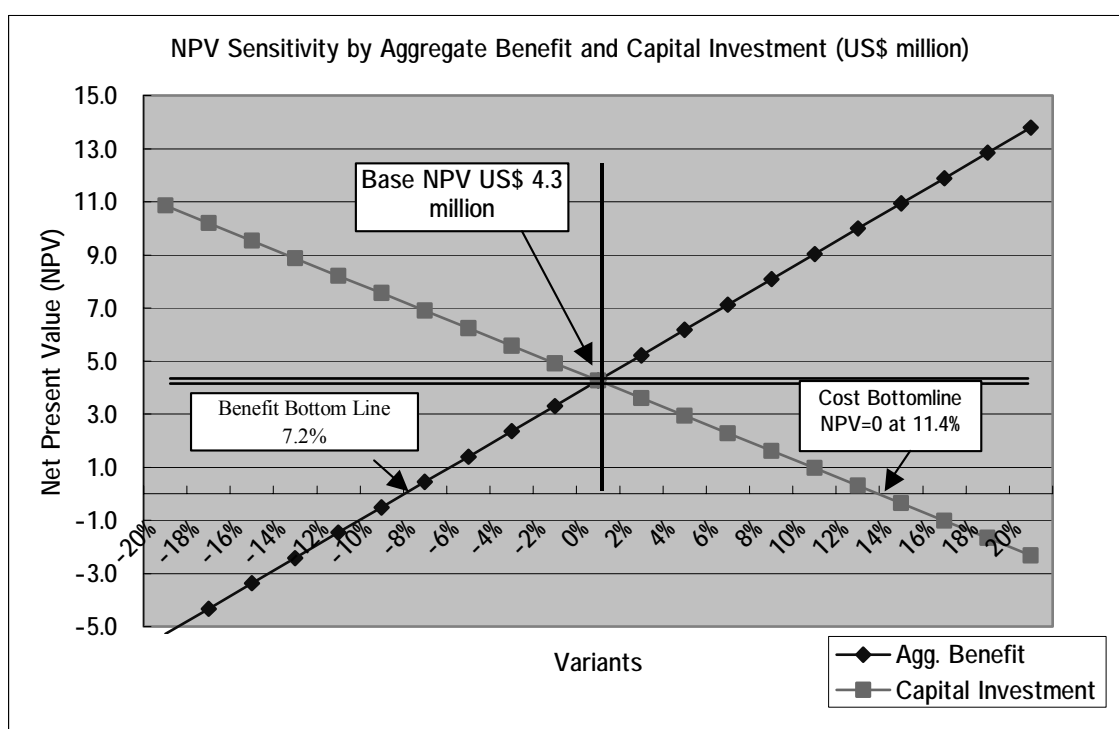
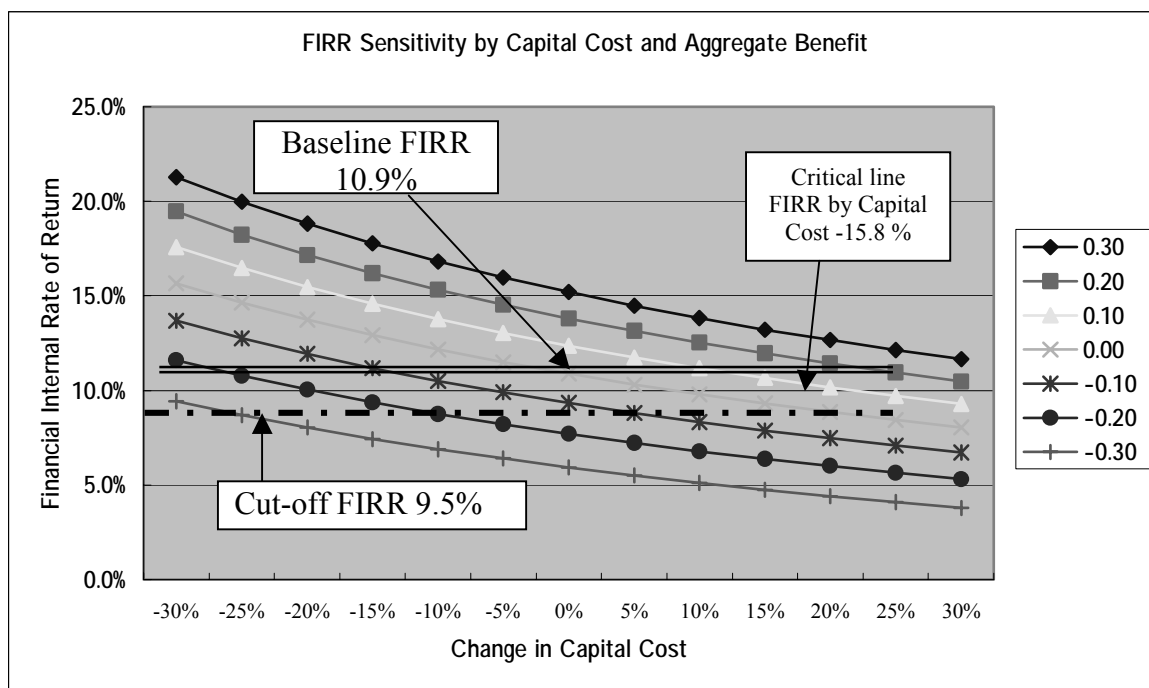
The major financial risks associated with the concerned project include lower Project benefit associated with sluggish demand for wastewater treatment, cost overrun during construction, and front-end delay in implementation. In this context, sensitivity analysis was carried out for the following three cases to assess the magnitude of the possible risks therein, *vis-à-vis*, (i) lower tariff by 10 percent, (ii) capital cost overrun by 10 percent, and (iii) one year delay in implementation (benefit generation).

The results of the sensitivity analysis for turned out to be 9.3 percent, 9.8 percent, and 9.5 percent for FIRR, and US\$ -0.51 million, US\$ 0.96 million, and breakeven US\$ 0.0 million for NPV, in that order. With this in view, the Project revealed marginal resiliency against the risks as specified above, while FIRRs and NPVs remain somewhat closer to the bottom-line profitability of vested capital. Evidently, PROFITABILITY is, among others, the most vulnerable risk factor.

Summarized and detailed variants associated with the possible fluctuation in major variables are also given below.

Results of Sensitivity Analysis

	Base Case	Benefits -10%	Capital Cost +10%	Implementation one-year delay
Financial Internal Rate of Return (FIRR)	10.9 %	9.3 %	9.8 %	9.5 %
Net Present Value (NPV) US\$ million	4.3	-0.51	0.96	0.0



(3) Affordability Analysis

Evidently the US\$ 59.2 million-worth investment program far exceeds the financial affordability of CORAASAN, with the entity's annual revenue (accounting profit) and source of fund (actual cash position) remain US\$ 13.5 million and US\$ 6.7 million, respectively. This inevitably led the agency in concern to the occasion of external borrowing from the alternatives of multi- (international) and bi-lateral financing institutions. In compliance with the hypothetical parameters associated with the two financing sources as given in Chapter 4, annuity payments for the borrowing of US\$ 47 million (equivalent to 80 percent of the aggregate financial cost of

the Project) stand at US\$ 4.8 million and 2.3 million for the respective of multi- and bi-lateral financing institutions. Provided that US\$ 10 million emanated from CORAASAN's own coffer as equity investment to the Project and the remaining US\$ 38 million from external borrowing, annual debt service for CORAASAN diminishes to US\$ 3.8 million and 1.8 million per annum, in that order.

In view of the above, CORAASAN would endeavor, in pursuance of the expeditious implementation of the Project with external borrowing, to confine the borrowing to US\$ 37 million from bi-lateral, or concessionary-loan, lending institutions. In this connection, combined with US\$ 10 million as own fund, financial soundness as borne out by Debt Service Coverage Ratio (DSCR, below 25 percent bottom-line) and the entity's ownership of the Project will substantially be secured.

With due recognition of the rung of financial hardship that CORAASAN would have to endure every year during the project period and beyond, the proposed Project could be implemented, IF and ONLY IF (i) the government could decisively commit to budget allocation of around US\$ 18.1 million for initial investment in early 2002, (ii) CORAASAN allocates a chunk of own fund of US\$ 10 million from its owner's equity, and deliberately carry the annual fiscal burden and recurrent costs, and (iii) CORAASAN could strive for enhance its tariff collection efficiency to around 95 percent and, in tandem, raise service fee by in average 60 percent during 5 years that come.

In this connection, if the occasion arises when CORAASAN considers funding sources embracing external borrowing, it is recommended that the entity in concern borrow funds in line with bi-lateral-type of "soft" loans with the conditions of no-capitalized interest to principal and longer repayment period with grace periods. As seen in Chapter 4, this type of borrowing ensures the lower principal surmounted in the wake of full disbursement of loans, and smaller amortization in the following repayment years.

Meanwhile, it would be noteworthy that the World Bank-type loan is considered where CORAASAN is not liable to amortization during the initial construction period. While high obligation of debt service during the repayment period is assumed in this case, financial burden during the initial investment period is much lesser than the other funding source. Possible funding alternatives and the associated results of implementability analysis are provided below

Financing Alternatives and Implementability

	All CORAASAN	GOD + Borrowing		GOD + CORAASAN + Borrowing		GOD Grant + CORAASAN (O/M)
Financial Burden						
Initial Year	58.7	NA		10.0		NA
Project Period (Debt Service+OM)	1.6 (OM)	Multi- 6.6	Bi- 4.1	Multi- 5.6	Bi- 3.6	1.8 (OM)
Incremental Revenue						
CE status quo 3.7 million/yr	Not Relevant	X	X	X		
CE 82=>90% 4.3 million/yr	Not Relevant	X		X (WB)		
CE 82=>95% 4.5 million/yr	Not Relevant	X		X		

(4) Narrative Evaluation-Overview and Tariff Collection System

As regards revenue generation in corporate accounting, a continuing issue would be a need to restructure revenue collection performance in the entity. As is the cases wherever in the world, current revenue collection by CORAASAN still remains below achievable levels partly due to the structural reasons associated with manpower shortage, and book-keeping and accounting system in use. In general, no effective payment records for individual consumers are maintained in the office, provided that customer ledgers may not properly be kept.

In this connection, some of the suggestions that might help improve the entity's capacity of tariff collection will come as follows: (i) expansion of local cash offices where consumers can pay during a stipulated period each month, and (ii) possible "Contracting-out" to private debt collecting firms, and (iii) further improvement in efficiency to manage accounts receivable and cost centers through the introduction of public accounting system with formal auditing by the government.

6.3.2 ECONOMIC FEASIBILITY OF THE PROJECT

Essential to proper investment programs is the allocation of scarce resources to its best advantage in the economy. In this light, financial and the quantitative analyses on the financial and economic aspects of the proposed project was undertaken, as reflected in the foregone chapter 4. With this in view, project evaluation comes in place, while providing sensitivity analysis and associated conclusive remark that follows. Sequentially, a couple of risks and uncertainty that cast possible concern over the smooth and effective implementation of the project will be noted in the ensuing subsection.

(1) Prerequisite-Economic Cost and Benefit and Concluding Feasibility by EIRR and NPV

The aggregate economic cost has been estimated at US\$ 45.6 million as par late 2001 price, whereas the economic cost of operation and maintenance at US\$ 1.3 million, while being converted from the financial cost of US\$ 1.6 million. On the benefit front, those turned out to be US\$ 6.3 million and US\$ 7.0 million per annum for the methodological alternatives of willingness to pay (*WTP*) and marginal cost pricing (*MCP*), respectively.

Project feasibility as borne out by EIRRs turned out to be 12.2 percent and 14.1 percent for *WTP* and *MCP* methodology, respectively. Likewise, ENPVs worked out to respective of US\$ 6.8 million and US\$ 11.6 million in the same alternative order as above. With the economic opportunity cost of capital that stand currently at 10.0 percent, the EIRR for the Project extensively outnumbers the real cost of capital in view, thereby making it possible to accept the concerned Project as economically feasible. The positive figures of NPV also revealed numerical supremacy of the project benefits over the costs accrued in the time perspective of 35 years. financial soundness of the Project, with the time-discounted net benefit remained positive in real terms.

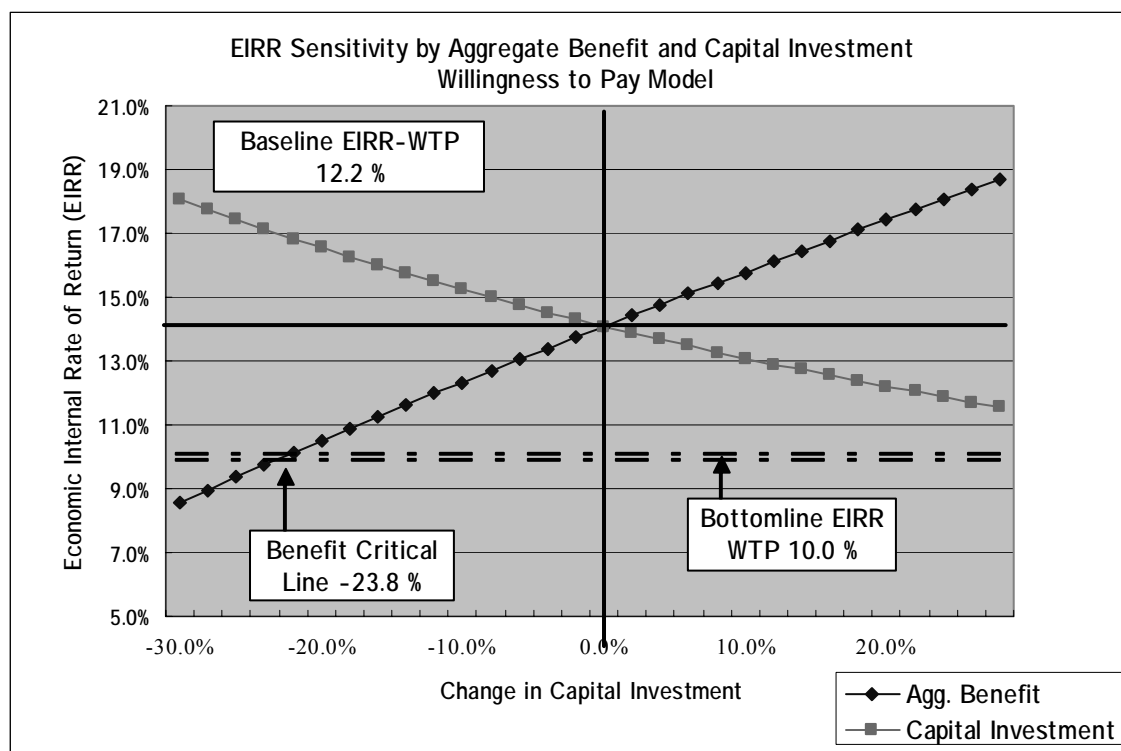
(2) Sensitivity Analysis and Conclusive Remarks

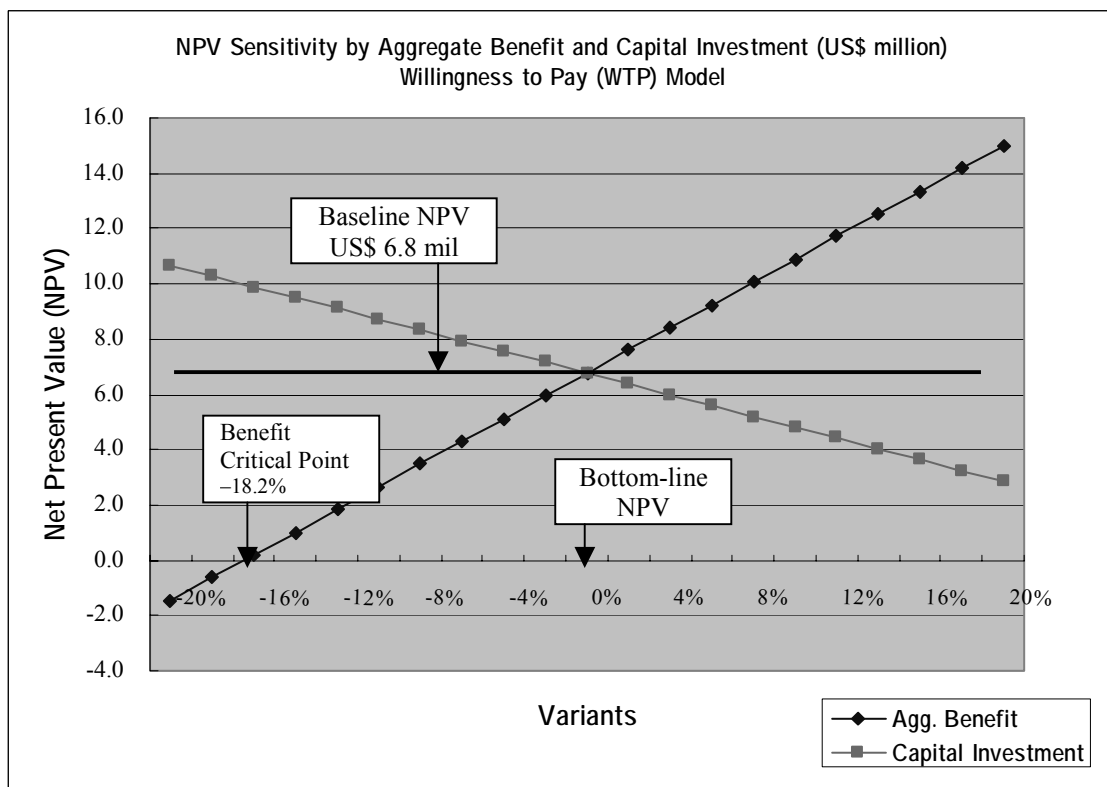
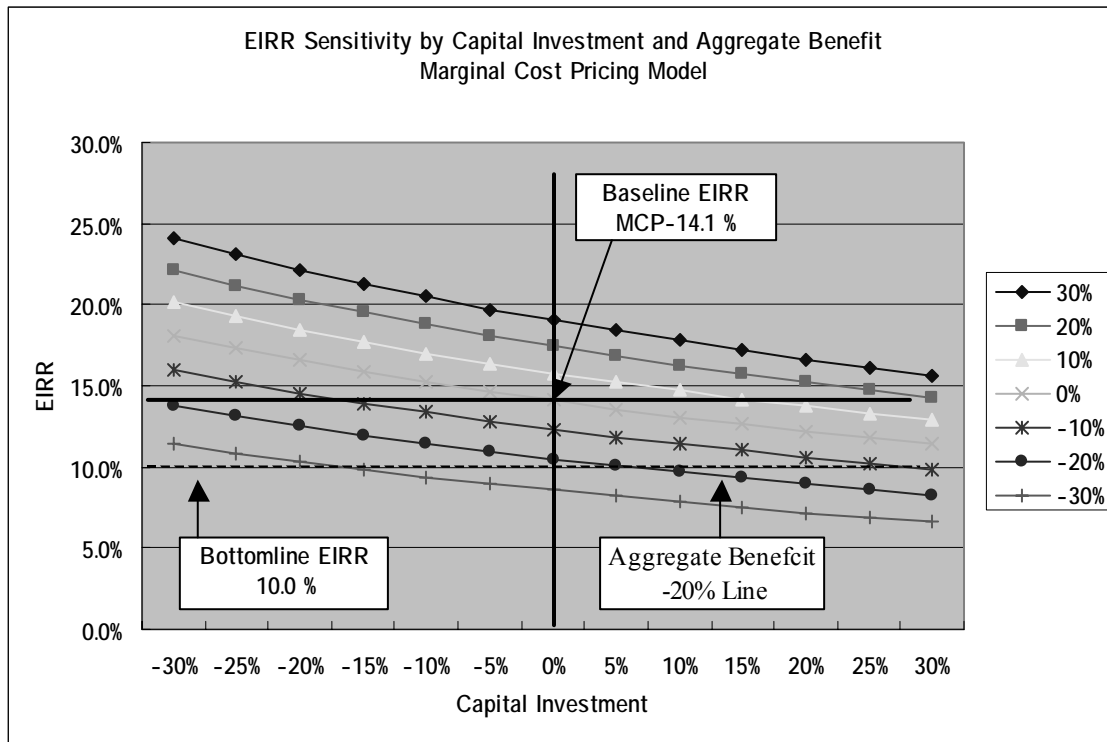
Sensitivity analysis for variation in relevant parameters, *vis-à-vis*, (i) lower value generation by 10 percent, (ii) capital cost overrun by 10 percent, and (iii) one year delay in implementation, gives 10.6 percent, 11.3 percent, and 10.0 percent of EIRR, and US\$ 2.7 million, 4.8 million,

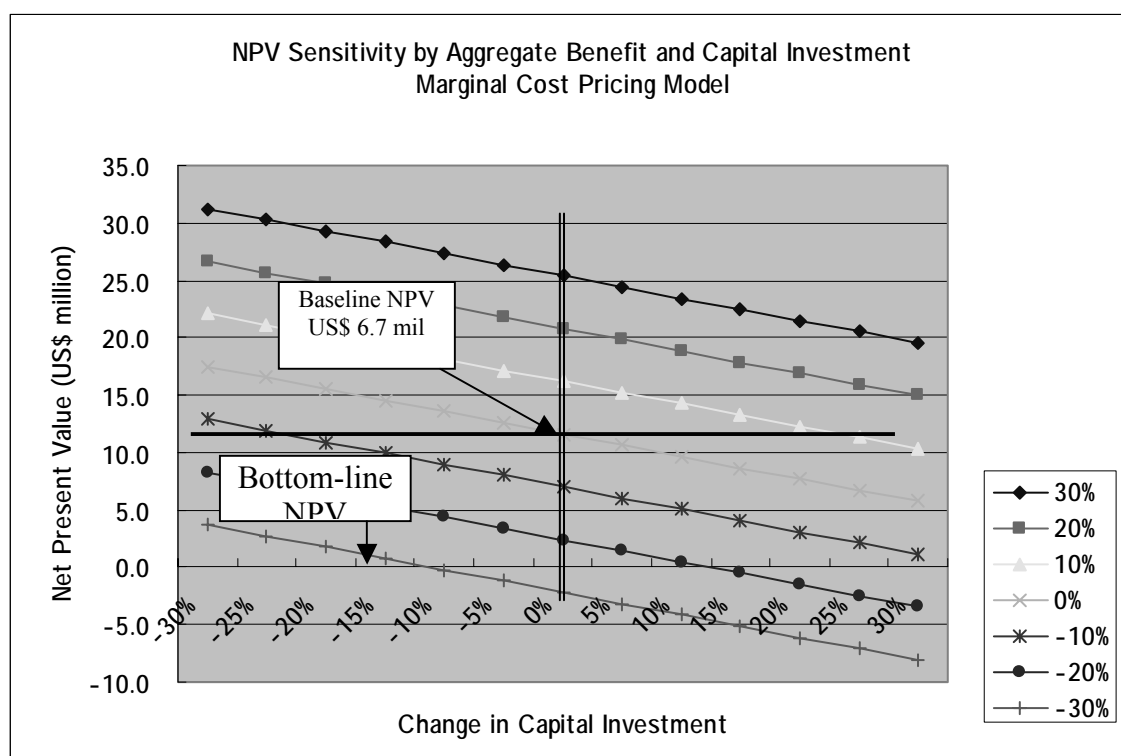
and 3.1 million of ENPV for the *WTP* model, in that order. Likewise, EIRRs and ENPVs remain satisfactory for all these cases, with EIRRS at 12.3 percent, 13.1 percent, 12.2 percent, and ENPV at US\$ 7.0 million, US\$ 9.7, and US\$ 7.5 million, in the same order. This evidently reveals resiliency associated with the Project against expedient downturn of economic value during the project period. To note that uprisings shift of initial investment is more sensitive to economic feasibility of the Project. Numerical and visual outputs of the analysis are given below.

Results of Sensitivity Analysis

	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







(3) Narrative Evaluation – Project Impact on Health and Environment Protection

With the incremental supply of efficient and effective services of wastewater management in Santiago, the prospective investment program is the least-cost and environmentally sound solution to mitigate sanitary and ambience degradation. The Project, combined with the public education programs for public awareness and project ownership, will also lead to a shift in better service quality on financial soundness and reduced morbidity, while enhancing social and economic infrastructure that is conducive to an improved level of people's welfare and urban beautification in the area. In particular, the project will also help augment both the availability and reliability in the provision of sewerage services, thus providing one of the basic prerequisites of industrial infrastructure for possible investment programs from domestic and external resources and welfare growth therein.

6.3.3 RISKS AND UNCERTAINTY

Lastly, but may not be least, some of the foreseeable uncertainty or concern that is casting some shadow over the expeditious and efficient implementation of the Project in terms of finance. Evidently shown in the table that immediately follows this commencing remark, the proposed Project seems to have gone too far beyond the capacity of CORAASAN only in the light of financial size and financing sources. While the analysis in the foregone sections of relevance diligently revealed a breakthrough to mobilize financial resources toward realization, with the economic justification that follows, issues would need to be streamlined and specifically addressed. These include, among others, (i) urgent need for enhancing financial basis of CORAASAN for the Project, (ii) fiscal support from the Government of Dominica, (iii) sufficient and equitable tariff policy, and iv) public accounting and auditing systems.

Magnitude of the Priority Project

	Initial Investment (US\$ 59.1 million)	O/M (US\$ 1.6 mil)
GDP (US\$ 19.7 bil)	0.3%	0.008%
Government Revenue (US\$ 3.04 bil)	1.9%	0.05%
Santiago City Revenue (US\$ 9.9 mil)	596.9%	16.2%
CORAASAN Revenue (US\$ 13.5 mil)	437.8%	11.8%
CORAASAN WW Revenue (US\$ 3.7 mil)	1,597.3%	43.2%

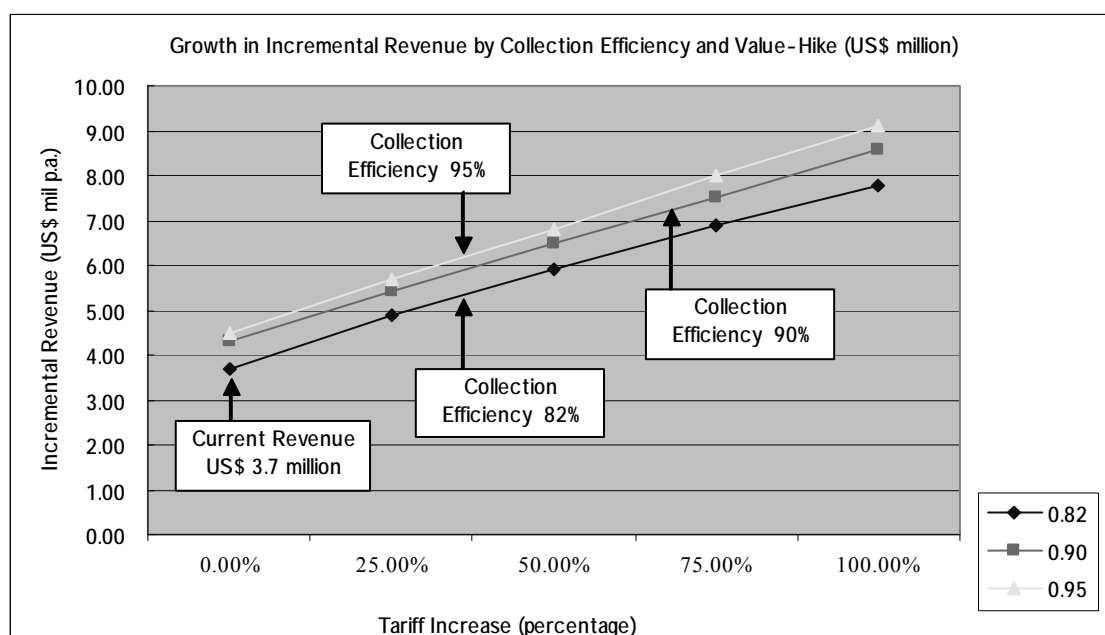
(1) Urgent Need for Enhancing Financial Basis-Collection Efficiency and Revision**1) Increasing Real Value of Sewerage Service in Pecuniary Term**

In pursuance of the government's commitment to improve and enhance pollution-free habitual and business environment, implementation of the Project is pressing. While the financial size of the proposed project seems to far exceed the pecuniary resources currently in place at CORAASAN, the analysis articulated in the foregoing sub-sections that the project could come in place, given that the policy condition of expanding financing basis through enhanced tariff collection capacity change in the schemes of cost-sharing amongst supplier (CORAASAN) and direct beneficiaries be met. To this end, the analysis profoundly suggested specifically to raise collection efficiency from 85-90 percent currently in place to 95 percent sooner. This closely relates also with "social equity" issue that everybody is equally obliged to share the cost of wastewater management in proportion to what he/she received under the scheme.

In this connection, one of the important assumptions with a bearing on the project benefit in a series of sequential analyses thus far is that the envisaged revenue attributable increase exactly in proportion to the quantity of incremental supply of wastewater treatment service under the project. This meant that, under the conditions of 95 percent collection efficiency and 60 percent revenue-hike in real terms over the period of 5 years to come, CORAASAN would gain US\$ 5.7 million-worth of cash revenue from direct beneficiaries. Project profitability and financial soundness as quantitatively measured by IRRs and DSCRs would loose the standing-ground unless this proposition of 100 percent linkage between incremental customer and benefits stand firm.

Change in Tariff Revenue (US\$ million/year) by Collection Efficiency and Value Increase

	Status Quo	25 %	50 %	75 %	100 %
Status Quo	3.7	4.9	5.9	6.9	7.8
90 %	4.3	5.4	6.5	7.5	8.6
95 %	4.5	5.7	6.8	8.0	9.1



Change in Profitability (FIRR) by Collection Efficiency (CE) and Revenue-hike

	Status Quo	25 %	50 %	75 %	100 %
CE-82 %	2.1 %	5.0 %	7.5 %	9.8 %	11.9 %
CE-90 %	3.3 %	6.3 %	8.9 %	11.3 %	13.5 %
CE-95 %	4.0 %	7.0 %	9.7 %	12.1 %	14.5 %

2) Tariff Structure - An Incipient View : Economic Efficiency, Cost Recovery, Cross Subsidy

In view of budget constraints at the government and the entity levels as well, an appropriate framework for domestic urban sanitation sector pricing, tariffs and contracts is therefore required not only to achieve an efficient allocation of scarce resources, but also to maintain the long-term financial sustainability of utilities and sanitation service undertakings, and to attract private sector, and possibly external capital, to the sector to the extent possible. In pricing, there would be two key objectives in terms of allocative efficiency: (i) tariffs should be sufficient to provide for the financial viability of the urban sanitation services and undertakings and generate a sufficient surplus to allow for their financing a significant part of their own investment programs in the years to come, and (ii) prices should be set at levels which encourage efficient use of service capacity and avoids wasteful consumption.

In view of the foregoing, it is reiterated that the tariff structure would need to be revised in line with CORAASAN's financial soundness and, again, social equity. As reflected in the preceding analysis, 60 percent of real-term hike associated with project implementation and service provision has been advised with a view to implementing the proposed scheme on a financially sound basis. Whether or not the hike takes place continually every year at the rate of around 3.5 percent with the presumption of 6.5 percent increase in demand for the service per year, meeting these policy conditions is a "MUST".

In the meantime, the principle of long-run marginal cost pricing for “Full Cost Recovery” would need to be introduced in wastewater development and operations by CORAASAN in pursuance of efficiency and financial incentives. With this, for instance, the US\$ 58.1 million investment program for incremental treatment of 10.2 million m³/year would need to be recovered annually at US\$ 5.6 million plus operation and maintenance cost that follows. This leads, in principle, the unit tariff currently in place of US\$ 0.38 /m³ (JICA team estimate) or US\$ 0.15 /m³ (CORAASAN information) upwardly to the level of long-run marginal cost of the service that stands at US\$ 0.7 /m³.

While the current analysis did not touch deeply the tariff structure in place other than that in Interim Report, a quick review on the finance management of CORAASAN led to some of the major findings and suggestions with the tariff-related issues in particular. Of this, the need for the upward revision of the tariff and equity-oriented cross subsidizing from water section to wastewater as well as large scale consumers to the small-size, or economically ragged sector in the society would be stressed and reiterated. Further, a concerted efforts in improving the charge collection system on the lines implied by efficiency and equity, unless otherwise no tangible success in managing and keeping supply of the service on financially sound basis could be realized, irrespective of how meticulously and constructively the charge structure and level have been in place.

(2) Fiscal Transfer from the Government of Dominica

Financial sustainability (Profitability) function that CORAASAN would face in financial management in the days that come will be depicted as follows.

$$\Pi = F(\rho, \tau)$$

Where ρ , τ denote the amount of *fiscal transfer*, *tariff collection efficiency*, and *tariff level*, respectively.

Besides a self-help effort on the tariff-related issues on the side of CORAASAN, government transfer plays a major role in the entity’s finance. With this in view, the Government of Dominica is profoundly requested to financially support CORAASAN in the management of wastewater public service and project implementation on efficient and financially sound manner. As reflected in the preceding analysis, the Project seems feasible and viable only when the government US\$ 12.1 million transfer or equity participation as a stakeholder, combined with CORAASAN’s own US\$ 10 million fund, could be of avail at the initial year of project commencement in 2002.

(3) Introduction of Public Accounting and Auditing systems

Accounting is a mean by which private investors can measure, evaluate and follow up the entity’s financial situation. In this light, Accounting is to provide useful, reliable and clear information for prospective investors’ decision-making. Provided that CORAASAN or any other public service undertakings would need to draw, in the days ahead, the private sector fund to their operation, of public accounting and auditing should be established as soonest. The public accounting aims, by the US Statement of Concepts No. 1 of the Financial Accounting Standard Board (FASB) to:

- 1) To provide useful information to the current and future investors and creditors and for other users that have to make rational investment and credit decisions,

- 2) To prepare information that help the users to determine the amounts, the opportunity and uncertainty of cash inflow projects related to the channeling of investments within the enterprise, and
- 3) To inform on the economic resources of an enterprise, the rights on them and the effect of the transactions and events that may change the allocation of said resources and the rights on them.

CORAASAN has have thus far no public auditing, thereby leading to the urgent need for the establishment of the legal and institutional framework for its external and internal auditing as soonest.

6.4 ENVIRONMENTAL CONSIDERATIONS

6.4.1 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.

The reduction of wastewater pollutant loads presently reaching the river and underground will improve the quality of life for those living in the Area. Improving the disposal of domestic, commercial and industrial wastewater will also improve the quality of life for those living in urban areas and near the factories premises. The Project will also contribute to improvement in the beneficial uses from the river, and groundwater or treated wastewater effluents, such as crop irrigation or reuse for industrial purposes.

6.4.2 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 which otherwise would inflow to river and the ground. The major benefits for residents will be the reduction in noxious odors and water- related diseases.

An improved wastewater management system will result in reduced overall costs for factories in comparison to on-site treatment, although it will mean higher operating costs for factories that are currently spending inadequate amounts on treatment or have no treatment facility at all.

Factories and commercial operations will also be required to pay for the costs of their connection to the trunk sewer or interceptors. Overall, however, operating costs are likely to comprise a relatively small proportion of factory turnover.

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.

6.4.3 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.

6.5 INSTITUTIONAL EVALUATION

In this section of the report, 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.

6.5.1 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.

6.5.2 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

6.5.3 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.

6.5.4 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 audiovisual 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.

6.6 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 sanitation conditions.