PROJECT BRIEF

1. IDENTIFIERS

PROJECT NUMBER:	
PROJECT NAME:	**Demonstrations of Innovative Approaches to the Rehabilitation of Heavily Contaminated Bays in the Wider Caribbean**
DURATION:	5 years
IMPLEMENTING AGENCY:	UNDP, UNEP
EXECUTING AGENCY:	UN Office of Project Services
REQUESTING COUNTRY OR COUNTRIES:	Cuba and Jamaica
ELIGIBILITY:	Eligible under para. 9(b) of GEF Instrument
GEF FOCAL AREA(S):	International Waters
GEF PROGRAMMING FRAMEWORK:	Operational Programme, #10, Contaminants – Based

2. SUMMARY

The GEF pilot phase project, "Planning and Management of Heavily Contaminated Bays and Coastal Areas in the Wider Caribbean" was a Pre-investment Facility (PRIF) project working in Havana Bay, Cuba; Cartagena Bay, Colombia; Puerto Limón, Costa Rica and Kingston Harbour, Jamaica. The project succeeded in achieving its principal objectives, including: 1) development of integrated Investment Action Plans for the rehabilitation and management of the four bays, 2) formulation of proposals for Institutional Strengthening to improve the operational capacities of those institutions responsible for bay management, and 3) identify sources of financing for the implementation of proposed remedial actions. The PRIF and related national and donor activities have helped to leverage baseline investments in the four bays in excess of $250 million.

One of the priority issues in the region identified in the pilot phase project and other studies is the problem of eutrophication resulting from excess inputs of nutrients to the coastal zone and adjacent international waters. Principal sources of nutrient contamination in the four pilot sites include poorly or untreated sewage, agriculture and industrial activities. As a follow-up to the PRIF and on-going baseline, the proposed GEF project will leverage national co-financing to help two of the countries to overcome a number of key barriers to the adoption of best practices that limit the contamination of their national and adjacent international waters. The project will implement demonstrations/pilot projects to test innovative technical, management, legislative and educational approaches for reducing the input of priority international waters contaminants, the nutrients nitrogen and phosphorus, to Havana Bay, Kingston Harbour and the adjacent Wider Caribbean. It will further strengthen and/or help create new institutions responsible for the rehabilitation and sustainable management of the two bays. The project supports the mandate of the Cartagena Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region, particularly Article 7, Pollution from Land-based Sources, and

Article 13, Scientific and Technical Co-operation, as well as the new Land-Based Sources Protocol currently in preparation.

In addition to the demonstrations/pilot projects noted above, UNEP-CAR/RCU will be responsible for regional coordination, including sharing and dissemination of project activities and nutrient pollution control strategies for the Wider Caribbean. Activities will include print and on-line information dissemination, regional workshops and study tours, in order to promote and exchange best practices and lessons learned to other countries in the Wider Caribbean Region facing similar problems with excess nutrients and eutrophication.

3. COSTS AND FINANCING (US$):

GEF:	- Project	:	US$ 6.91 million
	- Support Costs	:	US$ 0.40 million
	- PRIF	:	US$ 2.50 million
	Subtotal GEF	:	US$ 9.41 million
Co-financing:			
	- Government		
	Cuba	:	US$ 14.21 million*
	Jamaica	:	US$ 11.35 million
	Sub-total, Gov't.	:	US$ 25.55 million
	- Nordic Funds (PRIF)	:	US$ 0.30 million
Total Project Cost		:	US$ 35.26 million

4. ASSOCIATED FINANCING (US$) : US$ 183.24 MILLION

5. OPERATIONAL FOCAL POINT ENDORSEMENT:

Jamaica 17 March 1999
Name: Leonie Barnaby
Title: Director
Organisation: Environmental Protection & Conservation Division, Ministry of Environment and Housing

Cuba 16 March 1999
Name: Humberto Arango
Title: Director
Organisation: Ministry of Science, Technology and the Environment

6. **IA CONTACT:** Nick Remple, GEF Regional Coordinator, Latin America and the Caribbean, DC1-2284, 1 United Nations Plaza, New York, NY 10017 USA, Tel. 212 906 5426, Email:nick.remple@undp.org

* Assumes US$1 = 1 Cuban Peso

Background and Context (Baseline course of action)

Introduction

1. The Wider Caribbean Region (WCR) comprises the marine environment of the Gulf of Mexico, the Caribbean Sea, and the 200 mile zone of the Atlantic Ocean adjacent to the countries in the region. The Caribbean Sea, an arm of the Atlantic Ocean, is partially enclosed on the north and east by the Islands of the West Indies, bounded to the south by South America and Panama and to the west by Central America. The WCR has an area of about 1 942 500 km^2.

2. The main oceanic current in the Caribbean Sea is an extension of the North Equatorial and South Equatorial currents, which enters the Sea at the south-eastern extremity and flow in a generally north-western direction. The currents originate mainly as a consequence of wind and tide action, but are also affected by the topography of the sea bottom and the configuration of the coastline. The current velocity is generally considerable and may contribute significantly to the dispersion of long-lived contaminants generated in any site to the region, creating a potential transboundary pollution effect.

3. Economic activity in the WCR focuses on the expansion of tourism, agriculture and extractive industries that are often directly or indirectly linked to coastal and marine resources. Population growth combined with poorly managed economic development and industrialisation in the region have led to widespread contamination of the coastal and international waters of the Wider Caribbean. Principal contaminants impacting the region domestically and/or across national borders include untreated sewage, solid waste, sediments, petroleum hydrocarbons, pesticides and agricultural run-off, primarily from land-based sources.

4. An inventory of land-based point sources of pollution in the WCR, conducted in 1994, revealed that domestic wastewater/sewage was the predominant source of pollution, followed by six industrial categories: oil refineries, sugar refineries and distilleries, food processing, manufacture of beer and other drinks, pulp and paper factories and chemical manufacturing. Although not a part of the 1994 study, urban and agricultural non-point sources of pollution are also recognised as significant contributors to pollution of the WCR.

5. Nutrient enrichment is of increasing concern in the WCR, as it causes eutrophication[1], algal blooms, oxygen depletion and changes in marine ecosystem biodiversity. In many of the bays connected to highly populated centres, extremely low levels of oxygen are observed in the lower part of the water column, where bottom sediments are often turned black. These hypoxic conditions kill and drive away fish and benthic species. Like in other areas facing widespread eutrophication (Black Sea, Baltic Sea, Yellow Sea, Gulf of Mexico, etc.), there is

[1] A recent definition of eutrophication is that provided by Nixon (Ophelia 41:199-219, 1995): "An increase in the rate of supply of organic matter to an ecosystem"; this is nearly always the result of excessive inputs of the nutrients nitrogen and phosphorus to the aquatic environment. The nutrient enrichment most commonly results in the excessive stimulation of phytoplankton growth but may also trigger the growth of larger plants (macrophytes) on the sea floor in shallow areas.

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a longer-term risk that this phenomenon will extend beyond the natural borders of the bays and into the Gulf of Mexico and the Caribbean Sea. Nutrient enrichment and associated eutrophication over broad areas is so ubiquitous that it is now considered a global problem, and nutrients are considered to be among the priority contaminants requiring attention in the GEF International Waters Operational Programme 10 - Contaminants-Based.

6. The Caribbean Action Plan emerged in 1981 as a result of many years of work by governmental and non-governmental representatives of the Caribbean community. Assistance in the development of the plan was provided by the United Nations Environment Programme (UNEP) and the Economic Commission for Latin America and the Caribbean (ECLAC). The program objectives embraced by the Caribbean Action Plan, which was adopted in 1981, include the following: assistance to all countries of the region, recognising the special situation of the smaller islands; co-ordination of international assistance activities; strengthening existing national and sub-regional institutions; and technical co-operation in the use of the region's human, financial and natural resources.

7. In 1983 the Cartagena Convention (CAR) was adopted as the legal instrument for the implementation of the Caribbean Action Plan. The Convention is a framework agreement setting out the political and legal foundations for actions to be developed in the implementation of the Plan. These actions are directed by a series of operational Protocols designed to address special issues and to initiate concrete actions. The Convention Protocols include: the Oil Spills Protocol, concerning cooperation among countries in the region in combating oil spills and the preparation and updating of contingency plans; the Specially Protected Areas and Wildlife (SPAW) Protocol, an instrument for dealing with marine nature conservancy measures to protect, preserve and manage sensitive areas and threatened or endangered species of flora and fauna; and the Land-Based Sources of Marine Pollution (LBSMP) Protocol (Draft), an instrument for dealing with environmental pollution reaching the marine environment from land-based sources and activities, both point and non-point source. The governments of the nations and territories of the WCR established the Caribbean Environment Programme (CEP) in support of the Convention and its Protocols. A regional co-ordinating unit (UNEP-CAR/RCU) has been established in Kingston, Jamaica and serves as a Secretariat for the CEP.

8. Most of the countries in the WCR have also adopted national legal instruments to control various aspects of domestic and industrial wastewater disposal to coastal and marine waters. The degree to which these legal instruments are applied in the practical management and control of environmental pollution varies from country to country, but is generally rather weak. At the regional level, a new protocol to the Cartagena Convention on land-based sources of marine pollution (LBS protocol) is currently under development, and is expected to be adopted in 1999 (see Annex 5). The Contracting Parties to the Convention have taken advantage of the various studies of contamination of the Wider Caribbean in developing this protocol, with an aim towards regulating the sources most impacting the WCR. As drafted, the LBS Protocol, through source-specific annexes, sets regional effluent limits for selected point sources, based on appropriate control technologies. The LBS Protocol will also obligate the signatories to develop national plans

to implement best management practices for non-point sources and to implement coastal zone management programs. Both Jamaica and Cuba have signed the Cartagena Convention and have been active in the negotiations on the LBS Protocol.

9. The two geographical areas selected for this project, Havana Bay in Cuba and Kingston Harbour in Jamaica, are both heavily polluted areas with increasing industrial and agricultural activities and an expected growth in population and tourism. For both countries sewage and nutrient enrichment have been identified as priority environmental concerns. In addition, other countries in the Wider Caribbean Region face many of the same environmental problems, connected to discharges of untreated or poorly treated sewage. Thus, some of the approaches to nutrient removal to be tested in this project will be replicable between the two sites as well as among other sites in the Wider Caribbean Region.

Background - The Pilot Phase GEF Project

10. The GEF Pilot Phase (PRIF) project (1995-1998), "Planning and Management of Heavily Contaminated Bays and Coastal Areas in the Wider Caribbean", included Colombia (Cartagena Bay), Costa Rica (Puerto Limon), Cuba (Havana Bay) and Jamaica (Kingston Harbor) as participating countries.

The project had three main objectives:

1. Develop Integrated Investment Action Plans for the rehabilitation and management of the bays and surrounding coastal areas.
2. Formulate Institutional Strengthening Proposals to improve the operational capacities of those institutions responsible for bay management.
3. Identify Sources of financing for the implementation of proposed remedial action plans.

11. The project was the largest pre-investment grant financed by the Global Environment Facility (GEF) under its concluded pilot phase program. The GEF project was originally initiated by the UNEP CAR/RCU office in Kingston. The project was implemented by the United Nations Development Program (UNDP) and executed by the United Nations Office for Project Services (UNOPS) from November 1995 to May 1998.

The project achieved the following results:

- The present environmental conditions of the bays and coastal zones were characterized including the impact on their biodiversity and their regenerative capacity.
- Inventories of point and non-point sources of pollution were brought up to date including sewage, agricultural discharges, industrial and solid waste.
- Proposals to restructure the institutions responsible for bay management and to improve the legislative framework guiding economic activity to sustain remedial actions were prepared.
- An integrated investment action plan for the rehabilitation of the bays and coastal areas was formulated, to be implemented over the next 5, 10 and 15 years.

- An integrated inter-institutional management plan aimed at increasing the coordination, managerial, planning and enforcement capacities of the institutions responsible for bay and coastal zone management was developed.
- A capacity building program to further develop the technical and scientific capacities of the research institutions involved in environmental studies of bays and coastal areas was developed.
- Regional and national workshops were carried out to promote exchange of information, institutional cooperation and replicate project-related experiences in the Caribbean.
- The countries' environmental institutions were equipped and strengthened. Scientific equipment, modern office and communication systems and vehicles were provided.

The activities presented in this proposal are based on the information and results from the GEF Pre-investment Facility (PRIF) project.

Background – Havana Bay, Cuba

12. Havana Bay is the most important port in Cuba. It is surrounded by urban and industrial developments, which have a major impact on the quality of water reaching the bay and distributed to the Wider Caribbean Region. The average residence/turnover time of the water in the Bay is about 8 days.

13. Havana Bay receives suspended solids, hydrocarbons, heavy metals and other micro-pollutants from agriculture, industry and port activities. High concentrations of hydrocarbons and heavy metals have been observed in the sediments, and degradation of the ecosystem is increasing, both within Havana Bay and the adjacent Wider Caribbean area.

14. The existing wastewater collection system in Havana was designed for approximately 600 000 inhabitants. This system was constructed without any treatment of the wastewater. Today the main collector system is overloaded and many sewers discharge to local rivers flowing through the city. The tributary area of Havana Bay, including the rivers Luyano and Martin Perez, thus receives polluted water from large residential areas and also some industrial areas.

15. The pilot phase project determined that the main sources of pollution to Havana Bay are: 1) the Luyano River (organic material, nutrients, sewage, solid waste), 2) the gas plant and the oil refinery, 3) the Regla and Hacendados fish factories, and 4) the fishing port.

16. The project also determined that Havana Bay receives about 48 000 m^3 of wastewater per day, carrying around 4 800 kg nitrogen and 1 200 kg phosphorous, resulting in elevated concentrations of nutrients. Studies show that the waters of Havana Bay are strongly affected by the dumping of sewage, with concomitant risks to human health. Increased nutrient concentrations have promoted eutrophication and bacterial growth, and degradation of sea-grass and coral reef ecosystems.

17. The Government of Cuba has taken some mitigating actions to rehabilitate Havana Bay, but the special economic situation in Cuba has reduced the possibilities for

intervention. Cuba has several ongoing development programs for alternative, environmentally sound technologies related to wastewater treatment (WWT). Demonstrations of more sustainable and cost-effective technologies, which are expected to be applicable to other countries in the region, are urgently needed. The economic situation in Cuba also accentuates the need for potential domestic production of fertilisers and energy recovered from alternative WWT approaches.

18. Cuba has signed several international agreements that have established an interrelationship between the national legislative framework and international regulations. In spite of this, an analysis of the institutional and legal framework conducted in the pilot phase project found that: 1) Current laws and regulations are diffuse and to a certain degree outdated and not enforceable, 2) Port authority is lacking, and 3) The integration between central and sectoral government institutions is insufficient.

19. A proposal for rules and regulations for the use and protection of Havana Bay has been elaborated. The rules define the use of the bay in terms of port, industrial, cultural and tourist activities and the treatment of waste. They include environmental monitoring, environmental education and public information plans and the establishment of a monetary fund for the rehabilitation and a sustainable development of the bay. Meanwhile, and taking into consideration the above-referred deficiencies, the Cuban Government created on 29 July 1998 a Governmental Working Group for the sanitation, conservation and development of Havana Bay. The group is chaired by the Ministry of Transportation while the Government of the City of Havana and the Ministry of Science, Technology and Environment will operate as vice-chairs. On an interim basis, this group will assume the functions of a port authority until the new rules and regulations are approved.

Background – Kingston Harbour, Jamaica

19. Kingston, the capital of Jamaica, started its modern history when the English fleet sailed into the harbour in 1655. Kingston Harbour is the seventh largest natural harbour in the world, and consists of an upper basin and the inner and outer harbour. The harbour is relatively shallow, and the ship canal is regularly dredged to maintain the navigability of the canal. The residence time of water in the harbour ranges from 152 to 176 days between the wet and dry seasons.

20. The pilot phase project determined that the following sectors and activities contribute to the contamination of Kingston Harbour:

- Sewage is by far the most important source for the contamination of Kingston Harbour. Sewage from 25% of the population (850,000) is discharged with only limited treatment into the harbour, and the rest is not treated at all. The total wastewater production from the sewered areas is around 17 MGD (million gallons per day). Sewage is estimated to contribute 50 and 75 percent, respectively, of nitrogen and phosphorus inputs to the harbour.

- Industry established at the shore of Kingston Harbour includes oil refineries, cement production, power station, food industry, fish processing plants and garment manufacturing. Industrial wastewater is discharged into the harbour without any treatment.
- Uncollected solid wastes from the city are dumped into gullies and storm water drains, ending up in the harbour.
- From the port activities both wastewater and solid waste from ships are discharged into the harbour.
- Releases into the Rio Cobre and use of agrochemicals, including nutrients, are also important sources of pollution to the harbour.

21. Through these activities Kingston Harbour receives a large amount of nutrients, organic matter, suspended solids and toxic compounds and other micro-pollutants (heavy metals, chemicals, oils and greases). This has lead to severe eutrophication, and the water quality is continuing to deteriorate. In addition, sedimentation from Rio Cobre and Sandy Gully causes severe degradation of Hunts Bay. The pilot phase project determined that there is not much biological activity left in the bay, and that the sediments are so contaminated that they can be characterised as a net source of pollution to the bay, even if the other inputs of pollutants were cut off.

22. The pilot phase project determined that pollution from Kingston Harbour is of broader concern to the southern coast of Jamaica. Planktonic communities in the Port Royal Cays and Hellshire coast bear strong similarities to communities inside the harbour, and it is estimated that as much as 60% of the pollution observed along the Hellshire coastline originates from the harbour.

23. It has been reported that the deterioration of Kingston Harbour has been going on for about 30 years. Several studies have been performed and remedial actions have been proposed, but so far relatively little progress has been made in implementing these actions, mainly due to a lack of financial resources.

24. The Natural Resources Conservation Authority Act provides a sound and sufficient legal framework for the rehabilitation of Kingston Harbour. The institutional arrangements for management of sewage and solid waste are, however, fractured among too many agencies and the locus of responsibility seems unclear. In addition, environmental laws and standards are not very rigorously enforced.

Background – Summary

25. Table 1 summarises the pollution problems, the environmental impacts and obstacles to solve these problems for the Wider Caribbean Region and for the two selected

bays. The table shows that the two bays/countries face many of the same environmental problems, i.e. problems connected to discharges of sewage, nutrients and micro-pollutants, and that some of these discharges may also pose a risk for environmental degradation of the Wider Caribbean Region.

Table 1 Environmental impacts and obstacles

Pollution Problem	Sources	Environmental Impacts	Obstacles/ Barriers	Comments
Wider Caribbean				
Nutrients	Untreated sewage Agriculture run-off Industry	Risk for: Algae blooming Eutrophication Oxygen depletion Reduced biodiversity Reduced reproduction of species	Lack of financial resources Weak institutional and legislative frameworks	Cartagena Convention focuses on the environmental problems in the Wider Caribbean
Micro-pollutants (heavy metals, persistent organic pollutants, incl. Pesticides, oil and hydrocarbons)	Industrial and oil activities Hazardous waste Use of agro-chemicals Ship traffic	Bio-accumulation Contamination in food chain Reduced biodiversity	Lack of enforcement of existing regulations Lack of incentives to reduce emissions of persistent toxic substances Lack of alternative, more benign chemicals and industrial processes	Several international conventions and agreements focus on pollution of the marine environment (MARPOL, Oil Pollution Preparedness, etc.)
Havana Bay, Cuba				
Nutrients	Sewage Agriculture	Increased algae and bacterial growth Degradation of sea-grass and coral reef ecosystem Eutrophication Oxygen depletion Reduced biodiversity	Lack of financial resources Outdated, dispersed and non-enforceable legislation Lack of port authority Insufficient integration of sectoral and central institutions	Cuba has signed several international conventions and agreements (MARPOL, Cartagena Convention)
Suspended solids	Rivers Land use in watersheds	Sedimentation Reduced biodiversity		
Micro-pollutants (heavy metals, persistent organic pollutants, incl. Pesticides, oil and hydrocarbons)	Industrial and oil activities Hazardous waste Ship traffic	Bio-accumulation Contamination in food chain Reduced bio-diversity		
Solid waste	Port activities Industry Households	Littering Water pollution Threats to selected organisms		
Kingston Harbour, Jamaica				
Nutrients	Sewage	Increased algal and bacterial growth Eutrophication Oxygen depletion Reduced biodiversity	Institutional arrangements are fractured among too many agencies and the locus of responsibility seems unclear	Legal framework for the rehabilitation of Kingston Harbour exists. Jamaica has signed MARPOL and the Cartagena Convention
Suspended solids	Rio Cobre Sandy Gully	Sedimentation Reduced biodiversity	Lack of financial resources	
Micro-pollutants (heavy metals, persistent organic pollutants, incl. Pesticides, oil and hydrocarbons)	Industrial and oil activities Hazardous waste Ship traffic Use of agro-chemicals	Bio-accumulation Contamination in food chain Reduced biodiversity	Weak enforcement of environmental laws and standards	

Pollution Problem	Sources	Environmental Impacts	Obstacles/ Barriers	Comments
Solid waste	Port activities Industry Households	Littering Water pollution		

Rationale and Objectives (Alternative)

26. The *global environmental objective* of the project is to demonstrate and promote regional replication of innovative technical, management, legislative and educational approaches to reducing nutrient loads to Havana Bay and Kingston Harbour and to the Wider Caribbean Region.

27. The *long-term objective* of the project is to promote and facilitate environmentally sustainable development and management of the two bays and to disseminate and replicate successful approaches to the rehabilitation of these bays to other sites in the Wider Caribbean facing similar environmental challenges.

28. The rehabilitation of the national and associated international waters will be based on mitigating measures and institutional strengthening and co-operation in each of the selected areas. As shown in Table 1 the main environmental problems on a regional basis are connected to the discharges of nutrients (nitrogen and phosphorus) and micro-pollutants (heavy metals and persistent organic pollutants, including pesticides).

29. This GEF project will complement ongoing baseline activities in Havana and Kingston aimed at improving the quality of the respective aquatic (marine) systems, by introducing sustainable contaminant reduction and reuse technologies, and enhancing waterbody management capabilities, thus reducing environmental threats to the two bays and the Wider Caribbean. Based on the analyses carried out during the pilot phase project, the two countries have prioritised similar activities connected to biological treatment of sewage and nutrient removal. This is illustrated in Table 2, which shows the main obstacles to improving environmental quality and the proposed activities for each country (reference is made to project activity descriptions on the following pages).

Table 2 Global contaminants and proposed activities in each country

	Obstacles for improved environment	**Proposed activities (See activity description on the next pages)**		
		Regional	**Cuba**	**Jamaica**
Nutrients	Institutional weakness			4.1
	Incentive framework	1.2		4.1
	Public awareness	1.1		4.1
	Treatment capacity (lack of funding)		2.1, 2.2, 3.1, 3.2	5.1, 5 2, 5.3

Rationale for GEF Financing

30. The project falls under GEF Operational Program #10 International Waters – Contaminant-Based, whose objectives include "….demonstrate strategies for addressing

land-based activities that degrade marine waters…". In OP10, "GEF plays a catalytic role in demonstrating ways to overcome barriers to the adoption of best practices limiting contamination of International Waters". The main expected outputs from the 5-year project are

- Demonstrations of substantial reductions of nutrient inputs to the two bays, through the application of more sustainable technologies. The technologies proposed perform in line with the effluent limitations for municipal wastewater described in the draft LBS protocol to the Cartagena Convention (see annex 5).
- Development and strengthening of national environmental institutions responsible for management of the respective bays.
- Regional activities aiming at disseminating best practices and lessons learned from the project and related activities in the region.

31. The project will be consistent with and supportive of national action programs in the two countries aimed at reducing contamination of the bays. It is designed to provide incremental financing to facilitate the efforts of the two countries to achieve global environmental benefits through the reduction of transboundary pollution (nutrients) into the WCR. The project will support national investments, institutional arrangements, and capacity building programs supportive of global environmental protection.

32. The initial GEF support to this project will contribute to the reduction of financial risks and to overcoming economic transaction barriers.

33. The project will help build awareness, necessary skills, and capabilities among the different stakeholders, in order to assure the sustainable use of the bays and coastal areas as multiple use zones. The institutional framework will be strengthened by involving the different stakeholders in constructive discussions and through establishment of appropriate incentive structures.

Project Components/Activities and Expected Results

34. The two countries have identified somewhat different technological approaches for the rehabilitation of the bays and reduction of nutrient inputs to the bays and WCR. Some regional activities by UNEP/CAR-RCU are included to ensure the exchange of information on successful scientific and technical approaches to nutrient control, and on institutional and legislative frameworks and inter-institutional cooperation between the two countries and other countries within the WCR. This will also include necessary co-ordination with the relevant activities going on within the framework of the Cartagena Convention.

35. The project includes five outputs described below. A summary of the outputs/activities and the expected results are described in table 3.

Table 3 Outputs/activities and expected results

Outputs/Activities	**Expected results**
Output 1: *Regional Coordination, Exchange and Dissemination of Results (UNEP- CAR/RCU)*	

Outputs/Activities	Expected results
Activity 1.1: Regional workshops on nutrient removal technologies and sludge utilisation	Exchange of information from the project of interest to other countries in the region.
Activity 1.2: Study Tour for project officials	Technological capacity strengthening on nutrient removal and sludge treatment
Activity 1.3: Terminal workshop reviewing available options for nutrient removal and sludge utilisation	Proceedings from the workshop will be printed for regional dissemination and available on Internet.
Project site: Havana, Cuba	
Output 2: *Construction of a sewage treatment plant, including nutrient removal and sludge utilisation.*	
Activity 2.1: Nutrient removal	Reduced inputs of nutrients from sewage into Havana Bay and the Wider Caribbean
Activity 2.2: Sludge treatment	Utilisation of waste and wastewater from the treatment plant as energy and/or as fertilisers
Output 3: *Demonstration projects focusing on recycling of nutrients and energy from waste and wastewater.*	
Activity 3.1: Zero emission housing unit	Demonstration of "zero emission housing units" applicable to urban and rural areas
Activity 3.2: Sewage treatment demos in areas with low infrastructure and housing standards	Demonstration of water saving backwater collection system, including low flush toilets and pond wetland system for water treatment
Project site: Kingston Harbour, Jamaica	
Output 4: *Institutional strengthening for improved co-ordination of institutions involved in rehabilitation and environmental management of Kingston Harbour.*	
Activity 4.1: A new institutional entity responsible for the rehabilitation of Kingston Harbour	Improved coordination of activities, increased public and institutional awareness and more efficient implementation of environmental projects. Better coordination between existing monitoring activities by development of a monitoring plan. Annual reports on the environmental situation in the Bay
Output 5: *Design, construction and operation of a wastewater treatment facility for the Kingston Metropolitan Area (KMA)*	
Activity 5.1: Design of wastewater treatment facility	Reduced contamination from sewage effluent, including nutrients, to Kingston Harbour and the adjacent Caribbean Sea
Activity 5.2: Construction of wastewater treatment facility	
Activity 5.3 Operation and maintenance of the wastewater treatment facility	

Output 1: *UNEP-CAR/RCU will coordinate with the two involved national agencies to provide options on various appropriate treatment and recycling technologies for nutrient removal from sewage.*

36. The regional activities are included to ensure coordination between the two countries and compliance with the Cartagena Convention and its Protocols relevant to the project areas. Regional workshops will be convened in coordination with UNEP-CAR/RCU to discuss technical exchange and cooperation throughout the lifetime of the project. In addition, technology exchange and dissemination of lessons learned from this project should have greater regional benefits.

Activity 1.1: UNEP-CAR/RCU will conduct two regional training workshops (for three days) on nutrient removal technologies and sludge utilisation for sewage treatment systems in large communities. Though the ultimate goal is to provide technology transfer to the two target communities of Havana and Kingston, these workshops will be open to participation from all countries of the Wider Caribbean Region. These workshops will review available options for nutrient removal and sludge utilisation relevant to the technological, climatic, economic, institutional, and social/cultural conditions of the Wider Caribbean. Proceedings from the workshop will be printed and put on-line for regional dissemination.

Activity 1.2: UNEP-CAR/RCU will organise study tours for personnel from the two target countries -- Jamaica and Cuba -- that will be involved in the project. This will be a follow up activity from the workshops to more fully communicate the nutrient removal and sludge utilisation technologies.

Activity 1.3: A terminal workshop on viable opportunities for nutrient removal and sludge utilisation in the Wider Caribbean Region. Following the completion of the Havana and Kingston projects, a regional workshop will be convened by UNEP-CAR/RCU in coordination with the two participating national agencies to review lessons learned from the treatment technologies employed at the two sites. This three-day workshop will have regional implications for technology transfer for future similar construction activities in the region.

Output 2: *Design and build a demonstration sewage treatment plant in Havana, Cuba, with nutrient removal and sludge utilisation*

37. A new, integrated sewage treatment plant will be constructed which will cover a population of about 57,000 in the Luyano River area. The plant will include nutrient removal and will be designed for sludge utilisation either to energy or as fertiliser. The GEF substitutional financing covers the difference in cost between a basic primary/secondary treatment system and a more advanced, integrated system that includes tertiary treatment (removal of the nutrients nitrogen and phosphrous).

38. Process description: The proposed sewage treatment plant uses an activated sludge process, designed to remove suspended solids, organic matter and nutrients. The plant will be based on the following design criteria:

Table 4. Design criteria for the demonstration treatment plant in Havana

Design parameter	Influent loading	Effluent quality
Average wastewater flow	1100 m^3/hour	
Maximum wastewater flow	2400 m^3/hour	
Organic matter (BOD_5)	2880 kg/day	<20mg/l
Suspended solids (SS)		<30 mg/l
Total nitrogen (Tot-N)	528 kg/day	>70 % removal
Total phosphorous (Tot-P)	120 kg/day	>56 % removal

39. The proposed sewage treatment system includes the following elements:

- Collection and transport system to convey wastewater to the treatment plant site
- Headworks consisting of a bar screen, grit and grease removal, and if necessary, an influent pumping station
- Primary clarifier to remove suspended solids from the wastewater
- Biological treatment unit consisting of alternating anaerobic/anoxic/aerobic zones for optimised nutrient removal, equipped with biological selector zones
- Secondary clarifiers for the separation of treated wastewater and sludge
- Sludge return system to maintain a high suspended solids concentration in the biological process
- Effluent polishing in vertical flow filters
- Discharge piping

Activity 2.1: Nutrient removal

40. Nutrient removal occurs at several stages through the plant cycle. The two processes involved in nitrogen removal are called nitrification and denitrification. Nitrification converts ammonia in the incoming wastewater to nitrate. This process requires oxygen. Denitrification converts nitrate to nitrogen gas. This is a process that requires a relatively high organic loading and anoxic conditions. The effluent of an activated sludge process has elevated concentrations of nitrate due to the nitrification process in the aerated zone. By recycling a portion of this wastewater to the influent end of the basin, the nitrates will be exposed to anaerobic conditions and a high organic loading.

41. Phosphorus removal is accomplished by first exposing the wastewater and return activated sludge to anaerobic conditions. Micro-organisms exposed to alternating anaerobic and aerobic conditions increase their uptake of phosphorus above normal levels. Following the anaerobic zone is an aerated zone where the actual phosphorus uptake takes place. Sludge removed from this process will therefore have elevated levels of phosphorus, and effluent from this process generally has P concentrations less than 1 mg/l.

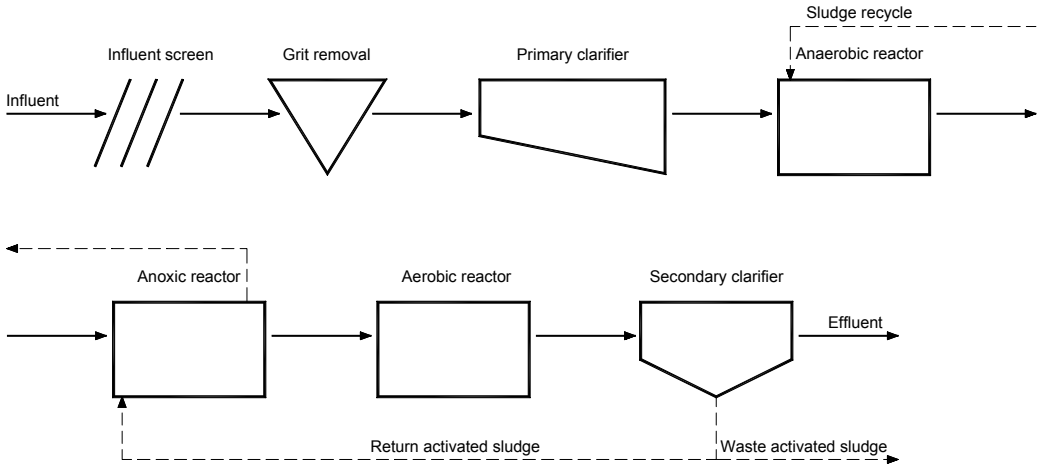
42. To accomplish both nitrogen and phosphorous removal, these two schemes must be combined. This can be accomplished by dividing the activated sludge process into three zones; first an anaerobic zone followed by an anoxic zone where nitrate is present, and finally an aerobic zone. This system is expected to remove approximately 60-70% of the nitrogen and phosphorous.

Activity 2.2: Sludge utilisation

43. The project proposal includes utilisation of the sludge produced in the wastewater treatment process, either as a fertiliser or as energy from gas. There are three possible solutions for sludge treatment:
1) Dewatering, and mixing with yard waste/bark for compost production, 2) Anaerobic digestion for methane gas production and energy utilisation, and 3) Dewatering, and anaerobic stabilisation.

The pre-design report will provide a final proposal for which sludge treatment alternative will be implemented.

Figure 1. Diagram of the proposed sewage treatment plant in Havana



Output 3: *Demonstration projects focusing on decentralised wastewater treatment*

45. To demonstrate sustainable technologies for decentralised wastewater treatment and disposal, two smaller projects are included in the project proposal. These activities will be a part of ongoing research activities at the University of Havana. The technologies to be demonstrated include use of low flush toilets to reduce water consumption and wastewater production, black water collection and treatment, and small scale constructed wetlands for wastewater treatment. For these demonstration projects
training/educational programs and monitoring programs will also be implemented.

Activity 3.1: Zero emission housing

46. Cuba is producing prefabricated apartment buildings for use in Cuba and for export (MATCO house). These buildings can be fitted with low flush toilets and separate collection systems for black and grey water. At approximately eight demonstration housing units, black water will be collected and transported to a central treatment facility, while grey water will be treated locally and used for irrigation purposes. About 90 percent of the nutrients are removed and recycled.

Activity 3.2: Sewage treatment in areas with low infrastructure and housing standards

47. In a small suburban area "Il Moro" all sewage is currently drained to an open canal and ends up in the Luyano River and subsequently in Havana Bay. To demonstrate alternatives for decentralised wastewater treatment, a constructed wetlands system will be built. The system consists of a septic tank, a trickling filter and open-surface constructed wetland and serves 50 households. The expected treatment efficiency for nutrients in this system is approximately 60-80 percent.

Output 4: *Institutional strengthening for improved co-ordination of institutions involved in rehabilitation and environmental management of Kingston Harbour (Jamaica)*

48. A key obstacle for improving the environment in Kingston Harbour is the absence of co-ordinating activities and an institution with the overall responsibility for the environment in Kingston Harbour. Thus, a project co-ordinating unit with the mandate to develop co-ordinating activities and identify responsibilities, and necessary institutional strengthening will be established.

Activity 4.1 Creation and coordination of a new inter-institutional entity responsible for the rehabilitation of Kingston Harbour

49. The National Steering Committee (NSC) is currently the government's highest level policy-making body with regard to the planning and management of Kingston Harbour. The new inter-institutional organisation for the rehabilitation of Kingston Harbour will consist of the National Steering Committee, the Kingston Harbour Executive Committee (KHEC), a Stakeholders Council (SC), and the new Project Management Unit (PMU). The PMU will serve as the central coordinating unit for Kingston Harbour activities and will report to the NSC and the KHEC. The different stakeholders in Kingston will through such an institution develop environmental awareness, necessary skills and capabilities, in order to improve the environmental management of Kingston Harbour.

50. This new institution (the PMU) will be given the required political power. Existing institutions involved in the rehabilitation of Kingston Harbour will recognise the new organisation as the main responsible institution for the overall planning and coordination of projects affecting the environmental quality of the harbour. For the implementation of different projects that are initiated, the institution will delegate projects to the appropriate existing organisations.

51. The PMU will have the direct responsibility to: 1) Implement and coordinate the various projects initiated to clean up Kingston Harbour, 2) Co-ordinate already initiated projects for improvement of the harbour's water quality, and 3) Review existing laws and regulations regarding the Kingston Harbour and initiate legislation improvements.

52. The first task for the PMU will be to take the responsibility for the design and construction of the new wastewater treatment plant. The next step will be to develop and implement a monitoring program for Kingston Harbour to monitor and document the impacts of different interventions, including the treatment plant.

53. Other possible projects the PMU could plan and coordinate (with additional, non-GEF, funding) could include:

- Improved agricultural practices
- Treatment of agricultural runoff using constructed wetland technology
- Treatment of municipal wastewater
- Waste management programs, including industrial waste minimisation, solid waste reduction, waste recycling, solid waste collection, ship waste,
- Program for rehabilitation and operation of smaller package treatment plants

Output 5: *Design and construct a wastewater treatment facility (5 MGD) for the Kingston Metropolitan Area (KMA) (Jamaica)*

54. A sewage treatment plant based on an Advanced Integrated Ponding System (AIPS) in combination with constructed wetlands will be constructed. The system is capable of removing up to 95% of the nutrients; with average efficiencies of around 80%. The proposed treatment plant is a pilot plant facility, treating only a portion of the total wastewater from Kingston, although long-term plans providing wastewater service for the entire city is under discussion. GEF financing will cover the incremental costs related to nutrient removal, while the Jamaican government is responsible for co-financing of the primary and secondary treatment components. Design criteria for the treatment facility is presented below:

Table 5: Design Criteria for AIPS system in Kingston

Design parameter	Influent loading	Effluent quality
Average wastewater flow	800 m^3/hour	
Maximum wastewater flow	2000 m^3/hour	
Organic matter (BOD_5)	150 mg/l	<5 mg/l
Organic matter (COD)	200 mg/l	<10 mg/l
Total nitrogen (Tot-N)	25 mg/l	<2.0 mg/l
Total phosphorous (Tot-P)	5 mg/l	<2.0 mg/l

55. The AIPS technology is a low-cost alternative to high-rate biological nutrient removal plants. The area requirements are quite high, but the simplicity of the treatment plant still makes it a viable option when space is available. The proposed treatment facility for Kingston consists of headworks with manually cleaned bar screens and grit removal in parallel concrete channels. From the headworks the wastewater flows by gravity to a primary or facultative pond. This pond has an aerobic surface overlaying deep anoxic cells in the influent for sedimentation and digestion of heavy solids in the incoming wastewater. Oxygen in the aerobic layer is provided by algae growth.

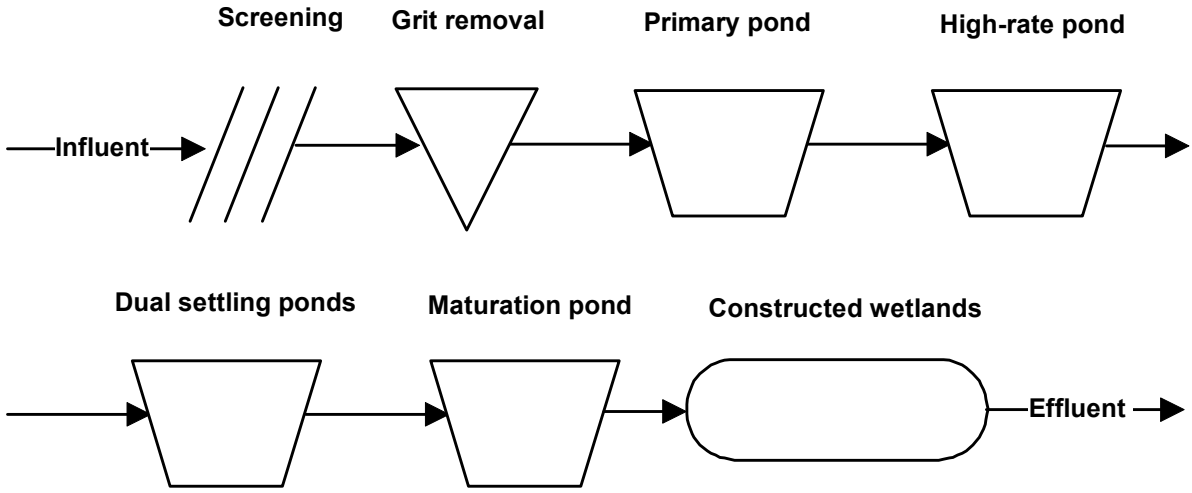
56. Next, the wastewater passes a high rate pond where additional oxygen is provided by algae growth, and soluble organic matter is oxidised. This pond is also equipped with deep cells in the influent end for sedimentation and digestion of solids passing over from the previous pond. The wastewater continues to dual settling ponds where the algae from the previous pond settle out. Finally, a maturation pond provides additional bacterial breakdown and storage for irrigation or other reuse. After the AIPS system, the wastewater is polished in constructed wetlands, providing additional nutrient removal. The wetlands can utilise existing mangroves, or other types of wetland vegetation.

57. Some AIPS systems have operated for about 30 years without removal of sludge, but it may be necessary to remove the sludge after about 5-10 years of operation. Treatment of

the sludge is to be accomplished in sludge drying beds with sufficient storage to provide adequate stabilisation and pasteurisation. Treated sludge can be used for soil amendment.

58. Main project activities for implementation of the AIPS wastewater treatment facility are: **Activity 5.1** Design, **Activity 5.2** Construction and **Activity 5.3** Operation and maintenance.

Figure 2. Diagram of the AIPS treatment process proposed in Kingston Harbour



Risks and Sustainability

59. As far as possible the project activities will be designed to minimise potential risks. To strengthen implementation and progress for the project, regional coordination will be established at UNEP-CAR/RCU office in Kingston. This will help to reduce the possible risk elements in the project activities. None of the possible risks identified are considered to be of major significance for delaying or impeding the implementation of the project components in the two countries involved.

Reluctance of authorities to support the initiative

60. The GEF-financed project components are focused on addressing global environmental issues, in this case control of a significant contaminant of both national and international waters, the nutrients nitrogen and phosphorus. Successful implementation of the global elements, through effective demonstrations of nutrient removal, will in turn strengthen the initiatives from local authorities to solve local pollution problems. This connection between local and global benefits is expected to reduce the risk of reluctance from authorities to support the proposed project components. Risks for reluctance of authorities to support the initiative is considered to be low.

Conflicts among institutions/stakeholders

61. Both Cuba and Jamaica face various national and local challenges related to institutional coordination and stakeholder involvement in projects such as this one. However, neither of the two countries have any major political conflicts, and no conflicts between local institutions have been identified which could impede progress of the project. The project implementation is based on close coordination, based on existing national and local institutions, and, in the case of Jamaica, strengthened by the establishment of a special project coordination organisation. Each national agency responsible for project coordination will play a key role in the management of possible conflicts among institutions/stakeholders throughout the whole project period. Risk for conflict among institutions/stakeholders is therefore considered as low.

Overestimation of institutional capacities

62. Risk may arise in the event that the project proposals have overestimated the technical and administrative capacities of the different agencies and institutions involved in the different project components. In both cities a need for institutional strengthening in environmental management of the bays has been identified during the pilot phase project. Limited amounts of institutional strengthening and training are therefore included to reduce this risk. With this input, the risk for overestimation of institutional capacities is reduced from medium to low.

Lack of technically qualified personnel

63. The available technical personnel in Kingston and Havana are generally not familiar with the proposed technologies for nutrient removal and sludge treatment. It is therefore assumed that international, technically qualified personnel may be engaged in the planning, construction and start-up of the sewage treatment plants as required. Both projects involve extensive training of local staff in operations and maintenance of the respective facilities to ensure sustainable plant operation beyond the project period.

Lack of financial resources

64. The Cuban authorities have made a commitment to support the project with all available domestic resources needed to implement the project. The inputs from the Government of Cuba to the project are mainly in the form of human resources, existing premises, land for the proposed plant, and construction of new facilities, all covered by local currency. In nearly all Cuban infrastructure projects such as this there is a need for partial funding in hard currency. Domestic sources for needed equipment and materials are scarce in Cuba, and often must be imported. The project proposes therefore to use a "low equipment/high labour rate" approach, while still utilizing a commercial technology for sewage treatment plants with nutrient removal. The pre-design report will identify in detail the available domestic resources and imports required. Much of the GEF financial contribution will then be used to finance the necessary imported materials. There is a risk that this GEF contribution will be insufficient. In that case additional financial resources will need to be mobilized, leading to project delays. The Cuban authorities are examining a number of approaches to sustainable O&M of the facility, including user fees, fertilizer sales, and using the increasing tourist revenue anticipated from improved conditions in the Bay. Overall, this risk is considered as a medium risk.

65. The Government of Jamaica (GOJ) has committed to support the current GEF project and to raise the money associated with baseline investments. Government of Jamaica input includes in-kind, human resources, use of existing premises and construction of new facilities. These inputs also include the free use of the Soapberry Fields lands for location of the plant. The strong government commitment to establishment of the PMU ($1.01 million of total $1.21 million (83%) over 5 years) also bodes well for the permanent establishment of the PMU as a coordinating body for Kingston Harbour environmental interventions.

66. A common concern for WWTP facilities like those proposed is the issue of cost recovery for operation and maintenance (O&M), including suitably trained staff. Total O&M costs for the 5 year KH project period are $375,000, of which GEF is financing $160,000, or 43%, and the government $215,000, or 57%. The annual budgeting in the project document is designed such that, by the end of year 5, the country is funding 75% of the O&M costs, so it seems quite reasonable that the government can assume full coverage of the O&M costs in year 6 and beyond. In addition, the project includes an operator training program to ensure continuity of trained and skilled staff. The financial risk in Jamaica is therefore considered very low.

Stakeholder Participation and Implementation Arrangements

66. Regional co-ordination and knowledge sharing (Output 1) will be implemented by UNEP-CAR/RCU, by reviewing project activities and ensuring an effective information exchange of experience and know-how. This will also ensure co-ordination with and fulfilment of the relevant articles and protocols of the Cartagena Convention. Each country will establish their own national project organisations, supervised by national authorities and integrated with other related national activities. UNDP will be the lead GEF implementing agency for Outputs 2-5. The UN Office of Project Services (UNOPS) will serve as overall Executing Agency for the project.

67. A project Steering Committee consisting of representatives from UNDP, UNEP and each of the two lead national agencies will be responsible for providing overall strategic and policy guidance to the project and monitoring project progress vs. a work plan. The Steering Committee will meet annually on the occasion of the TPR/APR.

68. *Cuba:* The Ministry of Science, Technology and Environment, through its Delegation for the City of Havana, will be responsible for the implementation of the project in Cuba and will co-ordinate all the activities with the Council of Administration of the City of Havana and other involved institutions, including the National Institute of Hydraulic Resources, the Ministry of Transportation, and the Port Authority of Havana. A National Project Office (NPO) in charge of the Project will be established in Havana, with a full time Co-ordinator and secretarial and logistic support. The NPO will be responsible for the general co-ordination of the activities, supervision of works, the inter-institutional arrangements and the extension and diffusion of outputs.

69. In Cuba, local organisations, advisory groups and scientific institutions have been widely consulted in the process of selecting the Luyano River as the project site, as the degradation of these rivers significantly influences the quality of life of a population of 140 000 inhabitants in the Luyano basin. NGOs planned for involvement in the project in Cuba include: Popular Councils (at

neighbourhood level), Association Pro-Naturaleza, and the Group for the Integral Development of the Capital (in the City of Havana).

70. *Jamaica:* The Natural Resources Conservation Authority (NRCA) is the permitting authority for all discharges of sewage, of industrial effluent and of any poisonous, noxious or polluting matter in Kingston. There is currently no single institution responsible for co-ordinating the management of Kingston Harbour, and a co-ordinating unit (the PMU) will therefore be established to co-ordinate environmental management initiatives in the Harbour area. The PMU will coordinate the process of engaging consultants, suppliers, and contractors in plant design, construction and O&M training, and will facilitate and expedite the involvement of government and external agencies in these processes to ensure government takeover and ownership of long-term O&M requirements. The PMU will report to the NSC and the KHEC and be staffed by a team of six, including a project manager, sewage, geotechnical, communications and environmental experts and a project accountant.

71. The National Steering Committee (NSC), the government's highest level policy-making body with regard to the planning and management of Kingston Harbour, consists of top level representatives of all private and public sector bodies with significant impact on the Harbour, as well as delegates from major international donors, NGO's and CBO's. The NSC is chaired by the Minister of the Environment, has been established as a permanent body, and meets biannually.

72. The Stakeholders Council will consist of representatives from relevant NGOs, CBOs, and other interested organisations that do not have direct representation in the NSC. The SC will nominate (up to 3) representatives to the National Steering Committee, where they will be able to participate in the formulation of policies for the management and regulation of the harbour, voice their concerns, and generally keep themselves updated on all matters relating to the fate of the harbour. The SC will be expected to function as a pressure group, expressing needs, concerns, and views to the bureaucrats and technocrats responsible for the management of Kingston Harbour. The Stakeholders Council will meet on a monthly basis.

Monitoring, Evaluation & Dissemination

74. Routine monitoring and evaluation of project activities are incorporated into the project design. In addition to routine reporting, the project will undertake an independent mid-term and final review and financial audit. The project will be subject to the standard annual UNDP tripartite review (TPR), Annual Project Report (APR), as well as the annual Project Implementation Review monitoring and evaluation exercise of the GEF (PIR). Each project site will also develop a suite of M&E indicators based on the process, stress reduction and environmental status framework.

75. Annual tripartite reviews of the project will be conducted by the National Steering Committee (Jamaica), the National Project Office (Cuba), UNEP and UNDP. The project managers will prepare an Annual Project Report (APR) and submit this to the two national agencies, UNDP and UNEP prior to each tripartite review meeting. The report will

summarise progress, results, system performance, local participation, and expenditures vs. budget. Additional APR's may be requested during the project period, if deemed necessary.

76. A project terminal report will be prepared for consideration at the terminal tripartite review meeting. It will be prepared in draft at least four months prior to the final tripartite review to allow review and technical clearance by the Steering Committee. In the final year of the project a full scale evaluation of the two project sites will be undertaken to provide detailed practical recommendations on application of the project results and lessons learned to the Wider Caribbean.

77. UNEP-CAR/RCU will arrange a terminal workshop on viable opportunities for nutrient removal and sludge utilisation, in coordination with the two participating national agencies. The workshop will review lessons learned in the project, and publish the results for distribution in the region.

Table 6. Total budget for the GEF project (1000 US $)

	Acti-vity	**Description**	**Total**	**GEF**	**Gov'ts**
Regional	*Output 1: Regional Co-ordination & Knowledge Sharing Activities*				
	1.1	Two regional 5-days workshops for nutrient removal technologies	240	240	0
	1.2	Study tour for officials involved in designing treatment options	80	80	0
	1.3	Terminal workshop on nutrient removal and sludge utilization	100	100	0
Cuba	*Output 2: Construction of a sewage treatment plant, including nutrient removal and sludge utilisation*				
	2.1	Sewage plant, including Nutrient Removal (GEF)	17 533	3410	14 123
	2.2	Sludge utilisation	240	240	-
	Output 3: Demonstration project focusing on nutrients and energy from waste and wastewater				
	3.1	MATCO prefabricated house	108	50	58
	3.2	Sewage treatment in areas with low infrastructure and housing standards	27	0	27
Jamaica	*Output 4: Institutional strengthening for improved co-ordination of institutions involved in rehabilitation and environmental management of Kingston Harbour.*				
	4.1	Establishment of a new institutional entity	1 210	200	1 010
	Output 5: Design and construct a wastewater treatment facility for the Kingston Metropolitan Area (KMA)				
	5.1	Design of wastewater treatment facility	1 910	380	1 530
	5.2	Construction of a wastewater treatment facility (GEF: nutrient removal components only)	10 240	1 650	8 590

	5.3	Operation and maintenance of the wastewater treatment facility	375	160	215
	Executing Agency Support Costs		400	400	0
	Project Total Budget		**32,463**	**6,910**	**25,553**

Annexes

Required:

A. Incremental Cost Annex A, A1, A2

B. Logical Framework Matrix

C. STAP Roster Technical Review

Optional:

D. Project progress plan

E. Cartagena Convention - LBS Protocol (draft): Proposed effluent limitations for domestic sewage

F. Copies of GEF Operational Focal Point Endorsement Letters

G. Final Report: Project RLA/93/G41 Planning and Management of Heavily Contaminated Bays and Coastal Areas in the Wider Caribbean, May, 1998

Annex A: Incremental Costs

1. Regional Context and Broad Development Goals

1.1 The governments of Cuba and Jamaica have demonstrated their commitment to protecting the natural environment, including coastal and marine ecosystems, by enacting policies, strategies, and programmes to mitigate the negative impacts of pollution. There is, however, a lacuna in management in that these initiatives have hitherto focused on addressing domestic impacts, rather than those occurring outside of national jurisdictional limits in international waters. Recognising the negative externalities imposed by the release of certain 'global' or transboundary contaminants, and the value to the region of demonstrating national approaches to the mitigation of these contaminants, the countries are now seeking to introduce abatement programmes for transboundary pollutants, specifically the nutrients nitrogen and phosphorus. Both countries place a high priority on implementation of the Caribbean Action Plan, and, as a sign of commitment to regional action, have ratified the Cartagena Convention. The Convention provides a legal framework for the implementation of the Caribbean Action Plan.

1.2 In addition, both Cuba and Jamaica have played an active role in the development of the Protocol to the Cartagena Convention on Land-based Sources of Marine Pollution. The majority of the pollutants impacting Havana Bay and Kingston Harbour are from land-based sources. With incremental assistance from the GEF, the project countries will design and operate their sewage treatment plants in accordance with the Global Programme of Action for Land-based Activities and any regional standards adopted by the Contracting Parties resulting from adoption of the LBS Protocol to the Cartagena Convention.

2. Global Environmental Objective

2.1 The proposed project would benefit global communities by demonstrating the efficacy and cost-effectiveness of locally appropriate technologies for reducing the inputs of nutrients into international waters. Four pilot projects would be undertaken in these two countries as add-ons to domestic (baseline) pollution abatement programmes. The treatment technologies would be modified as necessary, and may be replicated in the Wider Caribbean Region. In the long-term, these actions would help protect the productivity of the Caribbean and Gulf of Mexico, with positive spin-offs for biological diversity, human health, and sectors dependent on the marine environment, such as coastal and distant water fisheries, and tourism industries.

3. Baseline

3.1. The GEF pilot project, "Planning and Management of Heavily Contaminated Bays and Coastal Areas in the Wider Caribbean", identified the principal sources for regional contamination in the four countries, Cuba, Jamaica, Colombia and Costa Rica as discharges of untreated sewage, agro-chemicals, solid wastes, hydrocarbons, and sediments. The project also identified the barriers for collaborative actions at the regional level in order to prevent the inputs of contaminants into international waters, as: [1] lack of appropriate efficient and cost effective pollution abatement technologies; [2] weak institutional frameworks for the management of integrated water-body management projects; [3] lack of an appropriate incentives framework, promoting environmentally sound production and consumption patterns; [4] inadequate levels of inter-institutional co-ordination

at both individual country and regional levels; and [5] limited public awareness of international waters contamination problems. The pilot project identified a number of interventions to address the most potent barriers, focusing on specific sites in the four countries.

3.2. The proposed project includes remediation activities in Cuba (Havana Bay) and Jamaica (Kingston Harbour) in order to reduce the inputs of nutrients to the bays and to adjacent international waters. A description of the pollution problems and the actual abatement activities is given in the preceding sections.

3.3. Cuba: Studies undertaken during the pilot project have documented a major pollution problem in Havana Bay, with contamination emanating from the release of untreated sewage and discharge of wastewater into the Luyano River and into the Bay. The sewage treatment facilities serving the city of Havana need to be upgraded. Although the Cuban authorities are willing to take steps to and make the baseline investments to improve primary and secondary sewage treatment, financial constraints hamper their ability to address tertiary treatment needs to reduce the discharges of nutrients (nitrogen and phosphorus). One option to be considered involves the treatment and recycling of sewage for conversion to energy and fertiliser.

3.4 A number of initiatives have been undertaken to date to address other contamination problems in the Bay, and are a sign of the Government's commitment to resolving environmental degradation quandaries. The most significant activities may be summarised as follows: [1] a pollution-intensive old alcohol distillery has been deactivated; [2] construction of sewage treatment plants in the Quibu River Basin and the Almendares River Basin; [3] the design of a new submarine outfall in Playa del Chivo; [4] plans for the management of solid wastes and oil spills in Playas del Este; [5] construction of a ship waste incinerator; [6] supply of equipment for the Port Cleaning unit, including oil skimmers and barges for liquids and solids; [7] construction of a solid waste trap to clean the Luyano River; [8] planning and design of waste treatment plants for the Luyano and Martin Perèz River basins, and the Tadeo Stream; [9] design of a solid waste management system for Havana Bay; and [10] design of a comprehensive management system for solid and liquid ship waste. The costs of these activities are estimated at US$ 7,020,000; however, because they comprise sunk costs, they are not included as baseline or associated financing.

3.5 The baseline for Cuba includes investments in primary and secondary treatment of sewage (but not tertiary treatment, e.g. nutrient removal), sludge utilisation, and selected demonstrations of waste and wastewater reuse and recycling; these total $14,208,000 (assumes 1 Cuban peso = US$1.00). A primary barrier to tertiary treatment has been the lack of demonstrated, cost effective, low maintenance technologies to remove nutrients following secondary treatment.

3.6 Other planned activities (Associated Financing) over the forthcoming five years include [1] conversion of the Havana gas plant to facilitate natural gas use (cleaner technologies); [2] construction of a fixed barrier to reduce oil spills to the Bay and rehabilitation of the oil spill control system; [3] pollution management program, including of industrial wastes and sewage in Rio Almendares Basin; [4] development of waste treatment systems in Hemingway Marina; and [5], the dredging of contaminated soils in the Bay. These associated financing costs amount to just over US$ 11 million. (Information on these costs is given in Annex 1A, Table 1).

3.7 Jamaica: Contamination in Kingston Harbour emanates from several sectors. Studies undertaken under the pilot project identified the following problems: [1] sewage – organic matter,

nutrients, bacteria (from 25% of the population of 850,000) is discharged with limited treatment directly into the harbour); [2] organic matter, phosphorus, and suspended solids are being discharged into rivers and gullies emptying into the Harbour; [3] nitrogen contamination of groundwater; [4] the release of heavy metals, waste waters, oil and grease by local industries, including a local oil refinery, power station, fish processing plants, cement factories and food and garment manufacturing industries; and [5] uncollected solid wastes from the city of Kingston are dumped into gullies and storm water drains, and are leaking directly into the harbour.

3.7 The baseline for Jamaica totals $11,345,000, and includes establishment of a new institution to coordinate the rehabilitation of Kingston Harbour, construction of a wastewater treatment plant, and operation and management of the wastewater treatment plant.

3.8 Associated financing, estimated at US$ 183 million, includes [1] a USAID funded project to strengthen the national environmental regulatory agency (NRCA); [2] a solid waste management project funded by the IDB; [3] another USAID financed initiative to improve the quality of coastal waters; [4] preparation of a watershed management plan for all 29 watersheds discharging into the harbour (this initiative would enhance the technical capacity of the NRCA to monitor watersheds, manage data, and implement rehabilitation measures); [5] dredging of Hunts Bay and cleaning of Sandy Gully; and [6] modification and rehabilitation of existing transmission facilities to transport wastewater to the Soapberry treatment facility. (Information on the costs is given in Annex 1A, Table 2).

3.9 The lack of an institutional co-ordinating mechanism responsible for the overall management of environmental remediation efforts in the harbour serves as a barrier to effective pollution abatement. In addition, capacity for handling wastewater is deficient, and needs to be expanded, with tertiary treatments integrated into the wastewater handling system.

4. GEF Alternative

4.1 Regional: The two sites have been selected based on the existence of a recognized global/transboundary water pollution problem---eutrophication---that is representative for most of the countries in the region, the commitments of the national countries to address this emerging global issue, and the likelihood of finding applicable solutions. In both cases, the GEF would only finance the "add on" required to demonstrate approaches to mitigating the contamination of international waters by nutrients, building on a baseline of national efforts and complementary financing aimed at alleviating pollution risks in near shore and coastal waters. In order to ensure dissemination of new technologies and lessons learned, UNEP-CAR/RCU will act as a coordinating and knowledge sharing unit. This will ensure necessary coordination with other activities taking place within the framework of the Cartagena Convention and the Caribbean Environmental Programme. Regional workshops will be arranged.

4.2 Cuba: The GEF financing would augment existing plans (baseline) to install new (primary and secondary) sewage treatment plants in Havana, facilitating introduction and demonstration of a fully integrated facility which includes tertiary treatment (nutrient removal) and sludge utilisation. The plant is designed to remove 60-70% of nutrients from the treated wastewater. [In the absence of the GEF intervention, Cuban authorities would only undertake the costs of primary and secondary treatments to address BOD and pathogens, that have primarily domestic benefits and which are thus not eligible for GEF assistance]. In addition, the project would finance demonstration of technologies

for wastewater control in new housing developments, that could be replicated in urban and rural areas, piloting water conservation, and recycling/ treatment applications for black/grey-water. The project would make use of constructed wetlands technologies (with low O&M costs) for nutrient reduction. Accompanying activities, aimed at capacity building, would support training and dissemination of the results.

4.3 Jamaica: In Kingston Harbour, GEF activities would complement the expected baseline activities of the government and other donors in establishing an umbrella institution responsible for the rehabilitation of the water-body. This would improve cross-sector co-ordination of remediation measures, and improve the efficiency of existing and proposed environmental management investments. In addition, the GEF would finance the incremental costs of removing nutrients (nitrogen and phosphorus) from sewage, by funding a portion of the costs of constructing a new wastewater treatment plant for the greater Kingston area. The recommended technology is Advanced Integrated Ponding System (AIPS), — a system with low construction and O&M costs. The treatment plant consists of head-works, ponds, constructed wetlands and a sludge handling system, with the GEF financing the constructed wetlands. The plant would be capable of handling almost 30 percent of the wastewater flow in the existing sewerage system in the metropolitan area. This will contribute greatly to the reduction of nutrients to Kingston Harbour, and to the potential for transboundary eutrophication in the WCR.

5. Scope of Analysis

5.1 The scope of the assessment comprises existing and proposed interventions to address contamination problems in Havana Bay and Kingston Harbour. The baseline includes initiatives sponsored by national and regional authorities, as well as bilateral and multilateral donor agencies. Costs have been estimated over five years— the life of the demonstration. Expenditures incurred prior to 1998 have been treated as sunk costs, and are not reflected in the calculus.

5.2 GEF inputs would provide a number of incidental domestic benefits, by reducing inputs of nutrients and contamination in coastal as well as international waters. Sizeable co-financing has been leveraged in light of these benefits. However, it should be recognised that in many instances, the marginal benefits relate to discharge reductions beyond national standards, would arise in the longer term, and be diffused over a wide area. Thus it is unlikely that they would be realised in the absence of this intervention. The key purpose of this project is to demonstrate that transboundary issues can be addressed, cost effectively, as part of national pollution abatement schemes, thus providing a win/win solution for national, regional, and global communities.

6. Costs and the Incremental Cost Matrix

6.1 The alternative strategy comprises the baseline plus additional interventions proposed under the project. Total baseline expenditures amount to US$ 25,553,000. The cost of the alternative amounts to US$ 32,463,000 of which US$ 6,910,000 will be funded by the GEF. In addition, a sum of US$ 2,500,000 has already been expended on implementing the pilot phase GEF project, and US$ 300,000 has been received in co-financing from Nordic governments for preparation of this proposal.

6.2 The global and domestic benefits of the project are presented in the attached incremental cost matrix, with a cost breakdown between the baseline and alternative, showing the relative contributions of the GEF and co-financiers towards implementation of project outputs.

7. Technical Note on Substitutional aspects of the proposed treatment facility

7.4 The treatment facility proposed for the city of Havana is a nutrient removal facility utilising the activated sludge process. The wastewater is sequentially mixed and aerated with an activated sludge mixture to remove organic matter and nutrients. An important criteria for efficient nutrient removal is therefore hydraulic retention time. If the object was to remove only suspended solids and organic matter, the treatment plant can be reduced in size.

7.4 Under the conditions in Cuba, an activated sludge process to remove organic matter and suspended solids typically has a hydraulic retention time of 4 hours. The hydraulic residence time for a nutrient removal facility is around 10 hours, 2.5 times higher. The volume of the aeration tanks will therefore have to be about 2.5 times larger for a nutrient removal facility than for a conventional activated sludge system. The costs associated with the basins will therefore be higher for a nutrient removal facility.

7.4 A nutrient removal facility also has a higher oxygen requirement and has the need for alternating aerobic, anoxic and anaerobic zones. This requires a more sophisticated aeration system, adding to the cost of the facility. An internal recycle is also required that adds to the costs of the facility. The rest of the treatment plant, namely the influent screen, grit removal, primary and secondary clarifiers, and the sludge handling facility is comparable for the two alternatives.

7.4 The result is that a treatment facility designed for nutrient removal is more expensive to design and construct than a conventional activated sludge system for the removal of suspended solids and organic matter. The total cost of the proposed treatment plant for Havana is estimated at US$17,533,000. Up to 19% of the total cost, or US$3,410,000, is the premium cost for nutrient removal.

Annex A1

Associated Financing Information[2]

1. Havana Bay, Cuba

Activity	Costs (US$)
Deactivation of alcohol production line at existing distillery	80,000
Conversion of the Havana gas plant to facilitate natural gas use	750,000
Construction of a fixed barrier to reduce oil spills to the Bay and rehabilitation of the oil spill control system	1,350,000
Pollution management program, including of industrial wastes and sewage in Rio Almendares Basin	200,000
Development of waste treatment systems in Hemingway Marina	150, 000
Dredging of contaminated soils in the Bay	8,605,000
Total	**11,135,000**

2. Kingston Harbour

Activity	Costs (US$)
Strengthening of National Environmental Regulatory Agency	12,000,000
Solid Waste Management project	50,000,000
Coastal Water Quality Improvement Project	10,000,000
Watershed management programme for 29 watersheds discharging into the harbour	25,149,000
Dredging of Hunts Bay and cleaning of Sandy Gully	34,000,000
Modification and rehabilitation of existing transmission facilities to transport wastewater to the Soapberry treatment facility	52,095,000
Total	**183,244,000**

[2] The figures provided below are estimates of anticipated investments in the period 1998-2003. They have been obtained from National Development Plans, Project Documents and other sources of budget data. The figures for major investment activity are subject to change as feasibility work continues, and during construction.

Annex A2: Incremental Cost Matrix

Cost/ Benefit	Baseline	Alternative	Increment
Domestic Benefits	<u>Cuba</u> 1. High level of contamination due to municipal wastewater discharges into Havana Bay, affecting the ecological productivity of the water-body. New sewage collectors and primary and secondary sewage treatment (co-financing) for removal of organic matter (BOD), pathogens and suspended solid is being planned 2. Lack of appropriate technologies for water conservation and wastewater treatment in urban and rural housing developments <u>Jamaica</u> 1. High level of contamination due to municipal wastewater discharges into Kingston Harbour, affecting the ecological productivity of the water-body. The sewage production in Kingston outpaces existing treatment capacity. 2. Inadequate co-ordination of pollution control and rehabilitation of water-bodies.	<u>Cuba</u> 1. Development of new demonstration sewage treatment plant (co-financing) with tertiary treatment capacities 2. Demonstration of "zero discharge housing" based on water saving and separate black/grey water collection, treatment and recycling <u>Jamaica</u> 1. Establishment of sewage treatment facility (co-financing), including tertiary treatment to remove nutrients (nitrogen and phosphate). 2. Institutional strengthening activities.	<u>Cuba</u> 1. Reduction of nutrient inputs into Havana Bay and Wider Caribbean with concomitant reduction in local eutrophication 2. Low maintenance and cost effective measures for reducing sewage outflows from residential areas 3. Demonstration of low cost, alternative technological approaches to mitigating eutrophication in bays environments. <u>Jamaica</u> 1. Demonstration of efficacy of AIPS technologies, offering cost effective and low maintenance abatement. 2. More effective and targeted management, and improved regulatory capabilities. 3. Reduced nutrient inputs and eutrophication of Kingston Harbour

Cost/ Benefit	Baseline	Alternative	Increment
Global Benefits	1. The Caribbean countries are committed to finding common solutions to transboundary environmental problems, but national programmes are not addressing regional concerns. Inadequate exchange of information regarding management and technical experiences 2. Excess inputs of nutrients (phosphorus and nitrogen) into the Caribbean/Gulf of Mexico due to lack of tertiary sewage treatments 3. Donor initiatives in support of pollution abatement are often poorly co-ordinated, leading to non-optimal solutions	1. Activities would provide information on how to integrate regional concerns into national water-body management. Information exchange regarding management barriers 2. Demonstration of innovative, low cost technologies to reduce discharges of nutrients to two bays and WCR 3. Information exchange on the results, including financial and performance data 4. Development of inter-institutional organisation to co-ordinate and manage the rehabilitation of the water-bodies	1. Strengthening regional collaboration addressing priority pollutants and environmental management in international waters (Wider Caribbean) 2. Demonstration of feasibility of introducing appropriate and cost-effective technologies for tertiary sewage treatment. Replication to other countries would reduce the risk of eutrophication in the Wider Caribbean. 3. Demonstrations of innovative technologies that may be adapted to the local socio-economic and institutional situation. 4. Better targeting of water-body management initiatives leads to more efficient utilisation of scarce financial and human resources for international waters clean-up
Costs Regional Activities	0	420,000	420,000 (GEF)
Costs Cuba	14,208,000	16,598,000	2,390,000 (GEF)
Costs Jamaica	11,345,000	15,045,000	3,700,000 (GEF)
Support Costs	0	400,000	400,000 (GEF)
Total	25,553,000	32,463,000	6,910,000 (GEF) PRIF: 2,500,000

Cost/ Benefit	Baseline	Alternative	Increment
			Nordic Funds: 300,000

Annex B: Logical Framework Matrix

OBJECTIVES AND ACTIVITIES	INDICATORS	VERIFICATION	ASSUMPTIONS AND RISKS
Output 1: Regional co-ordination	Co-ordination established at CAR/RCU in Kingston	Responsibilities for regional co-ordination assigned to appropriate staff	The countries willing to support the regional activities financially
Activities 1. Regional co-ordination 2. Regional workshops	Effective project communication system, including reporting, between the national project units and CAR/RCU Program for workshops established	Bimonthly news bulletin Progress reports – yearly status reports Final report Regional workshops on specific issues	Staffing can be completed within 3 months Substantial investments in communication capability Need for clear lines of responsibility to national GEF-project and CAR/RCU
Project site: Havana, Cuba			
Output 2: Construction of a sewage treatment plant, including nutrient removal and sludge utilisation	Sewage treatment plant with a high (50%) and stable removal of nutrients, sludge treatment and relatively low Operation and Maintenance cost	Measured reductions of nutrients and other pollutants from the plant. Measured use of sludge as energy or fertiliser through the year	Mainly domestic produced facility due to trade and economic restrictions National contribution mainly through man-power
Activity 2.1 Nutrient removal 1. Capacity building, training and location and design of treatment plant 2. Planning and construction of one treatment plant 3. Program for optimising operation and monitoring the treatment plant 4. Research activities and training	Hiring and training of local experts Planning and design of sewage treatment plant Construction of Luyano River treatment plant. Operation, maintenance and monitoring programme established Operators hired	Training programme established Progress reports on planning, design and construction phase Program for operation, maintenance and monitoring Annual reports on operations and obtained reduction of pollutants	Need for qualified personnel Need for hard currency to hire necessary consultants and to buy necessary equipment abroad

OBJECTIVES AND ACTIVITIES	INDICATORS	VERIFICATION	ASSUMPTIONS AND RISKS
Activity 2.2 Sludge Utilisation 1. Research activities, including agricultural aspects of using produced fertiliser; training programs 2. Infrastructure for local recycling, utilisation and quality assurance of the fertiliser products	Analysis of infrastructure for local recycling and for use of sludge as agricultural fertiliser	Reports of research on agricultural aspects on use of sludge	
Output 3: Demonstration projects focusing on recycling of nutrients and energy from waste and wastewater	Demonstration of "zero emission housing" units for urban and rural areas Sustainable (low energy, economically feasible) technology for wastewater treatment, including recycling of nutrients	Reduced water consumption Low investment, operational and maintenance cost Production of components in Cuba	
Activity 3.1 MATCO prefabricated house 1. Water saving toilets, a black-water collection system and separate grey-water treatment in an apartment building 2. Technology transfer program and explore the possibilities of producing the main system components in Cuba 3. Program for survey, monitoring and research	Water saving toilets and separation of black-water/grey-water installed Program for technology transfer established Local counterparts identified Program for survey, monitoring and research established	Progress report on installation of water saving toilets, etc. Annual report on operation, monitoring and research Reports on local counterparts and on actual technology transfer	Communities will recognise the benefits of involvement Demonstration site activities poorly implemented and badly managed Reluctance to support the initiatives by the authorities and the public Need for relevant personnel Need for incentives for the public "Psychological" barriers for the public No local counterparts

OBJECTIVES AND ACTIVITIES	INDICATORS	VERIFICATION	ASSUMPTIONS AND RISKS
			interested
Activity 3.2 Sewage treatment in areas with low infrastructure and housing standards Activities 1. Water saving black-water collection system for 50 households 2. Program for public participation 3. Technology transfer program and explore the possibilities of producing the main system components in Cuba 4. Program for survey, monitoring and research	Water saving toilets and separation of black-water/grey-water installed Program for technology transfer established Local counterparts identified Program for survey, monitoring and research established Program for public participation and training established	Progress report on installation of water saving toilets, etc. Annual report on operation, monitoring research and public participation Reports on local counterparts and on actual technology transfer	

OBJECTIVES AND ACTIVITIES	INDICATORS	VERIFICATION	ASSUMPTIONS AND RISKS
Project site: Kingston, Jamaica			
Output 4 Institutional strengthening to improve co-ordination of institutions involved in rehabilitation and environmental management of Kingston Harbour	Establishment of a new inter-institutional organisation for the rehabilitation and environmental management of Kingston Harbour	Documentation establishing new institution	Required political power is given to the new inter-institutional organisation and it is recognised by existing institutions as responsible for the overall planning of the rehabilitation of Kingston Harbour
Activity 4.1 A new institutional entity responsible for the rehabilitation of Kingston Harbour Activities: 1. New organisation for the rehabilitation of the Harbour 2. Overall monitoring plan for Kingston Harbour	A new organisation involving all relevant institutions and including a project management unit established Water quality monitoring plan for Kingston Harbour established	Annual reports on the activities within the project management unit and the inter-institutional organisation. Annual environmental report for Kingston Harbour, including monitoring data and activities to improve harbour conditions	Need for qualified personnel Need for relevant communications systems Reluctance of existing institutions to support the initiative Financial constraints
Output 5 Reduction of inputs of nutrients to Kingston Harbour and to the Wider Caribbean	Sewage treatment plant with a high and stable removal of nutrients and low operation and maintenance cost	Measured reductions of nutrients and other pollutants from the treatment facility	Financial constraints to rehabilitate the sewerage system of Kingston Metropolitan Area
Activity 5.1 Design of a wastewater treatment facility Activities: 1. Select a consultant responsible for the design of the treatment plant 2. Conduct a geo-technical study of Soapberry lands 3. Pre-design of wastewater treatment plant 4. Detailed design of wastewater treatment plant	Hiring staff Geo-technical study performed Planning, pre-design and design of treatment plant	Report on geo-technical study Progress report on planning, pre-design and design phase	Need for qualified personnel

OBJECTIVES AND ACTIVITIES	INDICATORS	VERIFICATION	ASSUMPTIONS AND RISKS
Activity 5.2 Construction of a wastewater treatment facility 1. Selection of a contractor for the construction 2. Modifications of existing pump stations 3. Construction of new force mains from Seaview Gardens to Nance Pen and from Nance Pen to Soapberry 4. Modifications of Independence City and Bridgeport wastewater treatment plants 5. Construction of new wastewater treatment facilities at Soapberry 6. Construction of wetlands	Hiring contractor Construction and modifications of pump stations, forcemains, sewage treatment facilities and wetlands	Progress report on construction and modification activities	Need for qualified personnel
Activity 5.3 Operation and maintenance program for the treatment facility Activities: 1. Program for operator training 2. Program for operation and maintenance for the first year of operation 3. Monitoring program of performance	Operators hired Programs for • Operator training • Operation and maintenance • Performance monitoring established	Reports on • Operator training • Operation and monitoring data	Need for financing of operation and maintenance Need for qualified personnel

Demonstrations of Innovative Approaches to the Rehabilitation of Heavily Contaminated Bays in the Wider Caribbean - Project Brief

Annex C: STAP Technical Review Dr. Philip Tortell, Environmental Management, Ltd. March 20, 1999

1. Overall impression

The Project is a follow-up to the GEF PRIF which developed integrated investment action plans for the rehabilitation and management of four contaminated bays in the Caribbean; formulated institutional strengthening proposals to improve the operational capacities of institutions responsible for bay management; and identified sources of financing for the implementation of proposed remedial actions. As such, the Project builds on the PRIF results and consolidates the earlier GEF investment.

2. Relevance and priority

The Project aims to support the Cartagena Convention for the Protection and Development of the Marine Environment of the wider Caribbean Region, particularly Art.7 Pollution from Land-based. It is also in harmony with the Caribbean Regional Seas Programme and Action Plan and it recognizes the role that the CAR/RCU can play.

The two participating Governments have identified coastal and marine water quality as a priority problem, and with the assistance of the PRIF Project they have also determined the causes and origins of the problem, the severity of impact and the barriers that need to be overcome before the problem can be solved. The existing situation is amply described and effectively summarized in the Brief.

The participating Governments have embarked on a wide-ranging set of activities towards this end and the Project will assist by complementing ongoing activities and providing the resources so as to achieve incremental benefits for the Wider Caribbean.

3. Project Approach

It is a truism that seas are contiguous and that water quality problems will inevitably spill over from coastal embayments into the wider Caribbean sooner or later. Therefore, reducing the input from two major point sources of phosphorus and nitrogen seems entirely appropriate. However, in focusing exclusively on Kingston Harbour and Havana Bay, the Project appears to suggest that they are the two primary sources of pollution into the Wider Caribbean. Whether this is the case or not, merits discussion.

The Project will provide excellent opportunities for sharing results and experiences as well as for training and technology transfer on a TCDC basis. It is good to note that workshop and study tour activities envisaged under the Project are planned to be undertaken on a regional basis with the involvement of participants from the Wider Caribbean Region.

4. Objectives

The Project Brief identifies a global environmental objective and a long-term objective for the Project.

The global objective is *To demonstrate and promote regional replication of innovative technical, legislative and educational approaches to reducing nutrient loads to Havana Bay and Kingston Harbour and to the Wider Caribbean Region* .

The long term objective is *to promote and facilitate environmentally sustainable development and management of the two bays and to disseminate and replicate successful approaches to the rehabilitation of these bays to other sites in the Wider Caribbean facing similar environmental challenges* .

By definition, global and long term objectives are not usually quantifiable and while they will serve as overall targets, they cannot be used to assess Project progress and performance. This can only be done through explicit and focused immediate objectives which are currently absent from the Project Brief.

5. Background and justification

The background information and justification provided for the Project are considered sufficient to justify its development into a concrete proposal. Most of the background information arises from the GEF PRIF Project and as such can be considered relevant and reliable.

From the information provided in the Project Brief the Project appears to fit within national priorities and commitments which are already underway or imminent.

If this GEF Project is not undertaken, there is a risk that the gains made through the GEF PRIF Project will not be sustained and that the incremental benefits possible with GEF assistance will not be obtained.

6. Activities

The Project Brief has listed 11 activities which are expected to achieve the desired 5 outputs. As already noted above, these are not tied to any immediate objectives since none are explicitly mentioned in the Brief and can only be inferred from the outputs that are targeted. The following table lists the outputs targeted by the Project, comments on whether the proposed activities are considered adequate and notes additional outputs/activities that could be considered when formulating the Project Document.

OUTPUT	COMMENTS ON ADEQUACY OF ACTIVITIES, ETC
1 Regional coordination, exchange and dissemination of results	The Project plans to disseminate its results and findings widely throughout the region and beyond. This should not be restricted to the three activities currently identified under this output and the Project Document should provide for this to happen on a continuous basis .
2 Construction of a sewage treatment plant, including nutrient	GEF will fund the nutrient removal and utilization and this is an appropriate incremental benefit. Preliminary details provided and

removal and sludge utilisation, in Havana, Cuba	substantial further work is needed at the project development stage.
3 Demonstration of nutrients recycling and energy utilization from waste and wastewater in Havana, Cuba	The zero emission housing units and water saving devices and strategies that are planned will obtain incremental benefits. The Project Document will need to provide more detail on the activities envisaged.
4 Institutional strengthening for improved coordination of institutions involved in rehabilitation and environmental management of Kingston Harbour, Jamaica	The proposed PMU is not necessarily the best type of organization to cater for the planning and management needs of Kingston Harbour in an integrated manner. This would seem to be a suitable candidate for the development of an Integrated Coastal Area Planning and Management Process which would require much more planning and many more activities before it can be expected to succeed.
5 Design, construction and operation of a wastewater treatment facility for the Kingston Metropolitan Area (KNA), Jamaica	This is a similar output to the one in (2) above proposed for Havana and similar comments apply.

The following table takes the salient elements of the Project's global objective and long term objective and indicates to what extent they are expected to be obtained if the above activities and outputs are achieved.

Global Objective -	
To demonstrate and promote regional replication of innovative technical…	Possibly
legislative…	Not likely, no activities
and educational approaches…	Only Workshops
to reducing nutrient loads to Havana Bay and Kingston Harbour …	Yes, main focus
and to the Wider Caribbean Region	Probably

Long Term Objective -	
To promote and facilitate environmentally sustainable development	Possibly
and management of the two bays …	Uncertain
and to disseminate and replicate successful approaches …	Maybe
to the rehabilitation of these bays …	Possibly
to other sites in the Wider Caribbean facing similar environmental challenges	Uncertain

7. National priorities and community participation

The proposal appears to fit well within on-going or imminent national priority actions for the improvement of water quality in coastal waters and beyond.

Project implementation will involve a number of official institutions such as Central Government organizations and municipalities in each of the participating countries. However, there are a number of other stakeholders who should be involved such as the private sector, community organizations, NGOs and suchlike. Their meaningful participation, through appropriate mechanisms, should be built into the Project Document.

8. Time Frame

The Objectives/Outputs/Activities are expected to be achievable within the 5 years envisaged for the Project. However, this will depend on the soundness and robustness of the Project Document, the effectiveness of the implementation arrangements, the efficiency of project management, and the implementation of project components in parallel rather than in series.

9. Funding

The Project Brief does not provide the basis for cost computations but from the summaries provided it would seem that these have been adequately undertaken and the funding that is proposed is realistic. However, it is expected that the Project Document will contain a more detailed breakdown of how costs have been arrived at.

10. Innovative Features/Replicability

The Kingston sewage treatment proposal and the Havana zero emissions housing units may provide a new approach to these problems, especially for the region.

The Project is seen as a series of demonstrations which, once fine-tuned and successful, can be replicated elsewhere. It is hoped that project designers will exploit the opportunities for regional application of the Project.

11. Sustainability

If the Project is designed in such a way so as to involve existing institutions (in the absence of national execution) in the implementation of various discrete components, it will engender a sense of ownership which will enhance the sustainability of Project products.

It is heartening to note the degree of commitment shown by the participating Governments through the investments that they are prepared to make as part of the baseline. This too, augurs well for the sustainability of the Project products.

12. Rationale for GEF support

The GEF Project will complement on-going and imminent activities of the two participating countries towards the enhancement of water quality in their coastal environments. The Brief clearly notes the incremental nature of the GEF involvement which is targeted to waste nutrients which are a threat to the Wider Caribbean and international waters.

13. Conclusion

The Brief proposes a project which builds on the results of a GEF PRIF Project by complementing a number of initiatives in each of two localities which are addressing the baseline, thus achieving incremental benefits of a global nature. If the expected confirmation that these two localities are indeed significant sources of nutrient pollution for the Wider Caribbean is forthcoming, the Proposal merits GEF support.

The design and formulation of the Project Document will provide an opportunity to better target some of the elements of the global and long term objectives which are currently not well covered by activities envisaged in the Brief.

Annex D: Project progress plan

No	Output/Activities	1999		2000				2001				2002				2003				2004	
1	**Regional co-ordination Activities**																				
1.1	*Regional workshops*			■											■						
1.2	*Study tour for project officials*				■																
1.3	*Terminal workshop*																				■
2	**Wastewater treatment in Havana**																				
	Project mobilisation	■																			
2.1	*Treatment plant, including nutrient removal*																				
	Pre-design report	■																			
	Detail design/tender documents		■	■																	
	Tendering/contracting			■	■																
	Construction and commissioning				■	■	■	■	■	■	■	■	■	■	■						
	Operation and maintenance														■	■	■	■	■	■	■
2.2	*Sludge treatment*																				
	Pre-design	■																			
	Detail design/tender documents								■	■											
	Tendering/contracting										■	■									
	Construction and commissioning											■	■	■							
	Operation and maintenance													■	■	■	■	■	■	■	■
3	**Demonstration projects for recycling of nutrients and energy**																				
3.1	*Zero emission housing unit*																				
	Planning/detail design	■																			
3.2	*Sewage treatment in low standard/urban areas*		■																		
4	**Institutional strengthening, Kingston Harbour**																				
4.1	*A new institutional entity for rehabilitation of Kingston Harbour*	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
5	**Wastewater treatment in Kingston**																				
	Project mobilisation	■																			
5.1	*Detail design/tender documents*		■	■																	
5.2	*Tendering/contracting*			■	■																
5.4	*Construction and commissioning*				■	■	■	■	■	■	■	■	■	■							
5.5	*Operation and maintenance*													■	■	■	■	■	■	■	■

Annex E

Cartagena Convention - LBS Protocol

Proposed effluent limitations for domestic sewage

I. Definitions

Domestic Wastewater: includes all discharges from households, commercial facilities, hotels, septage and any other entity whose discharge is comprised of the following:

Toilet flushing (black water)

Showers, wash basins, kitchen and laundry (grey water)

With regard to small industries, discharges into domestic sewage systems of wastewater with characteristics, in terms of parameters and concentrations, similar to those of black and grey waters.

Domestic wastewater may also contain small quantities of industrial waste and processed wastewater. (See Section IV – Industrial Pretreatment).

B. Class I Waters: Waters in the Convention Area, that due to inherent or unique environmental characteristics or fragile biological or ecological characteristics or human use, are particularly sensitive to the impacts of domestic wastewater. Class I Waters include, but are not limited to: coral reefs, sea grass beds, mangroves, feeding and breeding areas for aquatic and terrestrial life, areas that provide habitat for species protected under the SPAW Protocol, protected areas listed in the SPAW Protocol, and waters used for public recreation.

C. Class II Waters: Waters in the Convention Area, other than Class I Waters, that due to oceanographic, hydrologic, climatic, or other factors, are less sensitive to the impacts of domestic wastewater and where discharges do not result in exposure to humans or living resources that are likely to be adversely affected by the discharges.

Existing Domestic Wastewater Systems: Publicly or privately owned domestic wastewater collection systems, or collection and treatment systems, that were constructed prior to entry into force of this Annex, for each Contracting Party.

New Domestic Wastewater Systems: Publicly or privately owned domestic wastewater collection systems, or collection and treatment systems, that were constructed subsequent to entry into force of this Annex for each Contracting Party.

Household Systems: On-site domestic wastewater disposal systems for homes and small commercial business in areas of low population density, or where centralized collection and treatment systems of domestic wastewater are not economically or technologically feasible. Household Systems include, but are not limited to: septic tanks and drain fields or mounds, holding tanks, latrines, and bio-digesting toilets.

Discharge of Domestic Wastewater

Contracting Parties shall:

Consistent with the provisions of this Annex, provide for the regulation of domestic wastewater discharging into, or adversely affecting, the Convention Area.

Wherever appropriate, locate domestic wastewater discharges such that there is no adverse affect on Class I Waters.

Encourage and promote domestic wastewater reuse that minimizes or eliminates discharges into, or that adversely affect, the waters of the Convention Area.

Effluent Limitations

Each Contracting Party shall ensure that domestic wastewater that discharges into, or adversely affects, the Convention Area, is treated by a new or existing domestic wastewater system whose effluent achieves the effluent limitations specified below in Parts A, B and C of this Section, in accordance with the following timetable:

YEARS AFTER ENTRY-INTO-FORCE FOR THE CONTRACTING PARTY	CATEGORIES OF EFFLUENT SOURCES
[0]	ALL NEW DOMESTIC WASTEWATER SYSTEMS AND NEW COMMERCIAL ESTABLISHMENTS SUCH AS HOTELS, RESTAURANTS, AND PUBLIC FACILITIES
[5]	EXISTING COMMERCIAL ESTABLISHMENTS SUCH AS HOTELS, RESTAURANTS, AND PUBLIC FACILITIES
[8]	URBAN COMMUNITIES WITH [50,000] [200,000] OR MORE INHABITANTS ALREADY POSSESSING WASTEWATER COLLECTION SYSTEMS
[12]	URBAN COMMUNITIES WITH [50,000][200,000] OR MORE INHABITANTS ~~NOT~~ POSSESSING WASTEWATER COLLECTION SYSTEMS
[15]	ALL OTHER COMMUNITIES EXCEPT HOUSEHOLD SYSTEMS

A. Discharges Into Class II Waters

Each Contracting Party shall ensure that domestic wastewater that discharges into, or adversely affects, Class II Waters, is treated by a new or existing domestic wastewater system whose effluent achieves the following effluent limitations based on a monthly average:

Parameter	Effluent Limit
Total Suspended Solids	100 mg/1*
Biochemical Oxygen Demand (BOD_5)	150 mg/1
Chemical Oxygen Demand	300 mg/1
pH	6-10

Fats, Oil and Grease	50 mg/1
Floatables	not visible

∗ Does not include algae from treatment ponds

B. Discharges Into Class I Waters

Each Contracting Party shall ensure that domestic wastewater that discharges into, or adversely affects, Class I Waters, is treated by a new or existing domestic wastewater system whose effluent achieves the following effluent limitations based on a monthly average:

Parameter	**Effluent Limit**
Total Suspended Solids	30 mg/1∗
Biochemical Oxygen Demand (BOD_5)	30 mg/1
Chemical Oxygen Demand	150 mg/1
pH	6-10
Fats, Oil and Grease	2 mg/1
Faecal Coliform	43 mpn/100ml for shellfishing areas 200 mpn/100ml all other areas
Total Chlorine	0.5 mg/1
Floatables	not visible

∗ Does not include algae from treatment ponds

C. Discharges Into Nutrient-Sensitive Class I Waters

Each Contracting Party shall ensure that in addition to the limitations in Part III B of this Annex, domestic wastewater that discharges into, or adversely affects, Class I Waters, where excess nutrients are a factor which contribute to, or have the potential to contribute to, the degradation of Class I Waters, is treated by a new or existing domestic wastewater system whose effluent achieves the following effluent limitations based on a monthly average:

Parameter	**Effluent Limit**

Total Nitrogen	15 mg/1

Contracting Parties shall also take into account the important contribution of phosphorus and its compounds to marine pollution and take appropriate measures to control or reduce the amount of phosphorus and its compounds, which are discharged to the marine environment.

Industrial Pre-treatment

Contracting Parties shall [endeavor, in keeping with economic capabilities to] develop and implement industrial pre-treatment programmes to ensure that industrial discharges into new and existing domestic wastewater treatment systems:

do not interfere with, damage or otherwise prevent domestic wastewater collection and treatment systems from meeting the effluent limitations specified in this Annex; [1]

do not endanger operations of, or populations in proximity to, collection and treatment systems through exposure to toxic and hazardous substances;

do not contaminate sludges or other reusable products from wastewater treatment;

do not allow pass-through of toxic contaminants in amounts toxic to human health and aquatic life; and have spill containment and contingency plans.

Contracting Parties [within the scope of their capabilities] shall promote appropriate industrial wastewater management (e.g., recirculation and closed loop systems) to [eliminate] or minimize wastewater discharges to domestic wastewater systems.

[1] *It is recognized that many large industrial wastewater inputs will necessitate the development of industrial pre-treatment standards and that pollutants entering the system through storm sewers may require appropriate controls.*

Household Systems

Contracting Parties shall [strive to], as expeditiously, economically and technologically feasible, in areas without sewage collection, ensure that household systems are constructed, operated and maintained to avoid contamination of surface or ground waters that are likely to adversely affect the Convention Area.

For those household systems requiring septage pump out, Contracting Parties shall [strive to] ensure that the septage is treated through a domestic wastewater system or an appropriate land treatment system.

VI. Management, Operations and Maintenance

Contracting Parties shall ensure that new and existing domestic wastewater systems are properly managed and that system managers develop and implement training programmes for wastewater collection and treatment system operators. Managers and operators shall have access to operators' manuals and technical support necessary for proper system operation.

Contracting Parties shall provide for monitoring and inspection of domestic wastewater systems, by competent national authorities to assess compliance with national regulations.

Annex F

Copies of GEF Operational Focal Point Endorsement Letters