IWEco National Sub-Project 1.1

Targeting Land Degradation and Effective Land Management through the Development of Innovative Financing Methodologies

ANTIGUA & BARBUDA

Appendix 31

COVER SHEET

- Name of small-scale intervention: **Targeting Land Degradation and Effective Land Management through the Development of Innovative Financing Methodologies, Antigua & Barbuda**
- Name of Lead Partner Organization:
  a) Ministry of Health & Environment
- Contact person:
  a) Amb. Diann Black-Layne, Director of Environment and GEF Focal Point, Department of Environment
- IWEco Project focus: Land Degradation
- Total area covered: Targeted interventions for mitigation of acute land degradation through the reduction of sewage effluent and oily waste disposal into the ambient environment employing innovative sustainable financing mechanisms
- Duration of sub-project: 48 months
- Amount of GEF grant: **$1,215,685** USD
- Amount of Co-financing: **$2,596,638** USD
- Total funding: **$3,812,323** USD

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1 PROJECT IDENTIFICATION

1.1 Project Summary

Land degradation has long been a problem for Antigua and Barbuda owing to inappropriate land use practices and particularly the improper disposal of wastes that include wastewater and oily waste residues. The weak enabling environment that includes lack of sufficiently robust policy, regulation and institutional response and capability has compounded the problem. In addition, there are generally insufficient infrastructure investments to deal with effluent generation that results in indiscriminate disposals across various locations on the island, and on mainland Antigua the main receiving area is the municipal landfill at Cooks. The contamination and consequent degradation of landscapes is acute in particular areas of Antigua and is of growing concern given that these areas are adjacent to croplands and commercial investments that presents a direct conflict and poses constraint to further expansion of these economic investments thereby compromising future livelihood opportunities.

One of the critical areas that has been of national attention is the McKinnons Salt Pond in northwest Antigua, an important ecological area that is located within close proximity to farm holdings and touristic developments, but however has been severely degraded by pollution influxes. In the context of pollution, land degradation and implications for farming, water availability is a serious issue for Antigua and Barbuda as the country ranks as one of the most water-stressed countries in the Caribbean (average annual total renewable water resources at 578 m^3/yr/capita; FAO Aquastat, 2014[1]), and given development patterns across the island, availability of suitable land for farming and water to service these farms is extremely limited. As ground water resources become in increasingly threatened by land-based pollution, water availability for farming is placed at high risk. In recent years the country has experienced increased tendency toward extended drought conditions and is exacerbating the situation.

Previous measures have been undertaken through donor support to address the issues of sustainable land management (SLM) as well as pollution control within the McKinnon's area and the IWEco Project will seek to build on these efforts. Under the Sustainable Island Resource Management Mechanism (SIRMM) Project, aquatic vegetation was established over portions of the McKinnon's pond as a phyto-remediation effort to immobilize and absorb excess pollutant loads, as well as to enhance the ecological quality of local environment and add to eco-touristic potential for visitors. This effort contributed to some degree to alleviate the situation but more work is required to further reduce the influx of sediments entering the McKinnon's Pond partly due from the erosion and instability of the watercourses' embankments in the mid to upper reaches of the Cedar Grove Watershed.

The IWEco Project will complement existing and future efforts of the government to address the land degradation and pollutant loading issues by targeting the pollution and land degradation sources within the Cedar Grove watershed and installation of and upgrading control measures for reducing sediment, nutrient and chemical loadings. A best practice approach will be adopted as was the case under the GEF-IWCAM project through further demonstration of best practices in the diversion of effluent, collection and reuse of treated wastewater through downstream users that include farmers and hotel operators. A component will be the further upgrade to the McKinnons wastewater treatment facility that was commissioned through contributions of the GEF-IWCAM Project. This effort will be augmented by

[1] FAO Aquastat Country Fact Sheet Antigua and Barbuda
http://www.fao.org/nr/water/aquastat/data/cf/readPdf.html?f=ATG-CF_eng.pdf

establishment of runoff control measures to the McKinnon's pond through the installation of vegetated drainage channels to minimize sediment eroded from and transported along the main watercourses to the wetland. Additionally, to enhance the ecological and landscape value of the area and make more resilient to coastal erosion in consideration of rising sea levels associated with climate change, reforestation and afforestation of mangroves will be undertaken along the pond's periphery. These mangroves will lend further benefits to phyto-remediation. Through on-site land and forest cover investments within 15 hectares over the target Cedar Grove and Cooks watershed areas, it is expected that an estimated 1,223.5 equivalent tonnes of CO_2 over the life of the project, or an average of 244.7 tCO_2eqv/year will be sequestered.

The project will facilitate education and awareness of land degradation activities and the best practices to mitigate its impacts in hopes of behavioural change against improper liquid waste disposal methods. Farmers will also be educated on best practices for irrigation and soil conservation. The project will also contribute to a financial sustainability management mechanism that will enhance private-public partnerships in utilizing recycled wastewater and contribute to sustained investments at the national level in addressing land and water resource degradation.

Table of Regional Components, Project Outcomes, and Link to Sub-Project

Regional Component	Project Outcomes
C1. TECHNICAL SOLUTIONS & BENEFITS	C1.1 Measurable **stress reduction at project sites** through appropriate sustainable water, land and ecosystems management interventions that account for climate change.
	C1.2 Enhanced **livelihood opportunities and socio-economic co-benefits** for targeted communities from improved ecosystem services functioning.
C2. MONITORING SYSTEMS	C2.1 Strengthened **national and regional systems for monitoring** of environmental status with respect to key international agreements.
C3. POLICY & CAPACITY	C3.1 Strengthened **policy and legislation** for the effective management of water, land and ecosystems resources that account for climate change.
	C3.2 Strengthened **capacity of national and regional institutions** and other stakeholders for water, land, and ecosystems management that accounts for climate change.
C4. KNOWLEDGE MANAGEMENT	C4.1. Improved **engagement and information access** for practitioners and other stakeholders through targeted knowledge sharing networks.

Table of GEF FA Objectives, Project Outcomes and Corresponding Sub-Project Outcomes

GEF Focal Area Outcome	Project Outcomes (above)	Sub-Project Outcomes
National Component 1: Develop and foster the implementation of targeted Innovative, climate-change resilient approaches to Sustainable Land Management (SLM) and enhanced management and maintenance of ecosystem services within the Cedar Grove / Five Isles Landscape in Antigua		
IW 1.3, 2.3; LD 3.3, BD 2.1	C1.1 Solutions	Measurable stress reduction achieved in the Cedar Grove / Five Isles Landscape through appropriate sustainable water, land and ecosystems management interventions that account for climate change.

LD 3.2; BD 2.1	C1.2 Benefits	Enhanced livelihood opportunities and socio-economic co-benefits for targeted communities from improved ecosystem services functioning.
National Component 2: Strengthening of Sustainable Land Management (SLM), Integrating Water Resources Management (IWRM) and Ecosystems Monitoring and Indicators		
IW 2.1; BD 2.1	C2.1 Monitoring	Adoption into national accounts of IW and LD, and BD-related indicators of process, stress reduction, and environmental and socioeconomic status to monitor improvements in the management of land and water resources and wastewater
National Component 3: Strengthening policy, legislative and institutional reforms and capacity building to support Sustainable Land Management (SLM), Integrating Water Resources Management (IWRM) and ecosystem services management taking into consideration climate change resilience building in Antigua and Barbuda.		
IW 1.1, 1.4, 2.1	C3.1 Policy	Strengthened policy and legislation for the effective management of water, land and ecosystems resources that account for climate change.
LD 3.1, 3.2; SFM 1.1, 1.2	C3.2 Capacity	Strengthened capacity of national and regional institutions and other stakeholders for water, land, and ecosystems management that accounts for climate change.
National Component 4 Enhancing knowledge exchange, promotion of best-practices, replication and expanding stakeholder involvement in the Cedar Grove / Five Isles Landscape area and at the national level.		
SFM 1.3	C4.1. Knowledge	Improved engagement and information access for practitioners and other stakeholders through targeted knowledge sharing networks.

Table of Sub-Project Outputs and GEF funding and co-finance

Outputs	Sources of funding		
	GEF funding (US$)	**Co-financing/ counterpart (US$)**	**Total Cost (US$)**
National Component 1.1 Innovative Solutions	**1,057,185**	**1,080,00**	2,137,185
Sub-component - 1.1.1 Rapid SLM-related diagnostic analysis on the extent of land degradation (using a community participatory approach) conducted to inform the definition of the innovative interventions (including development of a watershed management plan for the Cedar Grove/ Five Island watershed area).	34,000	165,000	199,000
Sub-component - 1.1.2 : Installed appropriate pre-treatment facility to absorb additional sewage diverted from the Cooks National Landfill	60,000	105,000	165,000
Sub-component - 1.1.3: Expanded McKinnon's Sewage Treatment plant to treat additional sewage diverted from the Cooks Sanitary Landfill (to include elements of energy efficiency and renewable energy)	894,326	689,000	1,583,326
Sub-component - 1.1.4: Installed land degradation control measures including phytoremediation within the Cedar Grove watershed (to include McKinnon's Pond) to reduce sedimentation and pollution	14,000	57,000	71,000
National Component 1.2 Socio-Economic Benefits	54,859	64,000	118,859
Sub-component - 1.2.1 Co-benefit assessment of IWEco interventions within project site and nationally	4,000	30,000	34,000
Project auditing/evaluation and reporting	50,859	34,0000	84,859
National Component 2.1 - Systems for monitoring	**8,000**	**380,000**	388,000
Sub-component - 2.1.1: Upgraded national accounts of IW and LD, and BD-related indicators of process, stress reduction, and environmental and socioeconomic status	8,000	380,000	388,000

	Sources of funding		
to monitor improvements in the management of land and water resources and wastewater			
National Component 3.1 Policy and legislation	**39,000**	**383,638**	422,638
Sub-component - 3.1.1 Policy guidelines and regulations to provide enabling environment support to implement a pilot sustainable financing mechanism for land degradation and pollution control (Ridge to Reef approach)	25,000	283,638	308,638
Sub-component - 3.1.2 Management mechanism for strengthening of the Ridge to Reef approach through partnership with the SIRF Fund, National Solid Waste Management Authority (NSMA) and the Central Board of Health.	14,000	100,000	114,000
National Component 3.2 Capacity Building	**65,000**	**621,000**	686,000
Sub-component - 3.2.1 Compliance framework to support sustainable land management and pollution control (focus on sewage handlers)	35,000	386,000	421,000
Sub-component - 3.2.2. Certified training programmes on improved environmental practices for land and water resource protection (include safe management and operation of sewage treatment facilities)	30,000	235,000	265,000
National Component 4.1 Knowledge Management	**46,500**	**132,000**	178,500
Sub-component - 4.1.1. Community and stakeholder consultations	23,500	36,100	59,600
Sub-component - 4.1.2. Awareness resources to support sustainable land management practices and effective pollution control measures (as part of the SIRF fund activities)	23,000	95,900	118,900
TOTAL (in PIF)	**1,215,685**	**2,596,638**	**3,812,323**
TOTAL (revised if applicable)	**1,215,685**	**2,596,638**	**3,812,323**

2 PROJECT DESIGN

2.1 Background and Context

Antigua and Barbuda is a twin island state located in the Caribbean Sea on the eastern arc of the Leeward Islands. Antigua is roughly round in shape and occupies a land area of 280 sq. km. (108 sq. miles) while Barbuda is approximately two thirds this size, occupying 160 sq. km. (62 sq. miles). The isle of Antigua will be the focus of this subproject as it builds on the GEF IWCAM's previous national intervention. Antigua is divided into three topographic zones, the mountainous south west region, the relatively flat Central Plains and the rolling limestone hills and valleys in the north and east. Soil formation has been determined primarily by the parent materials, topography and rainfall regime. Antigua has three main geological regions – the volcanic hills of the south west; the lower central region of volcanic related deposits and the limestone region of the north and east.

The estimated population of Antigua and Barbuda is 87,749[2]. Despite its small population, the island has a high-density ratio with the capital, St. John's, having the highest density per square mile. St. John's city in 2011 recorded an estimated 7,652.8 per square mile while St. John's rural has an estimated 1,134.9 per square mile.

Antigua and Barbuda both experience a tropical maritime climate with little variation in daily or seasonal temperatures. Average monthly minimum temperatures range from 22.4^{o}C in February to 25.4^{o}C in August, while monthly maximum temperatures range from 27.9^{o} C in February to 30.5^{o} C in September. Somewhat greater diurnal variation is observed in some inland areas. Relative Humidity averages range from lows of 72% - 78% in midafternoon to early morning highs of between 81% to 85%. The drier conditions and lower temperatures are experienced during the months of January to April.

The islands lie in the path of the north-easterly Trade Winds and experience fairly steady winds off the Atlantic ranging from the NE to the SE. Monthly average wind speeds are 17 to 26 km/hour, with lowest speeds during September to November. Rainfall is probably the most important and variable climatic feature and severe droughts are experienced every few years. Conversely, depending on the major climatic cycles associated with El Nino/La Nina, quite wet years are also possible. With the high increased occurrence of drought and the country's drive towards national food security, the demand to reduce the incidence of land degradation is presently of high priority.

2.1.1 Perspectives on land and water resources degradation

Land development challenges

The scope and understanding of land degradation and desertification within the context of a small island developing state like Antigua and Barbuda is applied following definitions as per the UNCCD Convention document of 1994. According to this definition, most areas of Antigua and Barbuda would be considered to fall within the range of semi-arid or dry sub-humid environments[3]. Based on the limited information available for evapotranspiration (ET) values, the ratio of precipitation to ET is about 0.57 for an average year, which is at the wetter end of the dry sub-humid range. Therefore, though there are issues with regards to drought throughout the year, the primary matter of concern with problems of land degradation include the loss of biological and/or economic productivity of rain-fed or irrigated land used for crops, range, pasture, forest or woodlands, which results from land uses, natural disasters or human actions, or combinations thereof. Based on the research conducted, it may be deduced that the main determining factor in the island's land degradation problems results from loss of soil productivity.

Central to addressing the challenges of realizing sub-optimal land use, reducing land degradation and loss of land productivity based on land capability, the government embarked on the development of a National Physical Development Plan (NPDP). During preparations of the NPDP, preliminary reports concluded that there were three main competing uses of land. These were identified as agriculture, housing and tourism.[4] Although the NPDP highlighted prime areas for expanding specific national land use developments, existing facilities, resource capacity deficits, coupled with climate change influences superimpose some level of constraint on achieving the 'optimal' zones prescribed within the NPDP. For example, some areas zoned for prime agricultural use conflict with present land uses that cause significant degradation of water and soil resources essential to further investments in agriculture. Cases

[2] Preliminary Data Release of 2011 Census.
[3] Government of Antigua and Barbuda: UNCCD Draft National Action Plan 2005
[4] State of the Environment Report: Preliminary report

in point are that of the National Landfill at Cooks (Five Isles), where sewage is dumped and buried, and the state-owned power plant which are in close proximity to prime agricultural land and have negative impacts of the resource base.

The NPDP and its development planning guidelines were adopted in 2012 by the Parliament of Antigua and Barbuda. Its implementation however, has been off to a slow start including the definition of Ridge-to-Reef spatial planning units that places land development within the construct of watershed management planning. It should be noted that the watershed management planning framework benefited from contributions from the GEF-IWCAM Project. In an attempt to build on the previous IWCAM project and catalyze the implementation of the NPDP, the IWEco Project will contribute to the development and implementation of critical aspects of a watershed management plan for the Cedar Grove watershed to address both soil and water conservation practices.

Freshwater Resources

As has been highlighted in the previous section on agriculture, freshwater resources on the island although significant, are limited and have been poorly regulated. Antigua's drainage areas were initially consolidated into thirteen (13) distinct watersheds. However, six (6) major watersheds were highlighted as critical based on their socio-economic, agro-ecological and hydrological values[5]. Combined, they constitute 43 percent of Antigua's land area; sustain 50% of its forests, and 90% of its crops. They also contain 90% of Antigua's ground water supply and 90% of its surface water reservoirs.

Water resources on the twin island state are used for both domestic and agricultural purposes. However, the demand for water has drastically exceeded the available supply from ground and surface water sources in addition to the decrease in the storage capacity of watershed basins primarily due to increase sedimentation and the lack of runoff control measures. This has been primarily due to population growth, pollution, improper development and climate change. As a result, the country is increasingly dependent on desalination which is more expensive to produce to meet national needs[6].

Antigua and Barbuda suffers from serious droughts and as such a practice and policy for the reuse of water must be implemented. Treated wastewater from the McKinnon's facility will provide an added benefit to assist local farmers and commercial entities during drought for irrigation purposes.

Table 1: Drought Periods experienced in Antigua and Barbuda 1928 -2013

DROUGHTS EXPERIENCED IN ANTIGUA (1928 - 2013)				
Severe	**Serious**	**Moderate**	**Slight**	No.
March, April, May 1928-June, July, August 1929	JJA 1940 - MAM 1941	JFM 1933 - AMJ 1933	ASO 1934 - SON 1934	1
SON 1929 - AMJ 1931	JFM 1944 - MJJ 1944	ASO 1933 - JJA 1934	AMJ 1937 - JAS 1937	2
FMA 1938 - AMJ 1938	NDJ 1944 - JAS 1945	JFM 1935 - MAM 1936	FMA 1943 - MAM 1943	3
JFM 1939 - OND 1939	ASO 1964 - JFM 1967	ASO 1941 - NDJ 1941	NDJ 1945 - JFM 1946	4

[5] ESAL, 2008 based on Fernandez 1990
[6] Sustainable Island Resource Zoning Plan for Antigua and Barbuda (including Redonda) 2012

JJA 1946 - ASO 1948	NDJ 1969 - MAM 1969	FMA 1950 - JJA 1950	FMA 1954 - JJA 1954	5
JFM 1953 - NDJ 1953/54	JFM 1980 - JFM 1981	ASO 1960 - JJA 1961	AMJ 1955 - JJA 1955	6
AMJ 1967 - NDJ 1968/69	MJJ 1984 - SON 1984	OND 1962 - NDJ 1962	SON 1955 - JJA 1956	7
FMA 1973 - JAS 1974	AMJ 1985 - JAS 1985	FMA 1963 - AMJ 1963	SON 1956 - MAM 1958	8
JFM 1975 - NDJ 1975/76	DJF 1985 - FMA 1986	DJF 1963 - FMA 1964	SON 1959 - DJF 1959/60	9
MAM 1976 - ASO 1977	JJA 1990 - DJF 1990/91	SON 1971 - NDJ 1971/72	DJF 1977 - FMA 1978	10
JFM 1983 - JFM 1984	JAS 1993 - JJA 1995	MJJ 1972 - OND 1972	MJJ 1982 - OND 1982	11
JJA 1986 - NDJ 1986/87	NDJ 1995 - MJJ 1996	DJF 1977 - MAM 1978	DJF 1983 - JFM 1984	12
AMJ 2000 - OND 2001	JAS 2009 - FMA 2010	DJF 1986 - MAM 1987	AMJ 1988 - JJA 1988	13
MJJ 2002 - OND 2003	JFM 2012 - ASO 2012	MAM 1989 - JAS 1989	JFM 1993 - MAM 1993	14
	NDJ 2012 - JFM 2013	OND 1989 - FMA 1990	MJJ 1998 - JAS 1998	15
		MAM 1991 - JFM 1992	MAM 2007 - JFM 2008	16
		ASO 1996 - OND 1996		17
		SON 1997 - FMA 1998		18
		MAM 2005 - AMJ 2005		19
		FMA 2006 - JFM 2007		20
		FMA 2009 - AMJ 2009		21
		NDJ 2010 - FMA 2011		22

Severe Droughts: Probability of at least one in a yr - 15.1%, at least one in 5 yrs - 56.0%, at least one in 10 yrs - 80.6%. Return Period - 6.6 years, Range - 3 to 27 seasons (average 15.2 seasons) or 5 to 29 months (average 17.2 months). These droughts normally start in the first half of the year.

Serious Droughts: Probability of at least one in a yr - 16.1%, at least one in 5 yrs - 58.5%, at least one in 10 yrs - 82.8%. Return Period - 6.2 years, Range - 3 to 24 seasons (average 9.4 seasons) or 5 to 26 months (average 11.9 months).

Moderate Droughts: Probability of at least one in a year - 22.8%, at least one in 5 yrs - 72.6%, at least one in 10 yrs - 92.5%. Return Period - 4.4 years, Range - 2 to 15 seasons (average 5.8 seasons) or 4 to 17 months (average 7.8 months).

Slight Drought: Probability of at least one in a year - 17.1%, at least one in 5 yrs - 60.9%, at least one in 10 yrs - 84.7%. Return Period - 5.8 years, Range - 2 to 19 seasons (average 5.2 seasons) or 4 to 21 months (average 7.2 months).

Droughts Overall: Probability of at least one (severe, serious, moderate or slight) in a year - 54.5%, Return Period - 1.8 years, Range - 2 to 27 season (average 8.5 seasons) or 4 to 29 months (average 10.5 months).
If there is a drought - 20.9% chance it is severe, 22.4% chance it is serious (43.6% severe or serious), 32.8% chance it is moderate and 23.9% it is slight. Probability of at least one serious or severe drought in 5 yrs (in 10 yrs) - 94.3% (99.7%) respectively. Longest period between any drought is 29 seasons (31 months); longest period between a severe or serious drought is 128 seasons (10 years and 10 months.

Currently, national capacity to manage and regulate water resource management is severely constrained with a variety of agencies having the onus of different aspects relating to its management. The Antigua Public Utilities Authority has legislative oversight to regulate the use of water sources but does not manage or regulate the disposal of wastewater. This is managed under the Public Health Act (Cap 353) that provides legislative powers to the Central Board of Health, another Government agency. The country is in the process of enacting a national water policy and act to establish and regulate a sustainable framework for the management of water resources. Policy formulation work was previously supported under the GEF-IWCAM Project.

Liquid waste generation and land degradation

Domestic and commercial effluent from on-site treatment systems are disposed of at the Cooks Sanitary and Civic Amenities Landfill. Though the Cooks landfill is properly constructed, efficient and fully

operational, the area where sewage is disposed is within a wetland. Cooks landfill caters to all types of municipal waste including sewage emanating mainly from the capital parish, St. John's. This landfill occupies approximately 14 hectares (35 acres) of land near the Western coast of the island. It has long been recognized within the country that the sewage disposal systems in place are inappropriate and insufficient to effectively dispose of the scale and scope of liquid wastes of a country with similar characteristics. In light of this, over the last ten years, there has been a series of discussions on the development of a central sewage treatment system. To bring these discussions to reality, in 2006 a project was approved by the GEF to install a demonstration sewage treatment system through which appropriate sewage management techniques could be highlighted within the country. The GEF IWCAM's intervention shows the benefits of a central wastewater treatment system serving the St. John's city area and its surrounding environs. Most wastewater is directed to on-site septic tank systems with soak-aways and/or drain fields. However, much of the sub-surface in the city core is saturated and heavy clay soils predominate in the suburban areas immediately east and north of St. John's. This soil type has a relatively low percolation rate[7] and as a result, sewage must be emptied via a collection system operated by both private and public entities. Collected sewage is transported to the Cooks landfill, where it is dumped into pits then buried. *Figure 1* highlights the annual sewage receipts at the Cooks landfill.

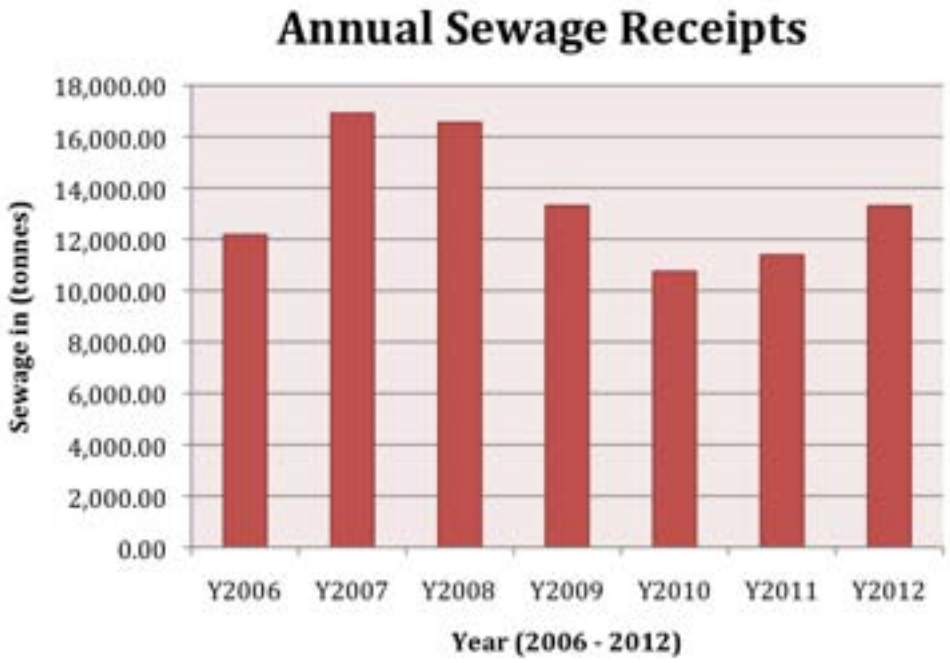


Figure 1: Annual Sewage Receipts[8]

Preliminary findings of the St. John's Wastewater Management Strategy (2010) highlighted an increasing trend in the amount of sewage disposed of at the landfill site during 2006 – 2009 with a sharp decline in 2010. Investigations revealed that this decline was due to the breaches in disposal times as many sewage handlers were able to enter the landfill after operating hours when no method of recording was done. This was later rectified with proper security controls. Illegal dumping of sewage outside of the landfill has been known to occur which presents a serious concern, but such data is unavailable at this time.

[7] Antigua Barbuda Wastewater Management Strategy (Draft) 2009
[8] Annual Data Sheets from the National Solid Waste Management Authority

Disposal of untreated sewage at the landfill site has resulted in significant land degradation and damage to the wetlands and pollution of the coastal zone in the Five Islands Harbour and finally the loss of opportunities to diversify land uses in the area. Additionally, expansion of the landfill is currently under discussion. This therefore requires an urgent intervention in expanding the facilities available to treat sewage and restrict encroachment of the landfill unto agricultural land.

Further, the Cooks landfill is located within a residential community with narrow arterial roads. As a result, residents are inundated with the pungent smell both emanating from the landfill as well as from the trucks daily transporting sewage. There are concerns regarding the seepage of effluent into the surrounding landscape and to a further extent, the Five Islands Bay, raising public and ecosystem health and concerns (Figure 3). Additional concerns have also been expressed in the deposits of wastewater that contain kitchen fats as well as wastewater with oils based on inefficient practices by sewage handlers.

Figure 2. Aerial view of the Cooks Landfill

Figure 3. Highly degraded and contaminated area where liquid waste is dumped and buried near Five Island Bay within Cooks Landfill

Under the GEF IWCAM project, a small demonstration Sewage Treatment Plant with the capacity to treat 91 m^3/day (20,000 gallons per day) was installed to collect municipal liquid waste from 20 residential housing units and two commercial properties in the North West Coast. The North West Coast of Antigua is the main tourism zone on the island, with the greatest concentration of hotels and the highest levels of water use. This area is however within the Cedar Grove / Five Isles Landscape, which is a drought risk zone with the lowest annual rainfall compared to other watersheds and limited ground water stores. Prior to the GEF IWCAM intervention, there were no municipal sewage treatment plants and although some exist in private hotels, most domestic properties utilize septic tank systems to provide primary treatment of sewage. Due to the lack of stringent enforcement policies, many of these plants, septic tanks, and soak-aways were not properly constructed or maintained and this has led to contamination of streams or groundwater (through overflow or runoff) as well as the McKinnon's Salt Pond especially during heavy storms. The McKinnon's Salt Pond has been a site for many fish kills however through previous government and donor funded initiatives, the occurrence of such fish kills has been less frequent.

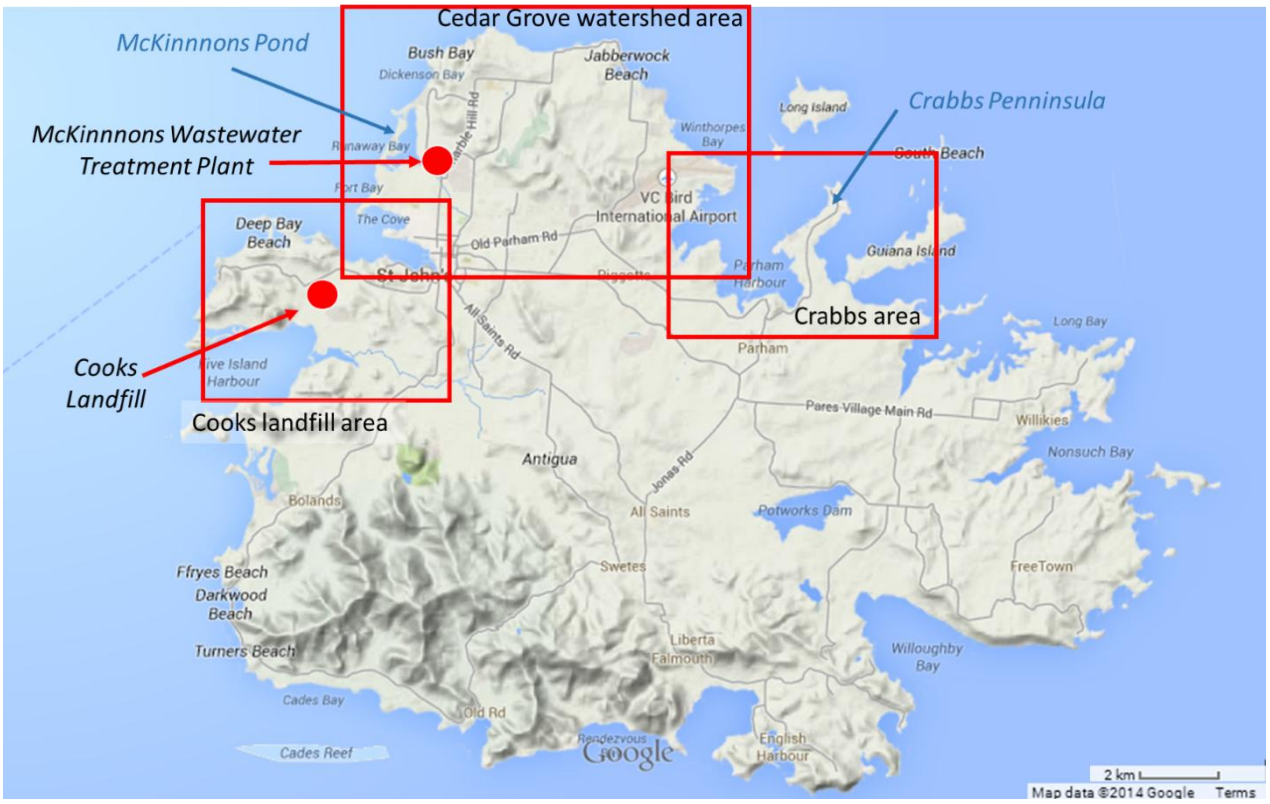


Figure 4: Landscape areas to be impacted by IWEco Subproject intervention (source: Google Earth)

It should be noted that the government, in showing its commitment to reducing the impact of sewage and waste oil disposal on the environment has already begun monitoring programs for water quality in these areas. Through the implementation of the GEF UNDP Sustainable Island Resource Management Mechanism project (SIRMM), random samplings of the area have been conducted and an online monitoring database established within the North West Coast. This establishes a baseline for monitoring possible impact of the plant's expansion to address both wastewater and waste oil disposal. Moreover, the NPDP calls for sustainable land management through the development and implementation of Ridge-to-Reef planning units based on local watershed boundaries for the development of local area management plans to foster sustainable land use with an aim of improving soil and water quality within the area. The plan will also consider hydrology patterns within the watershed region to ensure that runoff control measures are maintained as well as the landscape value and ecological integrity. This will facilitate the area's development as an ecotourism product.

Oily waste disposals and land degradation

The problem of waste oil on the island was brought to the forefront after a major oil spill in 2010 within the Crabbs Peninsula. The Crabbs Peninsula, located on the North East (*Figure 5),* is a hub of industrial activity; several entities in the area utilize and or store various forms of oil. Various companies were identified as possible sources via which oil could escape into the marine or terrestrial environment. A major user of oil is a state owned power-generating company and during preliminary investigations, it was observed that two (2) main issues persist in the use of oil. These include (i) the reliability of the waste oil collection system and (ii) the management of waste oil and oily water on the properties.

Based on consultation with the state owned company, an estimated 3 m^3 (600 gallons) of sludge is stored per month on site in separator pits awaiting collection from a privately owned recycling plant. This increases the potential for spills and leaks during storms and heavy rains. Currently, there is one privately owned plant that recycles waste oil from power plants. Its capacity however, is limited due to the processing capacity and time for the used oil. Local Oils Limited (LOL) operates as a recycling plant and recycles used motor oil or any other petroleum based substance for resale. LOL collects mainly from power stations, marinas, and a few garages however, given the often high ratio of oily water to oil, collection from the Government-owned plants are usually refused. This leads to a stockpile of approximately 3m^3 (600 gallons) per month, increasing the occurrences of spills within the surrounding environment. Only 114 m^3 (25,000 gallons) can be dewatered at a time, which takes approximately 2 weeks. As a result, large amounts of waste oil must be stored on site, increasing the possible occurrences of spills or leaks. To alleviate the storage of sludge, which increases the occurrences of spills within the terrestrial and marine environment, assistance will be needed to increase the separation of oil and oily water within the Government owned plants through the development and implementation of policy. The residual impacts of the constant release of waste oil into the surrounding environment is compromise of the quality of adjacent lands that are either being actively used, or otherwise zoned for

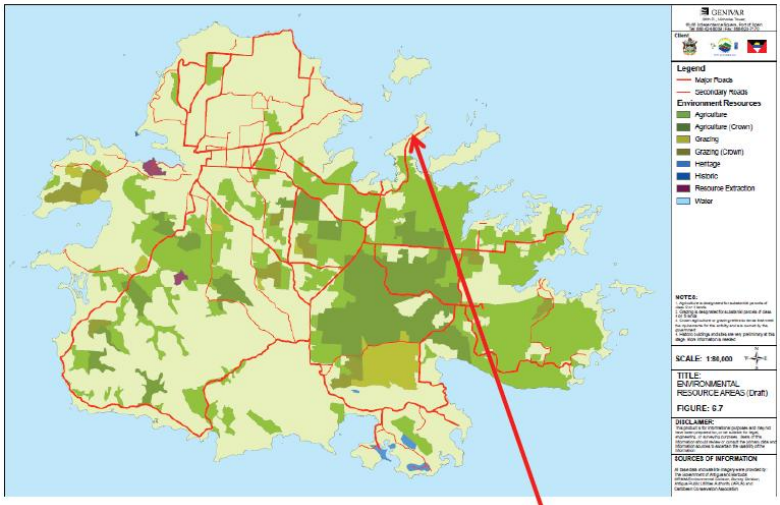


Figure 1: Zoning Map highlighting agricultural zones within the National Physical Development Plan

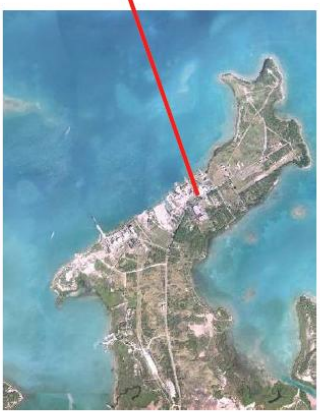


Photo 4: Aerial Photo of Crabbs Peninsular where Power Plants are located.

agricultural purposes.

Figure 5: Location of the main power generation station and ancillary facilities at Crabbs peninsula

Land and water conservation for agriculture

Antigua and Barbuda's agriculture can be described as vibrant, modern, and to some extent prosperous and competitive. The Government's overall goal in the agricultural sector is to "improve Antigua and Barbuda's food security and reduce poverty". To this end a policy was developed to guide the development of this important sector. The policy was formulated to ensure the capability of the agricultural sector's strategic role in national development is sustained and enhanced in light of the new and emerging challenges facing agricultural development. This is because global imperatives require agriculture to become internationally competitive; unfortunately, not all areas in agriculture in Antigua and Barbuda can realistically become competitive. Thus, the policy will focus on new approaches to increase productivity and competitiveness, deepen linkages with other sectors, venture into new frontier areas as well as conserve and utilize natural resources on a sustainable basis.

Despite a dramatic decline after the collapse of the sugar industry many years ago, the Agriculture sector accounts for approximately 4 % of the nation's GDP. Implementation of the GEF UNDP Sustainable Island Resource Management Mechanism (SIRMM) highlighted that water remains one of the biggest limitations to agricultural production, particularly for small-scale farmers. Many smaller holdings suffer from limited ground water availability, droughts and insect pests, or unfertile depleted soils. The growing impacts of climate change for the region and more specifically Antigua and Barbuda, include drier and warmer daily temperatures tending toward more frequent and prolonged droughts. Compounding the threat of water availability is land degradation through surface erosion and direct pollution over landscape areas. It is imperative for the sector to gain improved access to water supplies and arable lands that are not compromised by pollution to not only increase production and sustain livelihoods, but also to build national resilience to climate change impacts.

2.1.2 National policy and regulation in land and water resource management

The IWEco Project aligns with the national policies seeking protection and rehabilitation of the natural environment further to that outlined in the sections above. The National Sustainable Island Resource Zoning Plan which serves as the National Physical Development Plan requests the protection of water reservoirs from ineffective wastewater treatment and land degradation, and also calls for a sewage system for the St. John's area. The project also aligns with the recently enacted Environmental Protection and Management Act 2015 in addressing liquid waste disposal and discharge permits. The national project will provide and demonstrate the compliance framework appropriate to the EPMA 2015. IWEco national project is also linked to the National Environmental Management Strategy (NEMs) developed as Antigua and Barbuda's commitment to the St. George's Declaration. The development of the NEMs is an OECS initiative that seeks to establish national mechanisms for the implementation of the Barbados Plan of Action for SIDS. This project is consistent with Principle One of the NEMs.

This project is also consistent with the objectives of the UNCCD as it relates to improving the conditions of affected ecosystems as well as Article 7 of the Cartagena Convention which addresses the development and implementation of measures to prevent, reduce and control pollution caused by coastal disposal or by discharges emanating from rivers, estuaries coastal establishments, outfall structures. Additionally, as highlighted in the 2010 National UNCCD Performance Review Assessment report, financing and awareness on land degradation issues are in need of improvement, a gap this project aims to close by the end of its execution.

2.1.3 Stakeholder Analysis

A wide range of stakeholders will be associated with the implementation of the IWEco Project, although there are a few core stakeholders that will play major roles as facilitators who will promote the initiative, while there will be those who are beneficiaries and anticipated to buy into the project and become advocates for uptake and replication. An analysis of stakeholder perceptions and expectations reveal that farmers are amongst the most significant stakeholders given interests in investment in lands for agricultural production that is based on the maintenance of good soil quality and reliable access to water supply. The hospitality sector also has strong interest particularly from the standpoint of pollution control as it influences the quality of coastal recreational waters in the heavily touristic developed areas within the northwest coastal corridor of the island. Other critical stakeholders will be managers and operators of waste management facilities and waste haulers/handlers. The project seeks to strengthen the capacities and capabilities amongst this set of stakeholders toward implementation of best environmental practices in the area of pollution control and land degradation. The residents surrounding the Cooks landfill in particular have been negatively impacted as a result of the transportation and disposal of sewage; under a waste diversion programme this nuisance factor will be reduced.

An important consideration in discussion with stakeholders and professionals in relation to implementation of the project, are the forecasted additional costs to sewage handlers utilizing a new and expanded waste treatment facility at McKinnons. However, during the completion of the previous demonstration project, a survey of the residents within the area showed residents were willing to pay for the transport and efficient disposal of sewage in order to reduce the pollution, health and sanitation impacts caused by the improper handling of this type of waste. Additionally, it is envisaged that the awareness campaign will garner further widespread support for a user fee system to maintain the facility's operation.

Local farmers and commercial business are expected to benefit from the use of treated grey-water for irrigation and landscaping purposes. This will be highly beneficial during times of drought when water is use is restricted by the local water utility. Moreover, this will reduce the demand pressures for water supply generally.

The following is the list of national stakeholders and anticipated roles in the project.

Table 2 Roles of local non-governmental and community-based organizations in support of the project.

Local organization	Role in project
Antigua Hotels and Tourist Association	• Provide medium for stakeholder engagement with surrounding hotels near McKinnons Pond • Provide support as potential care taker and marketing agent for the McKinnon's Pond as part of ecotours on the island
Farmers	• Advocate (as recipients) for use of treated grey water and training on irrigation best practices (particularly for salad crops).
Liquid Waste (effluent) haulers	• Support and buy-in (as key target stakeholders) to guiding the development of liquid waste management policies • Participate in relevant training, certification and registration toward safer waste haulage
York Community Group	• Provide support to wider community engagement as care takers

Local organization	Role in project
(Residents near the McKinnon's Salt Pond)	for enhancing the landscape value of the McKinnon's salt pond • Advocate for the adoption of improved environmental management practices to reduce pollution to major watercourses flowing to McKinnon's pond
Cooks/Five Isle area residents	• Advocate for waste diversion to avoid nuisance factors associated with effluent haulage

2.2 Overall Objective and Outcomes

Antigua and Barbuda's IWEco Project will continue to support national efforts in addressing the challenges of land degradation through innovate approaches for pollution control in respect of investments in diversion and on-site remediation of effluent, and land degradation mitigation supported by cost recovery mechanisms. One major cost recovery pathway is sale of recycled wastewater (to farmers for irrigation and state-owned and private entities for landscaping and other non-potable uses) that will contribute long-term operation and maintenance of the investments. The target areas for investments are the McKinnons Pond and the Cooks Landfill environs. Previous initiatives have sought the rehabilitation of Pond in an attempt to enhance the ecological functioning and aesthetic value for ecotourism, and the IWEco project will build on such initiatives by expanding the coastal mangrove extents within the McKinnon's Pond. The SIRMM Project included the installation of aquatic plant species to increase the absorption of excess nutrients within the pond to encourage the regrowth of red and black mangroves. Reforestation activities will also include the Cook Landfill area to minimize the impact of coastal pollution and to also increase both the forest cover and filtration. Reforestation and land stabilization controls will be installed in wider areas of the Cedar Grove watershed to address point sources of land degradation.

Objective:

To alleviate the current issues of land degradation in the Cedar Grove / Five Islands Landscape and raise awareness to effective wastewater management and the use of private public partnerships to achieve financial sustainability in effective effluent management and land degradation mitigation policies.

The expected outcomes are:

- Measurable stress reduction achieved in the Cedar Grove / Five Islands Landscape, through appropriate sustainable water, land and ecosystems management interventions that account for climate change.
- Enhanced livelihood opportunities and socio-economic co-benefits for targeted communities from improved ecosystem services functioning.
- Strengthened policy and legislation for the effective management of water, land and ecosystems resources that account for climate change.
- Strengthened capacity of national and regional institutions and other stakeholders for water, land, and ecosystems management that accounts for climate change.

- Improved engagement and information access for practitioners and other stakeholders through targeted knowledge sharing networks.

Successful implementation of the IWEco national project will achieve the following objectives that are consistent with the GEF land degradation focal area:

- Sustainable land and watershed management through the analysis of land degradation from improper liquid waste disposal and the development and implementation of a local watershed management plan for the Cedar Grove and Five Island's area;
- Reforestation to improve ecosystem and habitat condition and enhance water quality around the McKinnons Pond, the wider Cedar Grove watershed area including the environs of Cooks Landfill;
- Sustained livelihoods for stakeholders dependent on the use and management of natural resources (land, water, and biodiversity). Farmers will benefit from the treated wastewater that is to be reused for crop production particularly during drought conditions;
- Reduced vulnerability to impacts of climate change for communities dependent on the use and management of natural resources within the project target areas.

2.3 Consistency with International Efforts

The IWEco sub-project is consistent with the objectives of the UNCCD as it relates to improving the conditions of affected ecosystems and Article 7 of the Cartagena Convention which addresses the development and implementation of measures to prevent, reduce and control pollution caused by coastal disposal or by discharges emanating from rivers, estuaries coastal establishments, outfall structures. Additionally, as highlighted in the 2010 National UNCCD Performance Review Assessment report, financing and awareness on land degradation issues are in need of improvement, a gap this project aims to close by the end of its execution.

Further, national project preparations are underway to enable access to the Special Climate Change Fund for climate change adaptation measures. The SCCF, which supports both long-term, and short-term adaptation activities in water resources management, land management, agriculture, and other areas coincides with the goals and objectives of the IWEco subproject.

The IWeco Project aligns with the national policies seeking protection and rehabilitation of the natural environment. The National Sustainable Island Resource Zoning Plan that serves as the National Land Use Plan requests the protection of water reservoirs from ineffective wastewater treatment and also calls for a sewage system for the St. John's area. The project also aligns with the National Environmental Management Strategy (NEMs) developed as Antigua and Barbuda's commitment to the St. Georges Declaration. The development of the NEMs is an OECS initiative that seeks to establish national mechanisms for the implementation of the Barbados Plan of Action for SIDS. This project is consistent with Principle One of the NEMs.

2.4 Activities, Outputs, Outcomes

A Summary of project outputs and description of the important activities are described below:

Component 1: Develop and foster the implementation of targeted Innovative, climate-change resilient approaches to Sustainable Land Management (SLM) and enhanced management and maintenance of ecosystem services within the Cedar Grove / Five Isles Landscape in Antigua.

The IWEco national project builds on the success of the previously implemented GEF IWCAM intervention and other donor-funded initiatives where measures will be expanded to reduce land degradation that results from land based sources of pollution. Under the GEF-lWCAM Project a sewage treatment facility was installed to handle wastewater discharges to the North West Coastal environment, a designated a biodiversity hotspot, given the severity of coastal and groundwater pollution from improper sewage discharge particularly from the city of St. John's. The Membrane Bioreactor (MBR) treatment plant, located within the Cedar Grove watershed and Five Islands Landscape and adjacent to the McKinnon's Salt Pond, treats up to 91 m^3 (20,000 gallons) of sewage per day. This technology was particularly important since it adequately removes the pollution which would otherwise negatively impact the surrounding ecosystems. It is located within close geographic proximity to farms, hotels and other businesses creating an opportunity for building sustainability of plant operation through use of the treated water through public-private partnerships.

The IWEco Project will further expand the McKinnon's Sewage treatment facility (previously developed by the IWCAM project) to handle an increased capacity of 455m^3/day (100,000 GPD) allowing for a reduction in the amount of sewage deposited at the national landfill and other illegal sites thereby reducing the consequent land degradation. The treated greywater from the plant will be sold to farmers within the McKinnon's area to irrigate an estimated 20 hectares (50 acres) of cropland, particularly important during times of severe drought. The project will also build on the GEF-IWCAM interventions (and others) to strengthen supportive cost-recovery strategies, legislation and policies for reducing land degradation and pollution control associated with the improper disposal of effluent throughout the island, and locally within the parish of St. John's.

The project will Hydrological assessments within the Cedar Grove Watershed will facilitate both the identification of sources of pollution, and unstable embankments of watercourses flowing into McKinnon's Pond and also inform the development of the watershed management plan.

The GEF Small Grants Programme (GEF-SGP) will support the development and implementation of smaller-scale investments associated with the main project to enhance economic livelihood opportunities. These will be defined during project inception and negotiated over the early stages of project implementation.

Sub-Component 1.1.1 - Diagnostic analysis

Activities:

- **1.1.1.1.** Baseline data collection (soil and water quality sampling to determine levels of nitrates / oil polluting soil and waterways) and hydrology assessment within the Cedar Grove Watershed Unit and formulation of a watershed management plan

- **1.1.1.2.** Feasibility Assessment for wastewater plant expansion
- **1.1.1.3.** Presentation of Lab reports and findings to public, private sector and community stakeholders
- **1.1.1.4** Stakeholder Consultations on use of treated greywater for irrigation purposes and soil tillage (begin developing PR strategy)

Output:

- **A rapid SLM and SFM-related diagnostic analysis on the extent of land degradation within the Cedar Grove watershed related to wastewater and waste oil disposal and other sources of land degradation**

Sub-Component 1.1.2 - Installation of pre-treatment facility for sewage processing

Activities:

- **1.1.2.1.** Procurement of materials and equipment;
- **1.1.2.2.** Construction and installation of facility
- **1.1.2.3** Develop operations & training manual for operations of pre-treatment/ sorting facility

Output:

- **Appropriate pre-treatment facility to absorb additional sewage diverted from the National Landfill**

Sub-Component 1.1.3 - Expansion of the McKinnons Wastewater Treatment Plant

Activities:

- **1.1.3.1** Procurement of materials and equipment needed for expansion as per feasibility assessments:
- **1.1.3.2** Construction and Installation of treatment compartments, solar panels and pumps to assist in electrical generation for lift stations and the transporting of sewage to main treatment compartments.
- **1.1.3.3** Installation of pipeworks to the surrounding commercial entities and homes for the sale of sewage treatment services.

Output:

- **Expanded McKinnon's Sewage Treatment plant to treat additional sewage diverted from the Cooks Sanitary Landfill and from the McKinnon's commercial entities; to include components of energy efficiency and renewable energy to facilitate self-sufficiency.**

Sub-Component 1.1.4 Reforestation and establishment of bio-engineered (soil) conservation installations within watercourses flowing into the McKinnon's Pond and around Cooks landfill

Activities:

- **1.1.4.1** Assessment of areas conducive to reforestation activities within the McKinnon's Pond and also the Cooks Land fill site.
- **1.1.4.2** Propagation of planting material and establishment of a green belt (mangrove plantings) around McKinnon's Pond to reduce acute land and shoreline degradation and assist with phyto-remediation.
- **1.1.4.3** Establishment of runoff control measures within the Cedar Grove Watershed to increase filtration capacity of water courses flowing into the McKinnon's Salt Pond and reduce on contaminant discharges to the adjacent marine environment.

Outputs:

- **Stabilized landscapes within the Cedar Grove Watershed and along degraded watercourse embankments draining to McKinnon's Pond**
- **Rehabilitated forests and improved soil conservation measures around McKinnon's Pond and over approximately 15 hectares**

Outcome:

- ***Measurable stress reduction achieved in the Cedar Grove / Five Isles Landscape through appropriate sustainable water, land and ecosystems management interventions that account for climate change.***

Component 1.2 Socio-economic benefits (supported through the GEF Small Grants Programme)

Activities:

- **1.2.1.1** Conduct a feasibility study for a community-based livelihood initiative associated with the main project.
- **1.2.1.2** Conduct of a livelihoods support case study highlighting impact of improved water and land management practices on operations of sewage/liquid waste handlers and farmers.

Output:

- **Assessed co-benefits of IWEco interventions within project site and at national level**

Outcomes:

- ***Enhanced livelihood opportunities and socio-economic co-benefits for targeted communities from improved ecosystem services functioning (including livelihoods Impact on sewage handlers/ liquid waste handlers and farmers)***

Component 2: Strengthen Sustainable Land Management (SLM), Integrating Water Resources Management (IWRM) and ecosystems Monitoring and Indicators frameworks in Antigua & Barbuda.

The project will contribute to the strengthening of the national capacity to monitor changes in environmental status as a result of the project investment. The approach will be participatory stakeholder engagement that will include the target beneficiaries and the support agencies engaged in the project.

Sub-Component 2.1.1 - Systems for monitoring

Activities

- **2.1.1.1** Compile all existing data and information pertaining to the environmental quality at target areas and their environs and complete gap/needs analysis;
- **2.1.1.2** Develop and institute a monitoring protocol for periodic assessment of identified environmental indicators at intervention sites with participatory engagement of stakeholders.

Outputs:

- **Protocol and installed instrumentation for monitoring at target site locations**
- **Generated data from monitoring process**
- **Adoption into national accounts of IW and LD, and BD-related indicators of process, stress reduction, and environmental and socioeconomic status to monitor improvements in the management of land and water resources and wastewater**

Outcome

- ***Strengthened national system for monitoring of environmental status with respect to key international agreements***

Component 3: Strengthening policy, legislative and institutional reforms and capacity building to support Sustainable Land Management (SLM), Integrating Water Resources Management (IWRM) and ecosystem services management taking into consideration climate change resilience building in Antigua and Barbuda.

The project seeks to create a supportive enabling environment for the roll-out of an innovative financial mechanism that will foster long-term sustainability of investments in land degradation mitigation and pollution control with public-private sector participation. This will necessitate addressing regulatory and policy gaps. It is proposed that Sustainable Island Resource Fund (SIRF Board) will form the basis for the financing mechanism effected through approved bylaws and ordinances. The board of the SIRF will be comprised of permanent secretaries, NGOs, private sector and finance specialists (from commercial banks and credit unions).

The project will also provide support to the development of compliance frameworks that will guide stakeholders in making investments that are in keeping with best practices for sustainable land management inclusive of watershed and water resource protection and pollution control. This will be in keeping with the strategic directions of the National Physical Development Plan. Capacities will be built among practitioners through certified programmes for good land and water resources management

practices. Wastewater handlers and treatment plant operators will be targeted in connection with the investments to be made in enhanced sewage management under the project.

Sub-Component 3.1.1 Policy guidelines and legislation to support sustainable financing for land degradation and pollution control

Activities:

- **3.1.1.1** Establish appropriate policy guideline, support legislation and a pilot mechanism for the sustainable financing and management of land degradation and pollution control (effluent and oily wastes) in Antigua and Barbuda on the basis of watershed management planning framework;
- **3.1.1.2** Develop and implement financial business plan to operationalize recommendations of the GEF-IWCAM Project in respect to viable operations of wastewater sector in the country

Sub-Component 3.1.2 Establish a 'ridge-to-reef' management mechanism through partnership with the SIRF Fund, National Solid Waste Management Authority (NSMA) and the Central Board of Health

Activities:

- **3.1.2.1** Support the establishment of SIRF Board for land and water pollution control services with approved by-laws and ordinances

Outputs:

- **Policy guidelines and legislation to support the pilot mechanism for sustainable financing and management of land and water degradation/pollution**
- **Ridge-to-reef management mechanism through partnership with the SIRF Fund, National Solid Waste Management Authority (NSMA) and the Central Board of Health.**

Outcome:

- ***Strengthened policy and legislation for the effective management of water, land and ecosystems resources that account for climate change.***

Sub-component 3.2.1 Compliance framework to support sustainable land management and pollution control

Activities:

- **3.2.1.1** Develop draft standards for sustainable land management, liquid waste collection and disposal, support policy and/or regulations;
- **3.2.1.2** Conduct sensitization workshops for land development practitioners/stakeholders, farmers, waste/sewage handlers on sustainable land management and pollution control policies;
- **3.2.1.3** Design a certification scheme and registration system for sustainable land management practice for land development practitioners/stakeholders and liquid waste collectors/haulers

Sub-component 3.2.2 Institutionalize a certified training programme on improved environmental practices for land and water resource protection

Activities:

- **3.2.2.1** Conduct an assessment of training needs (for certification programme)
- **3.2.1.3** Develop and implement training programme aligned with a tertiary academic institution (in sustainable land management practices and pollution control and remediation inclusive of operations and maintenance of the sewage treatment plant & waste oil separation) supported by field classroom training

Outputs:

- **Compliance framework for sustainable land management and pollution control**
- **Certification training workshops on sustainable land management practices and pollution control and remediation**

Outcome:

- ***Strengthened capacity of national and regional institutions and other stakeholders for water, land, and ecosystems management that accounts for climate change.***

Component 4: Enhancing knowledge exchange, promotion of best-practices, replication and expanding stakeholder involvement in the Cedar Grove / Five Isles Landscape area and at the national level.

Stakeholders will be made aware of the extent of national land degradation related to liquid waste disposal and the best practices to reduce land degradation particularly as it relates to proper sewage and oily waste disposal. Education and awareness will be expanded among farmers and other interested stakeholders on use of recycled wastewater and best practices in sustainable agriculture and land management. Through a participatory approach residents within the Cedar Grove watershed and the wider general public will contribute to the development of the watershed management plan and key policy guidelines to improve soil and water resource management at the local and national levels.

Sub-component 4.1.1 - Community and stakeholder consultations, technical exchanges and knowledge platforms

Activities:

- **4.1.1.1** Conduct KAP surveys of practitioners to guide design and development of outreach and awareness resources
- **4.1.1.2** Conduct stakeholder awareness consultations and community meetings
- **4.1.1.3** Establish an information platform for accessing information on certified liquid waste handlers, practitioners in land and water pollution remediation
- **4.1.1.4** Support technical exchanges, project visits amongst SIDS, and internships for professionals and practitioners

Sub-component 4.1.2 - Develop awareness resources to support sustainable land management practices and effective pollution control measures

Activities:

- **4.1.2.1** Develop and implement a PR strategy targeting high officials, policy makers, private sector, and other relevant stakeholders.
- **4.1.2.2** Develop and disseminate public service announcements, and a short feature documentary on addressing pollution and land degradation in the country.
- **4.1.2.3** Support information sharing via virtual regional and global knowledge sharing networks.

Outputs:

- KAP survey findings and recommendations for design of PA/PE resources
- Community and stakeholder consultations and empowered communities
- Web portal for knowledge sharing
- Sustainable land management and pollution control management systems publications
- Public service announcements, various PA/PE resources

Outcome:

- ***Improved engagement and information access for practitioners and other stakeholders through targeted knowledge sharing networks.***

2.5 Incremental Reasoning

2.5.1 Baseline:

Through some programs and policies relating to land degradation along with measures to address land based sources of pollution have been implemented there are still gaps between the current status and what is required to meet the country's obligations in accordance with national, regional and international sustainable development frameworks. The main issue relating to sustainable land management on mainland Antigua is land degradation associated with improper land development and use. This is mainly concentrated in urban areas but is also the main cause of chronic erosion in elevated areas. Another area of concern is land-based liquid and solid waste pollution sourced particularly from sewerage sludge and oily waste residues. Although the NPDP was adopted, efforts to initiate more localized plans for sustainable land management as well maintaining ecosystem functions have not yet been initiated.

On Barbuda, critical issues associated with unsustainable land management include sand mining, and improper sewage disposal. Land management in Antigua and Barbuda is controlled by many Government Agencies that are supported by various Acts of legislation. The lead agencies charged with the responsibility of land management and development include the Development Control Authority (DCA), Central Housing and Planning Authority (CHAPA), Lands Division, and the Surveys Division. The estimated value of government support to sustainable land management programmes through these agencies on an annual basis is approximately US$300,000. The main interventions on sustainable land management have been associated with the GEF full-sized project, the Sustainable Island Resource Management Mechanism (SIRMM) Project that included the development of a National Sustainable Land Zoning Plan, wastewater guidelines with regulations and a GIS-based management information tool were

all developed. These allowed for the identification of priorities for intervention and capacity building. The value of that project was US$7million.

Essentially, the IWEco Project intends to build on the outputs of the SIRMM and IWCAM project previously implemented through funding also provided by the GEF. Also under the IWCAM project a National IWRM policy statement was developed for Antigua and Barbuda and a National IWRM roadmap was also developed. The IWRM Roadmap is a guidance paper that outlines the various actions that should be undertaken by a country toward the formulation of national IWRM master plans.

The IWEco Project will also compliment other GEF projects approved under Antigua and Barbuda's STAR allocation. This is important as the projects within the STAR together will ensure the establishment of various aspects/ windows of a Sustainable Financing mechanism for general Environmental Management in Antigua and Barbuda, including the area of pollution control. The Financial Mechanism includes a Fund to be established for ecosystem services to the public. The Fund's business strategy entails the selling of ecosystem services with the profits used to implement the National Environmental Legislation. The services to be sold include renewable energy, watershed services, wastewater services and Used Oil. The current macroeconomic status of Antigua and Barbuda is such that financial investment options for Environmental Management is difficult if not an impossible challenge, hence the approach to using this fund with its proposed design.

The Fund is in its developmental phase and the IWEco National project will be using land degradation allocations of US$940,000 to support the establishment of the wastewater recycling window of the Fund. The success of this window and the "proceeds" from the sale of these services will continue to provide funding for the reduction of land degradation through the implementation of effective land management practices and its provisions within the environmental legislation.

2.5.2 Business as usual scenario

In the absence of focused interventions on land degradation control and pollution mitigation via increased capacity of the McKinnon's treatment facility there will be further encroachment and compromise of the capacity of the Cooks landfill with an increase in the land-degrading impacts of sewage seepage from the landfill into the surrounding areas. The McKinnons Pond will continue to receive elevated pollutant loadings from point and non-point sources from across the Cedar Grove watershed and exhibit continued degradation of the ecosystem quality of the pond itself and the adjacent receiving coastal waters. The challenges of waste oil being improperly disposed of by the state-owned power generation plants and other commercial investments will also continue to increase.

2.5.3 Incremental reasoning: Project rationale based on fit with GEF Strategy/Goals and expected GEF global environmental benefits (GEB).

The Government of Antigua and Barbuda has designed its national component of the GEF IWEco Project to enhance the enforcement of national legislation aimed at reducing land degradation caused by pollution. Additionally, the project builds on a national strategy to provide adequate financial services and other enabling policies to assist the government and the private sector in meeting their obligations under the national legislation with regards to effective land management and pollution control. The NPDP calls for the development of "Ridge-to-Reef Planning Units" in which watershed boundaries,

particularly those adjacent to coastal areas are used to plan and implement development controls that will facilitate remediation of adverse downstream impacts of development projects based on the hydrological functioning. Based on existing national circumstances, and the recognized leading causes of land degradation, the project specifically addresses the issue of sustainable land management and wastewater management within the northwest coastal corridor of Antigua, inclusive of the rehabilitation of the McKinnons Pond and the Cooks landfill's wetland to reduce sedimentation and the contamination of the coastal environment as well as improve soil and water quality.

The IWCAM project demonstrated best practice in wastewater management within the settlement areas of the Cedar Grove / Five Isles landscape and provided guidelines in support of future developments in a compliance framework. The project was a small-scale intervention that raised awareness to the growing demand for efficient wastewater management particularly in a watershed region. However, due to national budgetary constraints there have been inadequate resources to sustain follow-up IWCAM interventions. With this in mind and to address major pollutants impacting soil and water quality, the national component of the IWEco project will expand the IWCAM intervention to address the issue across the settlements of the Cedar Grove / Five Isles Landscape, to contribute to sustainability and realize the adoption of policy guidelines to support compliance with the LBS protocol and address major contributors to land degradation.

Further, as the twin-island state continues to experience impacts attributed to climate change, national efforts are underway to cushion the socio-economic and environmental impacts therein. This has been demonstrated through the shifts towards renewable energy, soil and water conservation and increasing food security. The National Interconnection Policy enables a maximum grid penetration of fifteen (15%) percent from renewable energy sources. The draft Water Policy and Act is currently under review while the Food and Nutrition Policy and Agricultural Policy advocates an increase in local food production. However, during droughts, farmers are most often forced to purchase water at higher rates or to reduce agricultural production, leaving soils exposed to the elements and invasive plant species. The project will enable the provision of alternate water supply through treated wastewater and reduce the economic burden to farmers.

National efforts are also underway to establish an environmental fund, the Sustainable Island Resource Framework Fund (SIRF) that will facilitate investments for environmental conservation and protection. As such, GEF resources are essential in the application of this new national mechanism to create avenues for sustainable financing through an environment value chain. The intervention will support a certification scheme to not only educate the general public but also sewage and waste oil haulers on the damaging effects of improper disposal practices to soil and water quality. This will also enable a transfer of knowledge on wastewater technologies.

2.5.4 Expected benefits: Socioeconomic and other development gains to be brought about by the proposed intervention.

The Project benefits are significant and local benefits will accrue in various forms and to the various communities and stakeholders as a result of the environmental value chain added. Sewage will be properly collected and treated with one of the best technologies to produce water for reuse for irrigation. This will also enable the development of public private partnerships as commercial entities will be engaged in cost effective measures to support a municipal treatment facility as opposed to expensive individual treatment systems. Moreover, the development and implementation of local watershed management plans will guide the decisions of national policy makers as it relates to land use,

soil and water conservation, and reducing environmental stressors. Reforestation activities aimed at enhancing habitat conditions and water quality will demonstrate the value of an improved landscape to support community livelihoods through ecotourism. Through public private partnerships, IWEco will demonstrate how recycling and rehabilitative efforts in the environment may become self-sustainable in the long-term as opposed to the perception of interventions becoming significant recurrent public expenditure.

Integrative benefits through the GEF multi-focal area management approach - Sustainable Forest Management, Land Degradation and International Waters: Investments in sustainable forest management will focus on innovation in vegetative control measures to enhance pollution mitigation within areas that are impacted by disposal of liquid effluent. The target areas in the environs of the Cooks Landfill and the McKinnons Pond are receiving areas for effluent disposals and as such have been degraded with loss of ecosystems functioning over time. These areas lie adjacent to coastal areas heavily utilized for harvesting of seafoods to various recreational purposes. The long-range impacts to the coastal waters are therefore of critical concern. The objective of forest management in Antigua and Barbuda is two-fold; to reduce on land degradation over fragile landscapes that are prone to erosion, and in the environmental buffering capacity to immobilize pollutants discharged to riparian and marine environments. McKinnons Pond and the adjacent Runaway Bay is an important biological area that is a receiving area for runoff and pollutant loads from the wider Cedar Grove watershed that includes the communities of Yorks, Marble Hill and Friar's Hill. Runaway Bay is an important recreational area with large hotel properties situated along the adjacent shoreline. The Cooks Landfill situated at Five Island Bay is of concern from the standpoint of potential contamination of the coastal waters particularly given the disposals of sewage and oily waste within the site.

The project will focus on innovative approaches to enhancing waste diversion and pollutant immobilization to avert land degradation caused by water pollution. There will be direct investments in wastewater but this will be augmented by in-situ ecological or phytoremediation (using plants with contamination absorptive capacities) along the coastal areas through reforestation. These measures will include the installation of runoff control measures. Coastal mangroves that have been degraded will be restored through planting mangrove and rehabilitation. Upland areas in the watershed that are undergoing land degradation will be rehabilitated with species native to the surrounding landscapes so as to conserve ecological integrity in as far as practical. Agricultural landscapes will enhanced using species of commercial interest to farmers.

Through on-site land and forest cover investments within 15 hectares over the target Cedar Grove and Cooks watershed areas, it is expected that an estimated 1,223.5 equivalent tonnes of CO_2 over the life of the project, or an average of 244.7 tCO_2eqv/year will be sequestered (see Annex 3.4).

The actions under the project will be supported by improvement in the policies that mainstream sustainable land and forest management within the wider national development frameworks so as to reduce the extent of land degradation in the country. The key outcome from investments supported by the GEF SFM contributions are in the promotion of good management practices in existing forests that are effected through enhancement of the enabling environment and uptake and up-scaling of lessons learnt in the management of land and forest resources.

2.5.5 Gender dimensions

The World Bank reports that in 2008 51% of all persons employed in the non-agricultural sector in Antigua and Barbuda, were women. While this is indicative that women have a significant share in the employment market, nationally, it is important that the project carefully consider all aspects of the equity dimension from the project inception to the close of implementation and beyond. The island's tourism product is the mainstay of its economy and any intervention aimed at reducing the impacts of land degradation will ultimately be beneficial to the elements of the natural resource base on which the tourism product is dependent. The flow of benefits anticipated as a direct result of project interventions will ultimately result in improvements in household income security and maintenance of health and stability in the home and community at large.

The project will seek to carefully consider the gender equity dimension over the course of implementation. The state of degradation caused by indiscriminate waste discharges influences the mid to long-range sustainable access to resources for agriculture and fisheries development, and development and sustainability of the vital tourism product. These influences have very direct economic value-chain impacts where the flow of benefits are compromised which in turn affects household income security, maintenance of health and stability in the home and the community at large. The gender roles in counterbalancing these impacts will need to be evaluated so as to determine relative influence and how the project can support means to address gender-based deficiencies and understand strengths in adapting.

During the project initiation phase a detailed gender audit will be undertaken as to evaluate gender roles and relative influence to determine precisely how the project can address gender-based deficiencies. Under Component 3: Strengthen policy, legislative and institutional reforms and capacity building to support Sustainable Land Management (SLM), Integrating Water Resources Management (IWRM) and ecosystem services management, emphasis will be placed on gender mainstreaming within both the policy and capacity building elements. Gender audits and targeted analyses to ascertain derived benefits by stakeholders will be conducted, along with training that will strengthen gender-equitable access to ecosystem services, safe and adequate water, sanitation, food security and other benefits derived from project implementation.

2.6 Budget and Co-finance

The total cost of the Antigua and Barbuda sub-project is **3,649,323 USD**. The GEF Grant is **1,215,685 USD**. The co-financing is **2,433,638 USD**, provided through the Government of Antigua and Barbuda, UNEP Car/RCU, UNDP, CARPHA, OECS and UWI.

Table 2: Sub-project 1.1 – Entire budget at activity level

National Sub-project 1.1: Antigua & Barbuda	GEF Funding (US$)	Co-Financing (US$)	Total component Cost (US$)
COMPONENT 1 : Implementation of targeted Innovative, climate-change resilient approaches to Sustainable Land Management (SLM) and enhanced management and maintenance of ecosystem services within the Cedar Grove / Five Isles Landscape in Antigua	**1,057,185**	**1,080,000**	**2,137,185**
Component 1.1 Measurable stress reduction in land, soil and watershed quality through appropriate sustainable water, land and ecosystems management interventions that account for land degradation and climate change.	1,057,185	1,080,000	2,137,185
Sub-component 1.1.1 : Rapid SLM-related diagnostic analysis on the extent of land degradation related to wastewater and waste oil disposal	34,000	165,000	199,000
Activity 1.1.1.1 - Baseline data collection (soil and water quality sampling to determine levels of nitrates / oil polluting soil and waterways) and hydrology assessment within the Cedar Grove Watershed Unit and formulation of a watershed management plan	15,000	78,000	93,000
Activity 1.1.1.2 -Feasibility Assessment with stakeholder engagement for wastewater plant expansion and oil recycling system development (technical operations and financial capacities).	15,000	78,000	93,000
Activity 1.1.1.3 - Presentation of lab report findings & feasibility assessments to stakeholders via consultations with government agencies, surrounding commercial entities and sewage handlers (to support connection to the McKinnon's Sewage treatment Plant)	2,000	4,000	6,000
Activity 1.1.1.4 - Stakeholder consultation with Farmers & NGOs on use of treated greywater for irrigation purposes (begin developing PR strategy)	2,000	5,000	7,000
Sub-component 1.1.2 : Sewage pre-treatment investment at McKinnons Wastewater Treatment Plant	60,000	105,000	165,000
Activity 1.1.2.1 - Construction & Installation of a sewage pre-treatment facility based on guidance of feasibility assessment	56,500	90,000	146,500
Activity 1.1.2.2 - Develop operations & training manual for operations of pre-treatment/ sorting facility	3,500	15,000	18,500
Sub-component 1.1.3: Expanded capacity investment at McKinnon's Sewage Treatment plant (include energy efficiency and renewable energy installations)	894,326	689,000	1,583,326
Activity 1.1.3.1 Procurement of materials and equipment needed for expansion as per feasibility assessments	654,326	373,000	1,027,326
Activity 1.1.3.2 - Construction and installation of treatment compartments, solar panels and pumps to assist in electrical generation for lift stations and the transporting of sewage to main treatment compartments	40,000	10,000	50,000
Activity 1.1.3.3 - Installation of pipeworks to the surrounding commercial entities and homes for the sale of sewage treatment services	200,000	306,000	506,000
Sub-component 1.1.4: Installed land degradation control measures including reforestation within the Cedar Grove watershed (to include McKinnon's Pond and Cooks area) to reduce sedimentation and pollution	14,000	57,000	71,000
Activity 1.1.4.1 - Assessment of areas conducive to phytoremediation and reforestation activities within the McKinnon's Pond/ Cedar Grove Watershed	2,000	5,000	7,000
Activity 1.1.4.2 - Propagation of planting material and establishment of a green belt (mangrove plantings) around McKinnon's Pond/ Cedar Grove Watershed	2,000	35,000	37,000
Activity 1.1.4.3 - Establish runoff control measures within the Cedar Grove Watershed to increase filtration capacity of water courses flowing into the McKinnon's Salt Pond.	10,000	17,000	27,000
Component 1.2 Enhanced livelihood opportunities and socio-economic co-benefits for targeted communities from improved ecosystem services functioning.	4,000	20,000	38,000
Sub-component 1.2.1 – Community co-benefits assessment of IWEco investments (at local project site and national level) for support under the GEF-SGP	54,859	64,000	118,859
Activity 1.2.1.1 – Conduct a feasibility study for a community-based livelihood initiative	2,000	10,000	12,000

National Sub-project 1.1: Antigua & Barbuda	GEF Funding (US$)	Co-Financing (US$)	Total component Cost (US$)
associated with the main project.			
Activity 1.2.1.2 – Conduct of a livelihoods support case study highlighting impact of improved water and land management practices on operations of sewage/liquid waste handlers and farmers	2,000	10,000	12,000
Sub Activity 2 – Project auditing/reporting / evaluation	50,859	44,000	94,859
COMPONENT 2: Strengthen Sustainable Land Management (SLM), Integrating Water Resources Management (IWRM) and ecosystems Monitoring and Indicators frameworks in Antigua & Barbuda.	**8,000**	**380,000**	**388,000**
Sub-Component 2.1: Strengthened national and regional systems for monitoring of environmental status with respect to key international agreements.	8,000	380,000	388,000
Sub-component 2.1.1: Monitoring protocol for assessment of environmental indicators at intervention sites	8,000	380,000	388,000
Activity 2.1.1.1 - Compile all existing data and information pertaining to the environmental quality at target areas and their environs and complete gap analysis	3,000	171,000	174,000
Activity 2.1.1.2 - Develop and institute a monitoring protocol for periodic assessment of identified environmental indicators at intervention sites with participatory engagement of stakeholders	4,600	190,500	195,100
Sub Activity 2 – Project auditing/reporting / evaluation	400	18,500	18,900
COMPONENT 3: Strengthen policy, legislative and institutional reforms and capacity building to support Sustainable Land Management (SLM), Integrating Water Resources Management (IWRM) and ecosystem services management taking into consideration climate change resilience building in Antigua and Barbuda.	**104,000**	**1,004,638**	**1,108,638**
Component 3.1 Strengthened policy and legislation for the effective management of water, land and ecosystems resources that account for climate change.	39,000	383,638	422,638
Sub-component 3.1.1 Policy guidelines and legislation to support sustainable financing for land degradation and pollution control	25,000	283,638	308,638
Activity 3.1.1.1 - Establish appropriate policy guideline, support legislation and a pilot mechanism for the sustainable financing and management of land degradation and pollution control	10,000	200,000	210,000
Activity 3.1.1.2 - Develop and implement financial business plan to operationalize recommendations of the GEF-IWCAM Project in respect to viable operations of wastewater sector in the country	15,000	83,638	98,638
Sub-component 3.1.2 'Ridge-to-reef' management mechanism through partnership with the SIRF Fund, National Solid Waste Management Authority (NSMA) and the Central Board of Health.	14,000	100,000	114,000
Activity 3.1.2.1 - Support the establishment of SIRF Board for land and water pollution control services with approved by-laws and ordinances.	14,000	100,000	114,000
Component 3.2 Strengthened capacity of national and regional institutions and other stakeholders for water, land, and ecosystems management that accounts for climate change.	**65,000**	**621,000**	**686,000**
Sub-component 3.2.1 Compliance framework to support sustainable land management and pollution control	35,000	386,000	421,000
Activity 3.2.1.1 - Develop draft standards for sustainable land management, liquid waste collection and disposal, support policy and/or regulations	20,000	200,000	220,000
Activity 3.2.1.2 - Conduct sensitization workshops for land development practitioners/stakeholders, farmers, waste/sewage handlers on sustainable land management and pollution control policies	5,000	80,000	85,000
Activity 3.2.1.3 - Design a certification scheme and registration system for sustainable land management practice for land development practitioners/stakeholders and liquid waste collectors/haulers	10,000	106,000	116,000
Sub-component 3.2.2 Certified training programme on improved environmental practices for land and water resource protection	30,000	235,000	265,000

National Sub-project 1.1: Antigua & Barbuda	GEF Funding (US$)	Co-Financing (US$)	Total component Cost (US$)
Activity 3.2.2.1 - Conduct an assessment of training needs	5,000	10,000	15,000
Activity 3.2.2.2 - Develop and implement training programme aligned with a tertiary academic institution (in sustainable land management practices and pollution control and remediation inclusive of operations and maintenance of the sewage treatment plant & waste oil separation) supported by field classroom training	20,000	180,718	200,718
Sub Activity 2 – Project auditing/reporting / evaluation	5,000	44,282	49,282
COMPONENT 4: Enhance knowledge exchange, promotion of best-practices, replication and expanding stakeholder involvement in the target watershed areas and at the national level.	**46,500**	**132,000**	**178,500**
Component 4.1 Improved engagement and information access for practitioners and other stakeholders through targeted knowledge sharing networks.	46,500	132,000	178,500
Sub-component 4.1.1. - Community and stakeholder consultations, technical exchanges and knowledge platforms	23,175	36,100	59,275
Activity 4.1.1.1 - Conduct KAP surveys of practitioners to guide design and development of outreach and awareness resources	7,000	15,000	22,000
Activity 4.1.1.2 - Undertake stakeholder consultations including farmers, oil users (mechanics, yachting sector, etc) and community meetings	3,000	9,100	12,100
Activity 4.1.1.3 - Establish an information platform for accessing information on certified liquid waste handlers, practitioners in land and water pollution remediation	3,175	10,000	13,175
Activity 4.1.1.4 - Support technical exchanges, project visits amongst SIDS, and internships	10,000	2,000	12,000
Sub-component 4.1.2 – Awareness-raising resources to support sustainable land management practices and effective pollution control measures	23,325	95,900	119,225
Activity 4.1.2.1 - Develop and implement PR strategy targeting high officials, policy makers, private sector and other relevant stakeholders.	7,000	30,000	18,000
Activity 4.1.2.2 - Develop and disseminate public service announcements, and a short feature documentary on addressing pollution and land degradation in the country	12,000	60,000	72,000
Activity 4.1.2.3 - Support information sharing via virtual regional and global knowledge sharing networks	2,000	1,000	3,000
Subactivity - Project audit/reporting/evaluation	2,325	4,900	7,225
Total Component Costs	**1,215,685**	**2,596,638**	**3,812,323**

2.6.1 Co-financing

Table 3. Co-finance

Name of Co-financier	Sources of Co-financing	Type of Co-financing	*Amount ($US)*
Government of Antigua & Barbuda (Environment Division)	GOA	Cash & Kind	1,114,000
UNEP CarRCU	GEF Agency	In-kind	210,000
UNDP	GEF Agency	In-kind	35,000
CARPHA	Other Multilateral Agency (ies)	In-kind	322,638
OECS	Other Multilateral Agency (ies)	In-kind	840,000
UWI	Other	In-kind	75,000
	Total co-financing		**$2,596,638**

2.6.2 Consultants Working for Technical Assistance Components

Table 4. Consultants working for technical assistance in the subproject description:

Sub-project 1.1 Antigua and Barbuda	GEF($)	Co-financing (US$)	Project total (US$)
International consultants	0	0	**0**
Local consultants	170,000	175,000	345,000
Total	**170,000**	**175,000**	**345,000**

2.7 Workplan and Timeline

Table 5: Workplan and Timeline

M = Meeting, **R**= Report (includes other publications), **W** = Workshop, **S** = Communication Strategy, **MR** = Mid-term Report, **TR** = Terminal Report, **I** = Project website (NOTE: the timing of the outputs are indicative; these will be finalized on project inception and subject to review during project implementation)

National Sub-project 1.1: Antigua & Barbuda	Year 1				Year 2				Year 3				Year 4			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
COMPONENT 1 : Implementation of targeted Innovative, climate-change resilient approaches to Sustainable Land Management (SLM) and enhanced management and maintenance of ecosystem services within the Cedar Grove / Five Isles Landscape in Antigua																
Component 1.1 Measurable stress reduction in land, soil and watershed quality through appropriate sustainable water, land and ecosystems management interventions that account for land degradation and climate change.																
Sub-component 1.1.1 : Rapid SLM-related diagnostic analysis on the extent of land degradation related to wastewater and waste oil disposal																
Activity 1.1.1.1 - Baseline data collection (soil and water quality sampling to determine levels of nitrates / oil polluting soil and waterways) and hydrology assessment within the Cedar Grove Watershed Unit and formulation of a watershed management plan	R											R				
Activity 1.1.1.2 -Feasibility Assessment with stakeholder engagement for wastewater plant expansion (technical operations and financial capacities).		R														
Activity 1.1.1.3 - Presentation of lab report findings & feasibility assessments to stakeholders via consultations with government agencies, surrounding commercial entities and sewage handlers (to support connection to the McKinnon's Sewage treatment Plant)			M													
Activity 1.1.1.4 - Stakeholder consultation with Farmers & NGOs on use of treated greywater for irrigation purposes (begin developing PR strategy)		W										**R**				
Sub-component 1.1.2 : Sewage pre-treatment investment at McKinnons Wastewater Treatment Plant																
Activity 1.1.2.1 - Construction & Installation of a sewage pre-treatment facility based on guidance of feasibility assessment																
Activity 1.1.2.2 - Develop operations & training manual for operations of pre-treatment/ sorting facility							R									
Sub-component 1.1.3: Expanded capacity investment at McKinnon's Sewage Treatment plant (include energy efficiency and renewable energy installations)																

National Sub-project 1.1: Antigua & Barbuda	Year 1				Year 2				Year 3				Year 4			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Activity 1.1.3.1 Procurement of materials and equipment needed for expansion as per feasibility assessments						R										
Activity 1.1.3.2 - Construction and installation of treatment compartments, solar panels and pumps to assist in electrical generation for lift stations and the transporting of sewage to main treatment compartments							R									
Activity 1.1.3.3 - Installation of pipeworks to the surrounding commercial entities and homes for the sale of sewage treatment services										R						
Sub-component 1.1.4: Installed land degradation control measures including reforestation within the Cedar Grove watershed (to include McKinnon's Pond and Cooks area) to reduce sedimentation and pollution																
Activity 1.1.4.1 - Assessment of areas conducive to reforestation activities within the McKinnon's Pond and also the Cooks Land fill site			R													
Activity 1.1.4.2 - Propagation of planting material and establishment of a green belt (mangrove plantings) around McKinnon's Pond as well as within the Cooks Landfill wetland								R								
Activity 1.1.4.3 - Establish runoff control measures within the Cedar Grove Watershed to increase filtration capacity of water courses flowing into the McKinnon's Salt Pond.									R							
Component 1.2 Enhanced livelihood opportunities and socio-economic co-benefits for targeted communities from improved ecosystem services functioning.																
Sub-component 1.2.1 – Community co-benefits assessment of IWEco investments (at local project site and national level) for support under the GEF-SGP																
Activity 1.2.1.1 – Conduct a feasibility study for a community-based livelihood initiative associated with the main project.			R													
Activity 1.2.1.2 – Conduct of a livelihoods support case study highlighting impact of improved water and land management practices on operations of sewage/liquid waste handlers and farmers													R			
COMPONENT 2: Strengthen Sustainable Land Management (SLM), Integrating Water Resources Management (IWRM) and ecosystems Monitoring and Indicators frameworks in Antigua & Barbuda.																
Sub-Component 2.1: Strengthened national and regional systems for monitoring of environmental status with respect to key international agreements.																
Sub-component 2.1.1: Monitoring protocol for assessment of environmental indicators at intervention sites																
Activity 2.1.1.1 - Compile all existing data and information pertaining to the environmental quality at target areas and their environs and complete gap analysis	R															

National Sub-project 1.1: Antigua & Barbuda	Year 1				Year 2				Year 3				Year 4			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Activity 2.1.1.2 - Develop and institute a monitoring protocol for periodic assessment of identified environmental indicators at intervention sites with participatory engagement of stakeholders				R		R		R		R		R		R		R
Component 3 Objective: To strengthen policy, legislative and institutional reforms and capacity building to support Sustainable Land Management (SLM), Integrating Water Resources Management (IWRM) and ecosystem services management taking into consideration climate change resilience building in Antigua and Barbuda.																
Sub-Component C3.1 Strengthened policy and legislation for the effective management of water, land and ecosystems resources that account for climate change.																
Sub-component 3.1.1 Policy guidelines and legislation to support sustainable financing for land degradation and pollution control																
Activity 3.1.1.1 - Establish appropriate policy guideline, support legislation and a pilot mechanism for the sustainable financing and management of land degradation and pollution control					R											
Activity 3.1.1.2 - Develop and implement financial business plan to operationalize recommendations of the GEF-IWCAM Project in respect to viable operations of wastewater sector in the country														R		
Sub-component 3.1.2 'Ridge-to-reef' management mechanism through partnership with the SIRF Fund, National Solid Waste Management Authority (NSMA) and the Central Board of Health.																
Activity 3.1.2.1 - Support the establishment of SIRF Board for land and water pollution control services with approved by-laws and ordinances.																
Component 3.2 Strengthened capacity of national and regional institutions and other stakeholders for water, land, and ecosystems management that accounts for climate change.																
Sub-component 3.2.1 Compliance framework to support sustainable land management and pollution control																
Activity 3.2.1.1 - Develop draft standards for sustainable land management, liquid waste collection and disposal, support policy and/or regulations						R										
Activity 3.2.1.2 - Conduct sensitization workshops for land development practitioners/stakeholders, farmers, waste/sewage handlers on sustainable land management and pollution control policies							W									
Activity 3.2.1.3 - Design a certification scheme and registration system for sustainable land management practice for land development practitioners/stakeholders and liquid waste collectors/haulers									R							

National Sub-project 1.1: Antigua & Barbuda	Year 1				Year 2				Year 3				Year 4			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Sub-component 3.2.2 Certified training programme on improved environmental practices for land and water resource protection																
Activity 3.2.2.1 - Conduct an assessment of training needs			R													
Activity 3.2.2.2 - Develop and implement training programme aligned with a tertiary academic institution (in sustainable land management practices and pollution control and remediation inclusive of operations and maintenance of the sewage treatment plant & waste oil separation) supported by field classroom training													R	W		
Component 4 Objective: To enhance knowledge exchange, promotion of best-practices, replication and expanding stakeholder involvement in the Cedar Grove watershed area and at the national level.																
Component 4.1 Improved engagement and information access for practitioners and other stakeholders through targeted knowledge sharing networks.																
Sub-component 4.1.1. - Community and stakeholder consultations, technical exchanges and knowledge platforms																
Activity 4.1.1.1 - Conduct KAP surveys of practitioners to guide design and development of outreach and awareness resources		R														R
Activity 4.1.1.2 - Undertake stakeholder consultations including farmers, oil users (mechanics, yachting sector, etc) and community meetings	M			M					M					M		
Activity 4.1.1.3 - Establish an information platform for accessing information on certified liquid waste handlers, practitioners in land and water pollution remediation										I						
Activity 4.1.1.4 - Support technical exchanges, project visits amongst SIDS, and internships																
Sub-component 4.1.2 – Awareness-raising resources to support sustainable land management practices and effective pollution control measures																
Activity 4.1.2.1 - Develop and implement PR strategy targeting high officials, policy makers, private sector and other relevant stakeholders.		S														
Activity 4.1.2.2 - Develop and disseminate public service announcements, and a short feature documentary on addressing pollution and land degradation in the country																
Activity 4.1.2.3 - Support information sharing via virtual regional and global knowledge sharing networks			R				R				R				R	

2.8 Risk Analysis

Table 6: Risk Analysis

Risk	Rating (L/M/H)	Risk management strategy
1. In sufficient budgetary allocation	L	Continuous Lobbying for co-financiancin locally and internationally; encouraging public private partnerships
2. Private trucking entities reject depositing at the McKinnon's Sewage treatment Plant	M	Raised awareness, stakeholder consultation and sensitisation will be undertaken prior to the relevant activities. Certification scheme to provide trucking entities with a credible status to solicit not only the trust of customers but to also increase client base.
3. Rejection of greywater reuse and purchases	H	Sufficient awareness, stakeholder consultation and sensitisation will be undertaken prior to the implementation; utilize pilot demonstration in partnership with one or two willing farmers.
4. Limited data to provide a comprehensive assessment	L	The Project provides for data base collection. Also, ongoing academic partnerships or internship program will enable data collection and analysis
5. Noncompliance of sewage handlers in collection procedures which may lead to mechanical failure of pretreatment facility	H	Sufficient awareness, stakeholder consultation and sensitisation will be undertaken prior to the activities to first initiate voluntary compliance. Later adoption of policy and legal framework will support further compliance.
6. Occurrence is on private lands so needs buy-in from landowners.	M	Stakeholder consultation and raised awareness of derived benefits. Physical Planning Act 2003 allows for compulsory purchase in the event of public good.
7. Non-cooperation of farmers in providing data as well as with respect to the use of treated greywater	M	Sufficient stakeholder consultation will assist in this process to address any perceived concerns. Further, constant public awareness will assist in sensitization
8. Difficult fiscal challenges faced by governments may worsen and may result in shifting priorities and human resource deployment away from resource management;	H	Sufficient stakeholder consultation will assist in this process. Ultimately high-level government support will be necessary and the Project will need to concentrate on fostering this support.
9. Limited persons with the necessary competencies for training.	H	Capacity assessments will be undertaken at project start, and appropriate training and capacity building provided through the Project
10. Availability of personnel to fully participate (commitment overload; trained persons are no longer in a position to apply knowledge through	H	Ensure training schedules are provided well in advance of planned event and courtesy calls to ensure attendance or participation.

Risk	Rating (L/M/H)	Risk management strategy
staff turn-over, other causes);		
11. Plant's expansion capacity may be limited pending other available resources for operations	H	Establish procurement needs list and source possible alternatives
12. Slow compliance or rejection policies developed	L	Sufficient awareness, stakeholder consultation and sensitisation will be undertaken through effective implementation of communications strategy and pilot demonstrations. Later adoption of policy and legal framework will support further compliance.
13. Lack of interest or willingness of practitioners or other stakeholders to attend training program	M	Effective implementation and monitoring of communications public awareness strategy
14. Inappropriate choice of dissemination methods;	L	Effective implementation and monitoring of communications public awareness strategy
15. Insufficient time and resources to develop and test best practices;	L	Capitalize on advances made by other projects and focus on areas where synergies exist
16. Lack of participation and poor attendance at consultations	L	Effective implementation and monitoring of communications public awareness strategy
17. Media fails to frequently air developed ads	L	Issue Cabinet Note for frequent circulation as most media houses are Government affiliated.
18. Delays in hiring consultants and executing consultancies	L	Ensure TORs are distributedly widely throughout the OECS with above average time frames for completion of tasks
19. Rejection of treated wastewater for reuse by potential beneficiaries (farmers/hoteliers)	L	Effective implementation Increased awareness through public outreach and participation activities.
20. Limited national capacity to conduct land degradation assessment relevant to liquid waste contamination	M	Collaborate with national and regional FAO offices for assistance. Advertise TOR regionally.
21. Concerns regarding land tenure for drainage rehabilitation /vegetation	M	Consult with property owners and offer guidance on best practices for improved filtration and drainage
22. Loss of plant seedlings or inability to thrive in soil still heavily contaminated	M	Conduct additional soil and water sample analysis prior to tree planting to determine readiness for planting in the third/ fourth year of the project

2.9 Sustainability

Efforts have been made to address wastewater management and the related land degradation issues at the national level however, the remedial measures are slow in implementation. However, some progress has

been made. For example, the legislative framework for wastewater management is currently under review through the recently enacted Environmental Protection and Management Act 2015. In the interim, the regulations of the Physical Planning Act have been updated to include elements of wastewater management, particularly related to the size and design of treatment facilities. Further, the regulations also speak to developments that necessitate the use of a treatment facility and fines for potential breaches. The IWCAM project developed a national wastewater management strategy which has been brought before Parliament for future implementation. Through the Sustainable Island Resource Management Project, an online database has been established to monitor wastewater discharges from pilot entities. This database will later be expanded to cater to all sewage treatment facilities.

The IWEco subproject will build on this progress by demonstrating the best practice for municipal sewage disposal while attempting remedial efforts. To ensure sustainability, the project will seek to assist the current management authorities for sewage to improve their management systems and community engagement activities to assist in tree planting activities and in so doing, reduce the current pollution and land degradation issues faced. The Cooks landfill is managed by the National Solid Waste Authority while the existing McKinnons Sewage Treatment facility is under the management of the Antigua Public Utilities Authority (APUA), which also has responsibility for water resources. This responsibility will be transferred to the SIRF department as APUA is a statutory body and unable to access or negotiate grants from international agencies. The SIRF is now partnering with Ministry of National Security through a prisoner rehabilitation initiative which utilizes inmates soon to be released in the construction and maintenance of projects. In the initial states, financial sustainability for the plant will be dependent on the receipts of grants however, the financial and business management plan being developed in addition to the continued prisoner rehabilitation programme, will ensure financial sustainability of the plants operation in the long term. Constructed vegetated drains or watercourses will be maintained by community groups and annual national clean-up days and also by the Central Board of Health as per annual work program for cleaning of waterways.

With the implementation of a user fee system and the possible implementation of a reuse water policy, sufficient revenue will be attained to sustain plant operations. Capacity in sewage management will also be enhanced through Activity 3 as personnel of the APUA, National Solid Waste Management Authority, the Central Board of Health as well as private sector representatives will be provided certified training.

Phytoremediation and reforestation activities within degraded areas of the target watershed will enhance ecosystem functioning through increase in vegetative forest cover conservation of soil and water quality. Based on consultations undertaken by the SIRMM Project with the Yorks Community Groups and surrounding hoteliers, interest has been expressed to maintain the area as an eco-touristic and recreational area. Buy-in and investment by the hospitality sector and residents are essential in securing sustainability. Finally, the development of the Cedar Grove Watershed Management plan under the project will advance sustainable development considerations within a 'ridge-to-reef' watershed management planning framework that will form the basis for future land use planning and development.

2.10 Replicability

The existing treatment facility is located within the capital parish of St. John's and its expansion will most likely cater to sewage collected from the central, northern and western parts of the island. The systems utilized here will most certainly be replicated to other parishes on the eastern side of the island to cater for sewage coming from the southern, eastern and northeastern sections to avert instances of illegal dumping.

The sewage management strategy calls for the establishment of an additional two plants within the parish of St. Johns to effectively manage all the sewage within the region. The success of the plant at McKinnon's will be built on when establishing the two additional plants. As indicated, the watershed management plan is part of a requirement of the "Ridge to Reef planning unit" of the NPDP and such a plan developed under IWEco will provide a guiding template for other management plans. Through the GEF SGP, community groups and NGOs will be engaged in reforestation activities to reduce environmental stressors which may serve as a catalyst for the development and execution of similar community based projects.

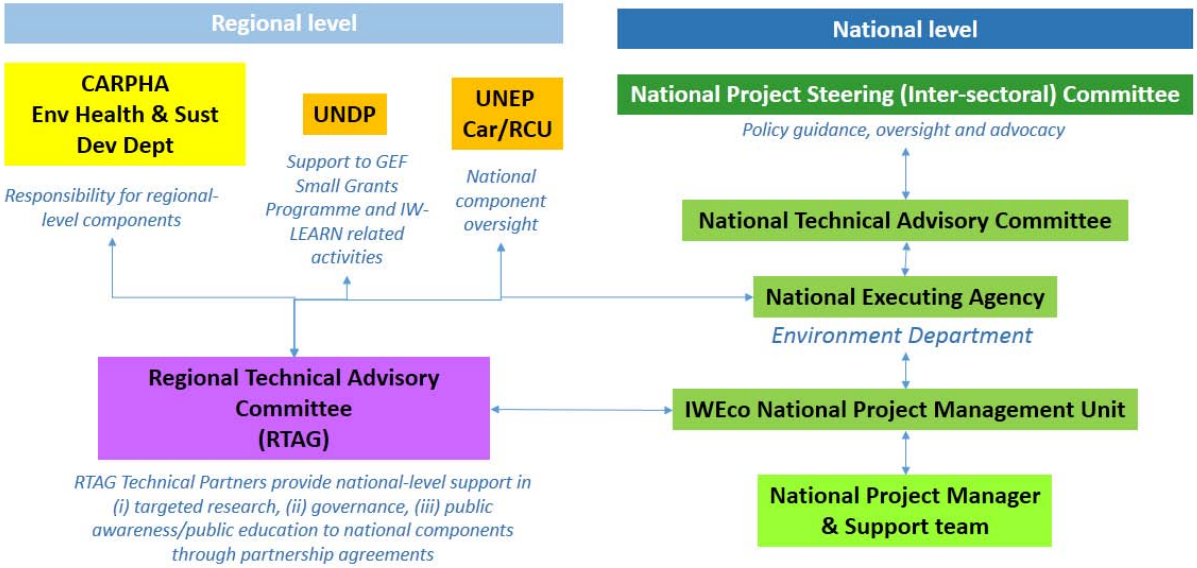
2.11 Execution Arrangements

All donor-funded projects are managed through a GEF Project Management Unit (PMU) with a lead project coordinator and administrative assistant reporting to the National Technical Advisory Committee (TAC). A similar system will be implemented for this project. A quarterly stipend will be awarded to Project staff and designated TAC members for project coordination; auditing and evaluation, additional office supplies and other administrative overheads. Coverage for this will be derived from each project component at a rate of 5% for a total of US$60,784.

Component 1	**GEF Co-financing US$**	**Co-Financing US$**	**Total component cost US$**
Component 1: To develop and foster the implementation of targeted innovative, climate change resilient approaches to Sustainable Land Management (SLM) and enhanced management of ecosystem services within the Cedar Grove Watershed	52,859	54,000	106,859
Component 2: Strengthening sustainable land management (SLM), integrated water resources management (IWRM) and ecosystems monitoring and indicators frameworks in Antigua and Barbuda	400	18,500	18,900
Component 3: Policy, legislative and institutional reforms and sustainable land management, integrating water and ecosystem services management taking into consideration resilience building in Antigua and Barbuda	5,200	44,282	49,482
Component 4: To enhance knowledge exchange, promotion of best practices, replication, and expanding stakeholder involvement in the Cedar Grove Watershed area and at the national level	2,325	4,900	7,225
Total Project Administrative & Coordinating	**US$60,784**	**US$121,682**	**US$182,466**

costs			

The IWEco national component will be absorbed into this existing management structure with the Department of Environment serving as the National Executing Agency. The reporting and management of accounts will be spearheaded by the Department of Environment based on inputs of the National Project Coordinator and decisions made by the PMU and TAC. Further, as the focal point for a number of MEA related projects, the DoE maintains a quarterly internal financial auditing programme and as such IWEco will be subject to this. The results of which will also facilitate external audits. Any remaining budgets for sub activities shall also further contribute to this, if needed.



2.12 Communications and Dissemination Mechanisms

The Department of Environment has previously initiated a knowledge management strategy that examines the type of data, audience and users of project outputs. As such, implementation of the IWEco Project will also adhere to this strategy through its internal reports, and quarterly "Lessons Learnt Workshops" undertaken by the Department for all executed projects.

Further, a communications and public awareness strategy will be developed through an appropriate consultant. Various sector groups within society will be targeted via three mediums, namely, audio, visual, and printed media to increase awareness on land degradation issues and the impacts of improper liquid waste disposal systems. The aim is to first highlight the harms of current practices and provide solutions with value chains. Educational materials will also highlight economic incentives linked to waste reuse. The Department of Environment will host consultations and deliver presentations with NGOs, community groups, schools and commercial entities to garner support and assistance for the sewage treatment plant. Awareness raising on the impacts of improper liquid waste disposal will also target persons engaged in both large and small scale activities involving liquid waste (wastewater and oil). This will enable such persons to gain a deeper understanding of the detriments caused to the environment due to inefficient handling of liquid waste.

Benefits derived from the Project will be demonstrated through public service announcement (PSAs) and documentary capturing value chains in sustainable land management and the reuse of liquid waste. Additionally, pilot partnerships will be established with local farmers and possibly hotels to demonstrate and capture the uses of treated greywater.

The DoE currently maintains a website and social media pages that will broadcasts news event or facts dedicated to raising awareness of the IWEco Project and outputs. Moreover, local media kit could be developed in alignment with the IWEco Regional Project for wider dissemination.

Finally, to build on other public awareness initiatives undertaken a system of monthly or quarterly lunch briefing could be used to engage higher level officials and policy makers on the progress and benefits of the Project.

2.13 Monitoring and Evaluation (M&E)

The sub-project will be monitored through the following M&E activities:

Sub-project start-up: An Inception Workshop will be held within the first 3 months of the establishment of the National Project Management/Coordinating Unit involving those with assigned roles in the overall project organization structure, UNEP, CARPHA and where appropriate/feasible regional partners, national advisors as well as other national and local stakeholders. The Inception Workshop is crucial to building ownership for the project and commitment to achieving project results and to plan the first year annual work plan.

The following are the key areas to be addressed in the Inception Workshop:

- Provide clear understanding amongst all partners of the project and create ownership of the sub-project.
- Detail the roles, support services and complementary responsibilities of UNEP Car/RCU and CARPHA vis à vis the project team.
- Provide guidance on the roles, functions, and responsibilities within the sub-project's decision-making structures, including reporting and communication lines, and conflict resolution mechanisms.
- Review the sub-project staff Terms of Reference as appropriate.
- Finalize the first annual work plan based on the project results framework and the relevant GEF Tracking Tool. Review and agree on the indicators, targets and their means of verification, and recheck assumptions and risks.
- Provide a detailed overview of reporting, monitoring and evaluation (M&E) requirements. The Monitoring and Evaluation work plan and budget should be agreed upon.
- Discuss financial reporting procedures and obligations, and arrangements for annual audit.
- Plan and schedule National Project Steering Committee meetings.

The first National Project Steering Committee meeting should be held within the first 6 months following the Sub-Project Inception Workshop. An Inception Workshop report is a key reference document and must be prepared and shared with participants to formalize various agreements and plans decided during the meeting.

Sub-project monitoring of implementation progress will be undertaken by the National Project Implementation Unit (NPIU) through the provision of quarterly reports. The reports are the responsibility of the National Project Coordinator, and will be developed with the close support of the PCU and RPC. Progress reports will be submitted to the PCU for onward submission to the PSC for review and reflection on challenges and opportunities. These reports will be the principle tools of regular project monitoring, form the basis for adaptive management. Each report will minimally contain:

- An account of implementation activities undertaken during the reporting period, and an update and assessment of progress against the implementation plan;
- Identification of (known and/or new) barriers to project implementation and corresponding recommendations for corrective actions during the following period (including revisions to the implementation plan, as necessary);
- A detailed and costed work plan for the subsequent reporting period, including status of funds held locally and, when necessary, a request for further cash transfers to the sub-project;
- An updated inventory of non-expendable equipment and items procured for the project; and
- Copies of project meeting reports or minutes and participant lists, as well as other technical outputs submitted to the project PCU.

The monitoring information will then be compiled and submitted as part of the reporting for the project, and integrated in the periodic reporting by the executing agencies to the PCU. The collection of information at the national and regional levels will be part of the project's knowledge management efforts.

Periodic Monitoring through site visits: UNEP/DEPI Task Manager and the UNEP Car/RCU will conduct visits to sub-project sites based on the agreed schedule in the sub-project's Inception Report/Annual Work Plan to assess first hand project progress. Other members of the NPSC may also join these visits. A Field Visit Report will be prepared by the Task Manager and UNEP Car/RCU and will be circulated no less than one month after the visit to the sub-project team and NPSC members.

Mid-term Evaluation of sub-project cycle: The sub-project will undergo an independent Mid-Term Evaluation at the mid-point of sub-project implementation. The Mid-Term Evaluation will determine progress being made toward the achievement of outcomes and will identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; will highlight issues requiring decisions and actions; and will present initial lessons learned about project design, implementation and management. Findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the sub-project's term. The organization, terms of reference and timing of the mid-term evaluation will be decided after consultation between the parties to the sub-project document. The Terms of Reference for this Mid-term evaluation will be prepared by the UNEP based on guidance from the Regional Coordinating Unit. The relevant GEF Focal Area Tracking Tools will also be completed during the mid-term evaluation cycle.

End of Sub-Project: An independent Final Evaluation will take place prior to the final NPSC meeting and will be undertaken in accordance with UNEP and GEF guidance. The final evaluation will focus on the delivery of the sub-project's results as initially planned (and as corrected after the mid-term evaluation, if any such correction took place). The final evaluation will look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental benefits/goals. The Terms of Reference for this evaluation will be prepared by the UNEP with the support of the Regional Coordinating Unit and the GEF.

During the last three months, the sub-project team will prepare the Sub-Project Terminal Report. This comprehensive report will summarize the results achieved (objectives, outcomes, outputs), lessons learned, problems met and areas where results may not have been achieved. It will also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability of the sub-project's results.

Learning and knowledge sharing: Results from the sub-project will be disseminated within and beyond the project intervention zone through existing information sharing networks and forums. The sub-project will identify and participate, as relevant and appropriate, in scientific, policy-based and/or any other networks, which may be of benefit to project implementation though lessons learned. The project will identify, analyze, and share lessons learned that might be beneficial in the design and implementation of similar future projects. Finally, there will be a two-way flow of information between this sub-project and other projects of a similar focus.

Additionally, baseline data will be collected to monitor and evaluate the intervention of the IWEco national component. A KAP study will be conducted prior to the intervention and post implementation of the project to assess the understanding of types of land degradation as well as best practices in sewage disposal and its impacts on the environment to reduce such land degradation impacts. Additionally, baseline data will be collected on the surrounding ecosystems near the landfill to monitor any changes in soil quality as more sewage is diverted to the McKinnon's Sewage Treatment facility and less deposits are made to the landfill.

Table 7: Monitoring and Evaluation Matrix for Sub-project 1.1

Sub-Project 1.1: ***Targeting land degradation and effective land management through the development of Innovative Financing methodologies in Antigua and Barbuda***				
Project Outputs	**Description of indicator**	**Baseline level**	**Mid-term targets**	**End-of-project targets**
COMPONENT 1 : Implementation of targeted Innovative, climate-change resilient approaches to Sustainable Land Management (SLM) and enhanced management and maintenance of ecosystem services within the Cedar Grove / Five Isles Landscape in Antigua				
Sub-component 1.1.1 : Rapid SLM-related diagnostic analysis on the extent of land degradation related to wastewater and waste oil disposal	• Published report and assessment of land degradation	• Limited baseline data available; to be collected at project start	• Assessment of land degradation and hydrological assessment • Feasibility assessment for operation of wastewater treatment plant • Watershed management plan	• Diagnostic study formed basis for project execution
Sub-component 1.1.2 : Sewage pre-treatment investment at McKinnons Wastewater Treatment Plant	• % volume of sewage pre-treated to acceptable design requirements	• 13,000 tonnes of sewage delivered to landfill site per annum • No pretreatment facility currently available	• Pre-treatment facility commissioned and contributing to proper functioning of the WWTP • At least 20% of influent sewage treated to acceptable design requirements	• Pre-treatment facility at 100% operating efficiency for project duration • At least 60% of influent sewage treated to acceptable design requirements
Sub-component 1.1.3: Expanded capacity investment at McKinnon's Sewage Treatment plant (include energy efficiency and renewable energy installations)	• Volume of wastewater treated (m^3/day) • Pollutant loads (N, P & BOD (kg/yr) • % decline in sewage receipts at Cooks National Landfill • Value of recycled water sales (US$)	• Feasibility assessment on Plant's expansion required • Existing capacity is 91 m^3/day (20,000 GPD); • No connections established to the sewage treatment facility	• Documented technical specifications as to the expansion of the McKinnon's Sewage Treatment Plant • At least 200 m^3/day wastewater treated and at 100% operating efficiency (*equivalent to at least 10 kg/yr BOD; 350 kg/yr N; 70 kg/yr P diverted*) • At least 25% decline in volume of untreated liquid waste from trucks deposited at the Cooks Landfill and other areas around the country.	• Capacity increased to 455m^3/day (100,000 GPD) and at 100% operating efficiency (*equivalent at least 24 kg/yr BOD; 700 kg/yr N; 140 kg/yr P diverted*); • sales of treated wastewater to adjacent farms with substitution (of potable water use) by at least 50% • growth in revenue base from service (sewer connections); • at least 40% decline in volume of untreated liquid waste from trucks deposited at the landfill and other areas around the country.
Sub-component 1.1.4: Land degradation control measures including reforestation within the Cedar Grove watershed (to include McKinnon's	• acreage of lands rehabilitated (ha)	• Limited vegetative rehabilitation at McKinnons Pond • No land degradation conservation measures at Cooks Landfill	• Total of at least 5 hectares of restorative measures including reforestation and bioengineering/drainage controls at McKinnons	• Total of at least 15 hectares of restorative measures including reforestation and bioengineering/drainage controls at McKinnons

Sub-Project 1.1: ***Targeting land degradation and effective land management through the development of Innovative Financing methodologies in Antigua and Barbuda***				
Project Outputs	**Description of indicator**	**Baseline level**	**Mid-term targets**	**End-of-project targets**
Pond) to reduce sedimentation and pollution			Pond Landfill	Pond • Most acutely degraded reaches of main watercourse into McKinnons Pond stabilized
Sub-component 1.2.1 – Community co-benefits assessment of IWEco investments (at local project site and national level) for support under the GEF-SGP	• Number of public/private sector (community-based) partnerships for use of recycled water and oil byproducts • % change in revenue earnings by local target community stakeholders	• Limited community-based initiatives in wastewater or oily waste reuse	• Feasibility study for community-based livelihood initiative completed and inform design of small-scale project • Study on livelihoods of stakeholders and economic opportunities completed (waste haulers, waste-pickers, resource users within impacted areas) – inform design of GEF-SGP assistance • At least 1 community based support enterprise(s) proposals conceptualized under the GEF Small Grants Programme • At least 20% increase among target community beneficiaries in revenue generated from co-benefit sharing	• Community-based enterprise(s) established and in operation through GEF-SGP support • At least 40% increase in revenue generated from co-benefit sharing
Component 2: Strengthen Sustainable Land Management (SLM), Integrating Water Resources Management (IWRM) and ecosystems Monitoring and Indicators frameworks in Antigua & Barbuda.				
Sub-component 2.1.1: Monitoring protocol for assessment of environmental indicators at intervention sites	• Monitoring protocol	• Very limited information exists for wastewater and oily waste discharges and impacts to receiving environments • Tracking of appropriate indicators is poor to non-existent; • assessments are very sporadic and limited time series • data and information tends not to be analyzed • reports generated are not shared - info lost • limited capacity to utilize information	• Data collection protocol and field data capture system installed • Data collection and assessment at least twice per year	• Data collection system linked to information systems within regulatory agencies

Sub-Project 1.1: ***Targeting land degradation and effective land management through the development of Innovative Financing methodologies in Antigua and Barbuda***				
Project Outputs	**Description of indicator**	**Baseline level**	**Mid-term targets**	**End-of-project targets**
		• decision making is very often not based on scientific information		
Component 3: Strengthen policy, legislative and institutional reforms and capacity building to support Sustainable Land Management (SLM), Integrating Water Resources Management (IWRM) and ecosystem services management taking into consideration climate change resilience building in Antigua and Barbuda				
Sub-component 3.1.1 Policy guidelines and legislation to support sustainable financing for land degradation and pollution control	• Regulations and fiscal policy guidelines on sewage and waste oil collection and safe disposal developed and adopted • Financial business plan for operation of wastewater facility • Policies and regulations for strengthened sustainable land management	• No regulations, register or registrar for operators • No specific policy guideline on fiscal incentives for wastewater or oil recycling • Weak policy and regulations on SLM and minimization of land degradation	• Fiscal policy guideline to support sustainable financing mechanism • Core SLM policy and regulations under revision	• Regulation and policy guideline ratified/adopted • Register and registrar in established • Core SLM policy and regulations adopted
Sub-component 3.1.2 'Ridge-to-reef' management mechanism through partnership with the SIRF Fund, National Solid Waste Management Authority (NSMA) and the Central Board of Health**.**	• Private sector partner MOU • Number of users of recycled water	• No sustainable partnership management mechanism in place	• Draft regulation and recommendations for establishment of pollution discharge register and registrar • Mechanism for trading of water and wastewater services in place • At least 10% of the farmers in adjacent areas accessing treated wastewater • At least 1 private sector organization MOU initiated	• Register and registrar in established • Successful management structure and partnership yielding sustainable flow of benefits including supply of treated wastewater for alternative uses • At least 30% of the farmers in adjacent areas accessing treated wastewater • 1 private sector organization engaged supply of water services under MOU
Sub-component 3.2.1 Compliance framework to support sustainable land management and pollution control	• Certification programme for improved land management and pollution control practices (including efficient sewage disposal)	• No certification scheme for waste haulers exists	• Certification programme for sustainable land management and pollution control initiated	• Certification programme adopted and institutionalized
Sub-component 3.2.2 Certified training programme on improved environmental practices for land and water resource protection	• Number of training workshops • Number stakeholders trained	• No dedicated national training programs on land and water resource protection (with focus on sepatge and oily waste management)	• At least 2 training workshops on land and water resource protection within a tertiary institution • At least 30% of known liquid waste	• Total of 5 workshops held targeting 100% of core stakeholders • at least 80% of operators trained and certified and registered

Sub-Project 1.1: ***Targeting land degradation and effective land management through the development of Innovative Financing methodologies in Antigua and Barbuda***				
Project Outputs	**Description of indicator**	**Baseline level**	**Mid-term targets**	**End-of-project targets**
			handlers/operators (sewage handlers) /practitioners certified and registered	
Component 4: Enhance knowledge exchange, promotion of best-practices, replication and expanding stakeholder involvement in the Soufriere watershed and at the national level.				
Sub-component 4.1.1. - Community and stakeholder consultations, technical exchanges and knowledge platforms	• number of consultations with stakeholders • sensitized communities and stakeholders involved in sewage and waste oil collection	• No ongoing consultations on wastewater management and waste oil disposal and contributions to land degradation	• At least 2 broad-based stakeholder consultations held • At least 50% of target stakeholders participating in consultations	• Total of 4 consultations • At least 80% of targeted stakeholders participating
Sub-component 4.1.2 – Awareness-raising resources to support sustainable land management practices and effective pollution control measures	• Number and types of public awareness products made available (highlighting SIRF activities for wastewater management; land degradation issues) • Level of sensitization amongst key sectors within the business and social communities	• No effective public campaigns on SIRF activities and municipal sewage treatment	• Design proposals for public awareness resources completed • Production and dissemination of awareness-raising resources underway (via all available media – social, electronic, print, television)	• Suite of awareness resources in active circulation and in use by core beneficiaries

3 SUB-PROJECT ANNEXES

Annex 3.1 Logical Framework and Objectively Verifiable Impact Indicators

Goal: To alleviate the current issues of land degradation in the Cedar Grove / Five Isles Landscapes in Antigua as well as raise awareness to effective wastewater management and the use of private public partnerships to achieve financial sustainability in effective sewage management policies					
Results level	**Indicator**	**Baseline**	**Targets**	**Sources of verification**	**Risks and Assumptions**
Component 1 Objective: To develop and foster the implementation of targeted Innovative, climate-change resilient approaches to Sustainable Land Management (SLM), Integrated Water Resources Management (IWRM), Integrated Coastal Zone management (ICZM) and enhanced management and maintenance of ecosystem services within the degraded landscape surrounding the Cooks Watershed Landfill.					
Outcome 1.1 Measurable stress reduction in land, soil and watershed quality through appropriate sustainable water, land and ecosystems management interventions that account for land degradation and climate change.	• Investments successfully demonstrate stress reduction and replication is taking place based on lessons learnt • Evidence of reduced impact of land degradation on ecosystem services within wetland and adjacent areas to landfill where sewage is disposed of (Post construction & implementation of sewage treatment facility) • Electricity consumption/ use of renewable energy for recycling waste Annual tonnage of sewage received from Cooks and by the McKinnon's Sewage treatment Plant by private waste haulers Revenue generation streams from users and traders of recycled products • Replication and up-scaling of methods and approaches is initiated in other parts of the country and across other SIDS	• No Data available on soil and water contamination loads in adjacent areas to McKinnon's and Cooks Landfill; to be collected at project's inception • No form of renewable energy installed in operation of sewage treatment plant • 13 tonnes of sewage per annum dumped into environment surrounding landfill	• Restoration on the degraded land area surrounding the McKinnons Pond (50% by project end); • A self-sufficient Sewage treatment plant at McKinnons pond • Reduction in the amount of untreated liquid waste from trucks deposited at the landfill and other areas around the country (30% reduction by project end) • Diversified revenue base for the McKinnon's Plant	• Lab reports Accounting records of the McKinnon's plants operation by project end Sewage receipts • Project reports • Media reports	**Risks**: (i) Private trucking entities reject depositing at the McKinnon's Sewage treatment Plant; (ii) Insufficient Budgetary allocations; (iii) Rejection of greywater reuse and purchase **Assumptions**: (i) Sufficient energy for operation of pumping systems;; (ii) Current Plant will be expanded to treat 455m^3 of sewage per day with appropriate pretreatment facilities (iii) academic partnerships or internship program will support monitoring of soil quality annually; (iv) Local farmers and Commercial entities agree to use treated grey water for irrigation.

Goal: To alleviate the current issues of land degradation in the Cedar Grove / Five Isles Landscapes in Antigua as well as raise awareness to effective wastewater management and the use of private public partnerships to achieve financial sustainability in effective sewage management policies					
Results level	**Indicator**	**Baseline**	**Targets**	**Sources of verification**	**Risks and Assumptions**
Sub-component 1.1.1 : Rapid SLM-related diagnostic analysis on the extent of land degradation related to wastewater and waste oil disposal.	• Published report and assessment of land degradation	Limited baseline data available; to be collected at project start	**Mid-term** • Assessment of land degradation and hydrological assessment • Feasibility assessment for operation of wastewater treatment plant • Watershed management plan **End of project** • Diagnostic studies and watershed management plan formed basis for project execution	Report findings; stakeholder feedback	**Risks**: Limited data to provide a comprehensive assessment **Assumptions**: Academic partnerships or internship program will enable data collection and analysis
Sub-component 1.1.2 : Sewage pre-treatment investment at McKinnons Wastewater Treatment Plant	• % volume of sewage pre-treated to acceptable design requirements	13,000 tonnes of sewage delivered to landfill site per annum No pretreatment facility currently available	**Mid-term** • Pre-treatment (sewage separator) facility commissioned and contributing to proper functioning of the WWTP • At least 20% of influent sewage treated to acceptable design requirements **End of project** • Pre-treatment facility at 100% operating efficiency for project duration • At least 60% of influent sewage treated to acceptable design requirements	Operations log and photos	**Risk**: noncompliance of sewage handlers in collection procedures that may lead to mechanical failure of pretreatment facility **Assumption**: Budgetary allocations will be sufficient to enable pretreatment and compliance of sewage handlers to established guidelines and certification scheme/registrar on sewage collection

Goal: To alleviate the current issues of land degradation in the Cedar Grove / Five Isles Landscapes in Antigua as well as raise awareness to effective wastewater management and the use of private public partnerships to achieve financial sustainability in effective sewage management policies					
Results level	**Indicator**	**Baseline**	**Targets**	**Sources of verification**	**Risks and Assumptions**
Sub-component 1.1.3: Expanded capacity investment at McKinnon's Sewage Treatment plant (include energy efficiency and renewable energy installations)	• Volume of wastewater treated (m^3/day) • Pollutant loads (N, P & BOD (kg/yr) • % decline in sewage receipts at Cooks National Landfill • Value of recycled water sales (US$)	• Feasibility assessment on Plant's expansion required • Existing capacity is 91 m^3/day (20,000 GPD); • No connections established to the sewage treatment facility	**Mid-term** • Documented technical specifications as to the expansion of the McKinnon's Sewage Treatment Plant • At least 200 m^3/day wastewater treated and at 100% operating efficiency (*equivalent to at least 10 kg/yr BOD; 350 kg/yr N; 70 kg/yr P diverted*) • At least 25% decline in volume of untreated liquid waste from trucks deposited at the Cooks Landfill and other areas around the country. **End of project** • Capacity increased to 455m^3/day (100,000 GPD) and at 100% operating efficiency (*equivalent at least 24 kg/yr BOD; 700 kg/yr N; 140 kg/yr P diverted*); • sales of treated wastewater to adjacent farms with substitution (of potable water use) by at least 50% • growth in revenue	Aerial photos; technical reports/publications; Project progress reports; media releases; scientific reports/publications; water sale agreements	**Risks:** (i) Occurrence is on private lands so needs buy-in from landowners. (ii) Unwillingness of commercial entities to connect to the McKinnon's Sewage treatment Plant **Assumptions:** (i) Suitable native species are available in sufficient quantity for planting early in the project; (ii) Farmers will be cooperative

Goal: To alleviate the current issues of land degradation in the Cedar Grove / Five Isles Landscapes in Antigua as well as raise awareness to effective wastewater management and the use of private public partnerships to achieve financial sustainability in effective sewage management policies					
Results level	**Indicator**	**Baseline**	**Targets**	**Sources of verification**	**Risks and Assumptions**
			base from service (sewer connections); • at least 40% reduction in the amount of untreated liquid waste from trucks deposited at the landfill and other areas around the country.		
Sub-component 1.1.4: Land degradation control measures including reforestation within the Cedar Grove watershed (to include McKinnon's Pond and Cooks area) to reduce sedimentation and pollution	• acreage of lands rehabilitated (ha)	• Limited vegetative rehabilitation at McKinnons Pond • No land degradation conservation measures at Cooks Landfill	**Mid-term** • Total of at least 4 hectares of restorative measures including reforestation and bioengineering/drainage controls at McKinnons Pond • **End of project** • Total of at least 15 hectares of restorative measures including reforestation and bioengineering/drainage controls at McKinnons Pond • Most acutely degraded reaches of main watercourse into McKinnons Pond stabilized	Photographs; technical reports/publications; Project progress reports; media releases; scientific reports/publications	**Risks:** (i) Past interventions may not have sufficiently reduced contamination within the Pond to allow regrowth. **Assumptions:** (i) previous interventions to rehabilitate McKinnon's Pond have significantly improved water quality to support regrowth of mangroves as well as enhance landscape value.

Goal: To alleviate the current issues of land degradation in the Cedar Grove / Five Isles Landscapes in Antigua as well as raise awareness to effective wastewater management and the use of private public partnerships to achieve financial sustainability in effective sewage management policies					
Results level	**Indicator**	**Baseline**	**Targets**	**Sources of verification**	**Risks and Assumptions**
Outcome 1.2 Enhanced livelihood opportunities and socio-economic co-benefits for targeted communities from improved ecosystem services functioning.	Evidence of income generation and/or economic benefits (for community, private sector) beyond the direct investments of the project	No data available; to be compiled at project's inception; Supply of water EC$ 400 per 1000 gallon transported by private trucks. Subsidized purchase rate for water to Farms is EC$0.55 per gallon	• increased productivity of ecosystem services, including the sustainable use of environmental resources within target area. • Reduced expenditure incurred by Farmers in the purchase of water for irrigation	• Case Study / report findings on livelihood impact assessment • Ministry of agriculture reports • Project reports • Farmer / community (to include recyclers and waste haulers) income generation	**Risk:** Non-cooperation of farmers in providing data as well as use of treated greywater **Assumption:** adequate data availability to assess livelihood of scavengers and farmers and full cooperation of case study participants Assumption: Participants
Sub-component 1.2.1 – Community co-benefits assessment of IWEco investments (at local project site and national level) for support under the GEF-SGP	• Number of public/private sector (community-based) partnerships for use of recycled water and oil byproducts • % change in revenue earnings by local target community stakeholders	Limited community-based initiatives in wastewater or oily waste reuse	**Mid-term** • Feasibility study for community-based livelihood initiative completed and inform design of small-scale project • Study on livelihoods of stakeholders and economic opportunities completed (waste haulers, waste-pickers, resource users within impacted areas) – inform design of GEF-SGP assistance • At least 1 community based support enterprise(s) proposals conceptualized under the GEF Small Grants Programme • At least 20% increase among target community beneficiaries in	i) Government expenditure on fuel purchases ii) Operation log revenue/sale receipts	**Risk:** Noncooperation of government entities to comply with waste oil separation guidelines as well as limited consumer market for recycled fuel. **Assumption**: sufficient amounts of byproducts produced from the waste oil recycling system for resale. Available demand market niche

Goal: To alleviate the current issues of land degradation in the Cedar Grove / Five Isles Landscapes in Antigua as well as raise awareness to effective wastewater management and the use of private public partnerships to achieve financial sustainability in effective sewage management policies					
Results level	**Indicator**	**Baseline**	**Targets**	**Sources of verification**	**Risks and Assumptions**
			revenue generated from co-benefit sharing **End of project** • Community-based enterprise(s) established and in operation through GEF-SGP support • At least 40% increase in revenue generated from co-benefit sharing		
Component 2 Objective: To strengthen Sustainable Land Management (SLM), Integrating Water Resources Management (IWRM) and ecosystems Monitoring and Indicators frameworks in Antigua & Barbuda.					
Outcome 2.1 A monitoring protocol for periodic assessment of identified environmental indicators at intervention sites with participatory engagement of stakeholders	• Systems in place to track environmental status data • and mechanisms in place to integrate data and information into national decision-making process for wastewater and oily waste/residue management • Heightened awareness amongst policy makers and national stakeholders of the value of monitoring systems for informed decision making • Improved understanding of the impacts of project investments on change of environmental status through monitoring and tracking the relevant indicators • Decision makers and technical personnel are using the data and information generated to strengthen the evidence base and apply it in future decision	Policy and regulatory processes for wastewater and oily waste discharges not driven by data inputs;	Robust assessment and system in place for monitoring waste water and oily residue discharges to support the strengthened regulatory framework	• Project Reports • Scientific reports • Data Bases and information Systems	**Risks:** (i) senior policy makers and other stakeholders do not recognize value of quantitative reporting; (ii) private sector perceive limited gains and adopt a 'business-as-usual' approach **Assumptions**: (i) governments integrate environmental considerations within mainstream planning in respect to contributions to improved health and livelihood attainment; (ii) the benefits of investments in environmental quality assessment is adequately reflected in national accounts and standard development indices; (iii) development partners continue to support investments in improved environmental assessments.

Goal: To alleviate the current issues of land degradation in the Cedar Grove / Five Isles Landscapes in Antigua as well as raise awareness to effective wastewater management and the use of private public partnerships to achieve financial sustainability in effective sewage management policies					
Results level	**Indicator**	**Baseline**	**Targets**	**Sources of verification**	**Risks and Assumptions**
	making.				
Sub-component 2.1.1: Monitoring protocol for assessment of environmental indicators at intervention sites	• Monitoring protocol	• Very limited information exists for wastewater and oily waste discharges and impacts to receiving environments • Tracking of appropriate indicators is poor to non-existent; • assessments are very sporadic and limited time series • data and information tends not to be analyzed • reports generated are not shared - info lost • limited capacity to utilize information • decision making is very often not based on scientific information	**Mid-term** • Data collection protocol and field data capture system installed • Data collection and assessment at least twice per year **End of project** • Data collection system linked to information systems within regulatory agencies	Interim and Final Reports	**Risks:** Difficulties in gaining buy-in from private sector and operators in providing data **Assumptions:** availability of personnel to manage the monitoring system; (ii) commitment by regulatory agencies to invest in the operation of the monitoring system; (iii) mechanisms are put in place to appropriately share information for effective policy making
Component 3 Objective: To strengthen policy, legislative and institutional reforms and capacity building to support Sustainable Land Management (SLM), Integrating Water Resources Management (IWRM) and ecosystem services management taking into consideration climate change resilience building in Antigua and Barbuda.					
Outcome 3.1 Strengthened policy and legislation for the effective management of water, land and ecosystems resources that account for climate change.	• Established Polices and compliance framework that supports long-term sustainability of investments • Evidence of uptake and use of project tools and training by key stakeholder groups	• Draft Regulations and policy on sewage. No policy on waste oil management • wastewater master plan has been developed that needs to be operationalized	• New/updated policies on sewage and waste oil management for Antigua and Barbuda established and in practice • An established financial incentive that supports compliance	• project progress reports • high-level policy pronouncements • gazetted notifications on legislative amendments and incentive frameworks	**Risks:** (i) difficult fiscal challenges faced by governments may worsen and may result in shifting priorities and human resource deployment away from resource management; (ii) limited persons with the necessary competencies for training. **Assumptions:** (i) governments will

Goal: To alleviate the current issues of land degradation in the Cedar Grove / Five Isles Landscapes in Antigua as well as raise awareness to effective wastewater management and the use of private public partnerships to achieve financial sustainability in effective sewage management policies					
Results level	**Indicator**	**Baseline**	**Targets**	**Sources of verification**	**Risks and Assumptions**
		• No compliance framework established for efficient sewage disposal • Draft financial strategy	for efficient sewage disposal. • Demonstration of a financial strategy to be adopted nationally for the management of liquid waste in order to reduce land degradation	• public-private sector MOUs • stakeholder consultation feedback • revenue generation statements	remain committed to investing in human resource and institutional capacity building for SLM and SFM; (ii) both state and non-state agencies have persons who have the necessary competencies for training; (iii) the donor community and other partners will continue to support stakeholder groups in building capacity for SLM and SFM. (iv) private sector will contribute resources and share responsibilities in capacity building,
Sub-component 3.1.1 Policy guidelines and legislation to support sustainable financing for land degradation and pollution control	• Regulations and fiscal policy guidelines to support sustainable land management and pollution control investments developed and adopted • Financial business plan for sustainable operation of wastewater and oil recycling facilities	• No regulations, register or registrar for operators • No specific policy guideline on fiscal incentives for wastewater or oil recycling • Weak policy and regulations on SLM and minimization of land degradation	**Mid-term** • Fiscal policy guideline to support sustainable financing mechanism □ Core SLM policy and regulations under revision **End of project** • Regulation and policy guideline ratified/adopted • Register and registrar in established □ Core SLM policy and regulations adopted	Draft regulations; policy guidelines; photographs and report findings	**Risks:** Availability of personnel to fully participate; commitment overload; trained persons are no longer in a position to apply knowledge through staff turn-over **Assumptions:** High level policy decision makers provide support to process
Sub-component 3.1.2 'Ridge-to-reef' management mechanism through partnership with the SIRF Fund, National Solid Waste Management Authority (NSMA) and the Central Board of Health.	• Private sector partner MOU • Number of users of recycled water	No sustainable partnership management mechanism in place	**Mid-term** • Draft regulation and recommendations for establishment of pollution discharge register and registrar • Mechanism for watershed ridge to reef based trading of water/wastewater	Bylaws of management structure; accounting records	**Risks**: Rejection of greywater reuse and purchases. **Assumption**: Local farmers and Commercial entities agree to use treated grey water for irrigation.

Goal: To alleviate the current issues of land degradation in the Cedar Grove / Five Isles Landscapes in Antigua as well as raise awareness to effective wastewater management and the use of private public partnerships to achieve financial sustainability in effective sewage management policies					
Results level	**Indicator**	**Baseline**	**Targets**	**Sources of verification**	**Risks and Assumptions**
			services in place • At least 10% of the farmers in adjacent areas accessing treated wastewater • At least 1 private sector organization MOU initiated **End of project** • Register and registrar in established • Successful management structure and partnership yielding sustainable flow of benefits including supply of treated wastewater for alternative uses • At least 30% of the farmers in adjacent areas accessing treated wastewater • 1 private sector organization engaged supply of water services under MOU		
Outcome 3.2 Strengthened capacity of national institutions and other stakeholders for water, land, and ecosystems management that accounts for climate change.	• Compliance framework for Sewerage handlers Trained personnel • Local institutional capacity developed sufficiently to sustain investments by the project	• Persons not adequately trained in best practices for sustainable land management liquid waste haulage and management • No standards in existence	• Land developers, effluent haulers and sewage treatment plant operators adequately trained and certified; • Compliance Framework in place	• Training resource material • project progress reports	**Risks:** (i) difficult fiscal challenges faced by governments may worsen and may result in shifting priorities and human resource deployment away from resource management; (ii) limited persons with the necessary competencies for training. **Assumptions:** (i) governments will remain committed to investing in human resource and institutional

Goal: To alleviate the current issues of land degradation in the Cedar Grove / Five Isles Landscapes in Antigua as well as raise awareness to effective wastewater management and the use of private public partnerships to achieve financial sustainability in effective sewage management policies					
Results level	**Indicator**	**Baseline**	**Targets**	**Sources of verification**	**Risks and Assumptions**
					capacity building for SLM and SFM; (ii) both state and non-state agencies have persons who have the necessary competencies for training; (iii) the donor community and other partners will continue to support stakeholder groups in building capacity for SLM and SFM. (iv) private sector will contribute resources and share responsibilities in capacity building,
Sub-component 3.2.1 Compliance framework to support sustainable land management and pollution control	Certification programme for improved land management and pollution control practices (including efficient sewage disposal)	No certification scheme for waste haulers exists	**Mid-term** • Certification programme for sustainable land management and pollution control initiated **End of project** • Certification programme adopted and institutionalized	Certificates awarded; registrar records; payment receipts for the efficient sewage collection and disposal to the McKinnon's Plant	Risks: Slow compliance or rejection policies developed Assumptions: Sewage transporters will adhere to policy and guidelines developed on efficient sewage handling in order to be certified as having environmentally sound practices thereby enlisting the trust of customers.

Goal: To alleviate the current issues of land degradation in the Cedar Grove / Five Isles Landscapes in Antigua as well as raise awareness to effective wastewater management and the use of private public partnerships to achieve financial sustainability in effective sewage management policies					
Results level	**Indicator**	**Baseline**	**Targets**	**Sources of verification**	**Risks and Assumptions**
Sub-component 3.2.2 Certified training programme on improved environmental practices for land and water resource protection	• Number of training workshops • Number stakeholders trained	No dedicated national training programs on land and water resource protection (with focus on sepatge and oily waste management)	**Mid-term** • At least 2 training workshops on land and water resource protection within a tertiary institution • At least 30% of known liquid waste handlers/operators (sewage handlers) /practitioners certified and registered **End of project** • Total of 5 workshops held targeting 100% of core stakeholders • at least 80% of operators trained and certified and registered	Manuals Produces, report of training programs, certificates awarded	Risks: lack of interest or willingness of practitioners or other stakeholders to attend training program; Assumptions: Active participation due to implementation of compliance framework
Component 4 Objective: To enhance knowledge exchange, promotion of best-practices, replication and expanding stakeholder involvement in the target watershed areas and at the national level.					
Outcome 4.1 Improved engagement and information access for practitioners and other stakeholders through targeted knowledge sharing networks.	• Expanded information hub and access for practitioners and other stakeholders on best practices in land resource and pollution control management • Technologies and approaches are being adapted and replicated through effective knowledge management methods and tools	Draft policy guidelines on best practices in land resources management, pollution control and natural treatment systems but not widely disseminated	• Increased knowledge on best practices in land resources management, sewage management and natural treatment systems; • Enhance online data sources of information on certified and registered liquid waste handlers, available services for wastewater treatment, properties	• Report on sensitizing and training workshops; online data base • Project reports • Media reports • Awareness-raising resources	**Risks:** (i) inappropriate choice of dissemination methods; (ii) insufficient time and resources to develop and test best practices; **Assumptions**: (i) stakeholders and project beneficiaries are engaged from the onset in contributing perspectives; (ii) information capture is achieved in manner that lends to easy translation to many audiences;

Goal: To alleviate the current issues of land degradation in the Cedar Grove / Five Isles Landscapes in Antigua as well as raise awareness to effective wastewater management and the use of private public partnerships to achieve financial sustainability in effective sewage management policies					
Results level	**Indicator**	**Baseline**	**Targets**	**Sources of verification**	**Risks and Assumptions**
			connected to the McKinnon's Sewage Treatment facility		
Sub-component 4.1.1. - Community and stakeholder consultations, technical exchanges and knowledge platforms	• number of consultations with stakeholders • sensitized communities and stakeholders involved in sewage and waste oil collection	No ongoing consultations on wastewater management and waste oil disposal and contributions to land degradation	**Mid-term** • At least 2 broad-based stakeholder consultations held • At least 50% of target stakeholders participating in consultations **End of project** • Total of 4 consultations • At least 80% of targeted stakeholders participating	Report of consultation/ community meetings	**Risks:** Lack of participation and poor attendance at consultations **Assumptions**: Community residents and key stakeholders will be actively engaged to increase participation and attendance at consultations
Sub-component 4.1.2 – Awareness-raising resources to support sustainable land management practices and effective pollution control measures	• Number and types of public awareness products made available (highlighting SIRF activities for wastewater management and oil recycling; land degradation issues) • Level of sensitization amongst key sectors within the business and social communities	No effective public campaigns on SIRF activities and municipal sewage treatment	**Mid-term** • Design proposals for public awareness resources completed • Production and dissemination of awareness-raising resources underway (via all available media – social, electronic, print, television); **End of project** • Suite of awareness resources in active circulation and in use by core beneficiaries	• Evidence on widespread media campaigns to raise awareness; • Reports on PA programmes: newspaper clipping; Project Annual Reports;	Risks: Media fails to frequently air developed ads Assumptions: No cause for 'negative press' generated through the duration of Project; Media willing to advocate awareness

Annex 3.2. Letters of Co-financing

GOVERNMENT OF ANTIGUA AND BARBUDA

Environment Division
#1 Prime Minister's Office Drive
Factory Road
St. John's, ANTIGUA
TEL: 462 – 4625
FAX: 462 - 4625

6th December 2013

Dr. Maryam Naimir-Fuller
Director
Division of Global Environment Facility Coordination (DGEF)
United Nations Environment Programme
PO Box 30552, Nairobi,
Kenya
E-mail: maryam.niamir-fuller@unep.org

Dear Ms Naimir-Fuller,

Subject: Letter of Commitment for Partnership and Co-financing to the GEF-funded Full Size Project "Integrating Water, Land and Ecosystems Management in Caribbean Small Island Developing States (IWEco Project)"

The Government of Antigua and Barbuda through the Environment Division notes and commends the development of the GEF-funded Integrating Water, Land and Ecosystems Management in Caribbean Small Island Developing States (IWEco) Project. Through the Environment Division, the Government welcomes the opportunity to partner with CARPHA in the implementation of this project given its role in land degradation and liquid waste management. Antigua and Barbuda, as a party to a number of multilateral environmental agreements with various national obligations regarding the environment, is perfecting existing and establishing new steps particularly through project development to implement these obligations effectively. The Environment Division, established in 1997, was developed as part of this effort to effectively manage the environment while meeting the country's obligations to all multilateral environmental agreements and pursue the implementation of their objectives. Therefore, the Environment Division has the mandate to develop and implement projects relevant to multilateral environmental agreements.

We note that several of the IWEco Project outcomes and outputs are of direct relevance to the scope of work that is carried out by the Environment Division and we are in a position to lend support to this important regional initiative.

This letter therefore serves to confirm the commitment of the Environment Division in contributing to the implementation of the GEF-IWEco Project particularly in the expansion of the McKinnon's Sewage Treatment Plant, and establishing a financial strategy and certification programme for liquid waste treatment systems at the national level of the project.

The contribution of the Environment Division to the national project activities of the IWEco Project is estimated at US$951,000 both in-kind and cash over the duration of the project.

We are pleased to be engaged as a partner and look forward to fruitful collaboration in the implementation of the Integrated Water, Land and Ecosystems Project.

Yours Sincerely,

.....

Mrs. Diann Black-Layne
Chief Environment Officer
Environment Division
Ministry of Agriculture, Housing, Lands and the Environment

cc Nelson Andrade Colmenares
Coordinator, UNEP-CAR/RCU
Email: nac@cep.unep.org

Annex 3.3 Terms of Reference for Partners and Consultants

(to be fully defined at Project Inception)

Invitation for proposals for Feasibility Study of Wastewater Treatment Services within St. John's North.

GOAL: To conduct a technical and financial feasibility and viability study on the proposed expansion of the McKinnon's Sewage Treatment Plant.

BACKGROUND

The IWEco National Project forms part of a Regional Initiative that focuses on strengthening the commitment and capacity of the participating countries to implement an integrated approach to the management of land, ecosystems, watersheds and coastal areas. This Project is a follow up to the Integrated Watershed and Coastal Areas Management Project (IWCAM) executed 2006 - 2010. The long-term goal was to enhance the capacity of the countries to plan and manage their aquatic resources and ecosystems on a sustainable basis by examining and reducing land based sources of pollution (LBS).

At the national level, Antigua and Barbuda's participation focused on wastewater management within the McKinnon's area. Various surveys, including a willingness to pay for sewage treatment were conducted. The IWCAM project installed a Membrane Bioreactor (MBR) plant that treats up to 20,000gallons of sewage per day. The plant is located within the Cedar Grove / Five Isles / Crabbs Landscape and adjacent the McKinnon's Salt Pond, a critical habitat for a number of biodiversity species. It is also located within the proximity of hotels and other businesses, a situation that will ensure sustainable operation of the plant through public private partnerships. The Plant's operation sought to connect 20 homes and one commercial entity. Moreover, the IWCAM project produced a national wastewater management strategy that identifies opportunities for revenue generation in the management of wastewater.

To sustain the effectiveness of the IWCAM project, the IWEco national project will build on the outputs of the IWCAM project previously implemented by expanding the capacity of the existing plant. Additionally, the national project will strategically advance the support system for the GEF IWCAM intervention through the development and implementation of an innovative financial base that will encourage policy reform in land degradation and wastewater collection, treatment and management.

Sewage and waste oil have been identified as major sources of pollution and land degradation that results in the destruction of various habitats. To this end and to allow effective linkage to the regional project, the national component consists of three main activities related to addressing wastewater management most notably are the implementation of a financial strategy, expansion

of the previously established sewage treatment facility and enhancement of waste oil recycling; and capacity building and awareness.

OBJECTIVE

The project seeks to identify a suitably qualified candidate or firm to assess the financial and technical possible expansion of the McKinnon's Treatment Plant to treat sewage outside the vicinity of the Plant. This will explore connectivity of commercial entities and residential entities within the Cedar Grove / Five Isles / Crabbs Landscape area consisting mainly of Friar's Hill Road and the Yorks community.

GUIDELINES

The consultant will be contracted to assess the existing technical capacity and propose and design the technical specifications for the expansion of the McKinnon's Sewage Treatment Plant. Expansion of the Plant should facilitate wastewater treatment services outside the Plant's vicinity to include the commercial entities along Friars Hill Road, Yorks Community and collection from private sewage collection trucks. The information developed will determine the financial feasibility and viability of the proposed expansion.

SCOPE OF ASSIGNMENT

1. Conduct literature review of previous initiatives related to wastewater management and wastewater uses within the local project site, nationally and regionally for possible incorporation.

2. Conduct a review of the existing McKinnon's Treatment Plant's current flow, loadings, wastewater treatment processes, bio-solids or sludge residual management, operation and maintenance and other facets of wastewater treatment.

3. Assess the technical design and financial feasibility of the possible expansion of the McKinnon's Sewage Treatment Facility to provide wastewater treatment services outside the Plant's vicinity to include the commercial entities along Friars Hill Road, Yorks Community and collection from private sewage collection trucks. This should include the estimated associated costs for construction and installation of preliminary treatment measures, site electrical, fencing, and conveyance of wastewater pipelines to the Plant. The proposed design for expansion should consider:

    - Avoiding or minimizing impacts to the natural environment, including water quality
    - Be efficient and reliable
    - Balance cost with the risk of uncertainty and the flexibility to respond to changes in growth projections, technology, and regulations.
    - Ensure the wastewater system is designed and constructed to meet future regulatory requirements.

4. Assess the financial viability of the Plants possible expansion to include the resale of by-products based on suggestions of the draft national wastewater management strategy. This task should be completed to a refined scope through a consultative process. Refinement scope expected:
    - Based on interviews with key stakeholders
    - Estimation of the Plant's water production capacity and resale
    - Any other usage uncovered by the consultant.

5. Plan and execute at least two stakeholder consultations to communicate the findings of these activities.

OUTPUTS

The outputs of the assignment will be:

1. Completed technical and financial feasibility study
2. Technical Specifications for Plant's expansion
3. Draft financial strategy/ business plan

To produce the outputs the consultant will be required to:

1. Provide an implementation schedule for delivery of work three weeks after award of the contract

2. Provide an update on project activities six weeks after the award of contract

3. Present a draft report to the project steering group eight weeks after the award of contract

4. Present a finalized report of the technical and financial feasibility and viability, four months after the award of contract.

The documents produced within this TOR will become the property of the IWEco Project and the Environment Division, which is the National Executing Agency (NEA).

Contract Duration

The contract shall be for four months

Qualifications

The applicant should be suitably qualified with at least:

a. A first degree (or equivalent) and/or a minimum of 5 years experience in wastewater management and socioeconomic studies.
b. Knowledge of and experience in sewage collection and treatment systems as well as environmental management systems.

Payment Schedule

Payment will be on the basis of outputs as follows:

- 25% mobilisation costs upon the signing of the contract
- 10% upon delivery of the inception report & implementation schedule
- 10% Mid Progress Report
- 25% upon the delivery of the draft report
- 30% upon delivery of Final Report

Evaluation Criteria
Proposals will be evaluated based on price/cost effectiveness, methodology and experience

Submission Requirements
Proposal submissions are to include:
a. Proposal for cost of the exercise inclusive of an operating budget
b. A technical proposal not exceeding 10 pages in length, including CVs. Other material deemed to be relevant to the proposal may be attached as annexes

Proposals must be submitted to:
Proposals from interested parties should be forwarded on or before XXX, 2014 to:

IWEco Project Coordinator
C/o The office of the GEF Focal Point
Environment Division
St. John's Antigua

Or email to iwecoanu@environmentdivision.info

Annex 3.4. Carbon accounting /Work schedule – Antigua and Barbuda

Ouputs from FAO Ex-Ante Carbon-balance Tool (EX-ACT) tool

	YEAR 1				YEAR 2				YEAR 3				YEAR 4				Responsible Entity
Components/Sub-components/Activities	1 QTR	2 QTR	3 QTR	4 QTR	1 QTR	2 QTR	3 QTR	4 QTR	1 QTR	2 QTR	3 QTR	4 QTR	1 QTR	2 QTR	3 QTR	4 QTR	
Component 1 : To develop and foster the implementation of targeted Innovative, climate-change resilient approaches to Sustainable Land Management (SLM) and enhanced management and maintenance of ecosystem services within the Cedar Grove Watershed																	
Sub-Component C1.1 Measurable stress reduction in land, soil and watershed quality through appropriate sustainable water, land and ecosystems management interventions that account for land degradation and climate change.																	
C1.1.1 : (using a community participatory approach) conducted to inform the definition of the innovative interventions (based as appropriate on the outputs and lesson learnt of the GEF-IWCAM project and other relevant interventions).																	
Subactivity 1 - Rapid SLM- related diagnostic analysis on the extent of land degradation (using a community participaory approach) conducted to inform the definition of the innovative interventions); Development of a watershed management plan for the Cedar Grove watershed area; Baseline data collection - soil and water quality sampling within the wetland surrounding the Cooks Landfill and sampling of soil and water quality within the McKinnon's/Cedar Grove watershed (to determine the levels of nitrates/oil polluting soil and waterways)*																	Department of Environment/TAC /Fisheries Division Laboratory

Sub-activity 2 -Feasibility Assessment with stakeholder engagement for wastewater plant expansion (technical operations and financial capacities) Recommendations of IWCAM developed Wastewater management Strategy included in the installation of storm water interceptors and sewage lift stations to facilitate sewage collection within the McKinnon's /Cedar Grove Watershed area																	Consultant/ Department of Environment
Subactivity 3 - Presentation of lab report findings & feasibility assessments to stakeholders via consultations with government agencies, surrounding commercial entities and sewage handlers (to support connection to the McKinnon's Sewage treatment Plant)																	Consultant/ Department of Environment
Subactivity 4 - Stakeholder consultation with Farmers & NGOs on use of treated greywater for irrigation purposes (begin developing PR strategy)																	Consultant/Department of Environment/ Agriculture Extensions Unit
C1.1.2 : Installation of an appropriate pre-treatment facility to absorb additional sewage diverted from the Cooks National Landfill and neighbouring commercial entities around McKinnon's																	
Sub-activity 1 -Procurement of materials and equipments needed for pretreatment/ sorting facility for sewage containing other debris or contaminants																	Consultant/TAC/ DoE/ Ministry of Finance
Subactivity 2: Construction & Installation of pretreatment facility based on guidance of feasibility assessment																	
Sub-activity 3 - Develop operations & training manual for operations of pre-treatment/ sorting facility (community members & Prisoners)																	Consultant/TAC/ Department of Environment
Activity C 1.1.3: Expansion of McKinnon's Sewage Treatment plant to treat additional sewage diverted from the Cooks Sanitary Landfill to include elements of energy efficiency and renewable energy (by project end) *																	

Sub-activity 1:Procurement of materials and equipments needed for expansion as per feasibility assessments: Purchase of solar panels Purchase of additional Pumps, lift stations & pipes Purchase of additional material to expand MBR																	Consultant/TAC/ Department of Environment /Ministry of Finance
Sub-activity 2 - Construction and Installation of treatment compartments, solar panels and pumps to assist in electrical generation for lift stations and the transporting of sewage to main treatment compartments ** (PPP)																	Public Works Dept/ TAC/Department of Environment/Consultant
Sub-activity 3 - Installation of pipes to the surrounding commercial entities and homes for the sale of sewage treatment services																	TAC/Public Works Dept/Department of Environment (DoE)/APUA
C.1.1.4: Install land degradation control measures including reforestation within the Cedar Grove watershed (to include McKinnon's Pond) to reduce sedimentation and pollution. ** (reduce budget)																	
Sub -activity 1 - Develop and implement local strategy and action plan through a community and private sector participatory approach																	TAC/DoE/APUA
Sub-activity 2 - Procurement of materials for slope/bank stabilizing; filtering																	DoE/Ministry of Finance
Sub-activity 3 - Construction and installation of slope/bank stabilizing materials , etc.																	TAC/DoE/APUA/Consultant
Sub-Component C 1.2 Enhanced livelihood opportunities and socio-economic co-benefits for targeted communities from improved ecosystem services functioning.																	
Activity 1.2.1 - Assess co-benefits of IWEco interventions within project site and nationally																	
Subactivity 1 - Prepare finding report on impact on livelihoods; project impact/prisoner rehabilitation project																	Department of Enviornment/TAC /Consultant
Subactivity 2 - Livehoods study or case study highlighting Impact on sewage handlers/ liquid																	DoE/TAC/Consultant

waste handlers and farmers																	
Component 3 Objective: To strengthen policy, legislative and institutional reforms and capacity building to support Sustainable Land Management (SLM), Integrating Water Resources Management (IWRM) and ecosystem services management taking into consideration climate change resilience building in Antigua and Barbuda.																	
Sub-Component C3.1 Strengthened policy and legislation for the effective management of water, land and ecosystems resources that account for climate change.																	
Activity C3.1.1 Develop policy guidelines and legislation to provide the support needed to implement the outputs of a pilot mechanism for the sustainable financing and management of liquid waste and the feasibility Assessment for wastewater plant expansion and oil recycling system																	
Sub activity 1 - Establish a pilot mechanism for the sustainable financing and management of liquid waste in Antigua and Barbuda (using community, private and public sector partnerships linked to the SIRF Fund)																	Consultant/Department of Environment
Subactivity 2 - Develop and implement financial business plan to enhance the recommendations of the IWCAM; cost recovery of sewage plant to include sale of treated grey water $10/1000gallons to farmers for food crop production; and $25/1000gallons to commercial entities for landscape irrigation ; residential sewer connection fee $EC20 per month																	Consultant/TAC/ Department of Environment/Agriculture Extensions Unit
Activity 3.1.2 Establish management mechanism through partnership with the SIRF Fund, National Solid Waste Management Authority (NSMA) and the Central Board of Health.																	
Sub-activity 1 - Establishment of SIRF Board for wastewater management services & facilitation of recycling waste oil services with approved bylaws and ordinances (with priate/public and community																	Department of Environment /TAC

based members)																	
Sub-Component C3.2 Strengthened capacity of national and regional institutions and other stakeholders for water, land, and ecosystems management that accounts for climate change.																	
Activity C3.2.1 Trained personnel in operations and maintenance of the sewage treatment plant																	
Subactivity 1- Conduct Training Workshop with field visits																	Consultant/TAC/ Department of Environment
Activity C 3.2.2 Compliance framework for sewage handlers																	
Subactivity 1 - Draft standards for liquid waste collection, policy and or regulations																	Consultant/National Solid Waste/ Department of Environment/TAC
Subactivity 2 - Conduct training and sensitization workshop for sewage handlers																	Consultant/National Solid Waste/ DoE/TAC
Subactivity 3 - Implement certification shceme and registrar for 10 liquid waste collectors																	DoE/ National Solid Waste/ Central Board of Health
Activity C3.2.3 Institutionalize a certified training programme on the management and operation of sewage treatment facilities																	
Subactivity 1- conduct an assessment of training needs																	Consultant/DoE
Subactivity 2 - Develop and implement training programme aligned with a tertiary academic instituition																	TAC/DoE/Ministry of Education
Component 4 Objective: To enhance knowledge exchange, promotion of best-practices, replication and expanding stakeholder involvement in the Cedar Grove watershed area and at the national level.																	
Sub-Component C 4.1 Improved engagement and information access for practitioners and other																	

stakeholders through targeted knowledge sharing networks.																	
Activity C 4.1.1. - Community and stakeholder consultations																	
Sub-activity 1 - Undertake a KAP survey and analysis																	TAC/Consultant
Sub-activity 2 - Undertake stakeholder consultations including, farmers, private sector (supermarkets, hoteliers, mechanics, yachting sector, etc) and community meetings																	Consultant/TAC/ DoE/National Solid Waste Authority
Sub-activity 3 - Establish webplatform for accessing information on certified liquid waste handlers; treatment system used at McKinnon's, commercial entities attached to the McKinnon's facility;																	DoE
Subactivity 4 - Support technical exchanges, project visits amongst SIDS, and internships																	Department of Environment
Activity C4.1.2 - Develop and publicize sewage management systems (as part of the SIRF fund activities)																	
Sub-activity 1 - Develop and implement PR strategy targeting high officials, policy makers, private sector, etc.																	Consultant/Government Information Services/ Department of Environment
Sub-activity 2 - Develop and advertise Public Service Announcemnts, and or documentary on addressing liquid waste nationally																	Consultant/TAC/ Government Information Services
Sub-activity 3 - Support information sharing on the regional and global networks																	TAC/Department of Environment/Agriculture Extension Unit
Component 5 Objective: Project Management																	
Sub-activity 1 - Establish a Technical Advisory Committee (TAC) and TAC meetings to report to the National Project Management Committee (previously established for all projects)																	DoE

Sub-activity 2 - Prepare amendments and detail of sub-project - logframe, costs, implementation arrangements, etc																	Project Coordinator/TAC
Sub-activity 3 - Hiring of administrative and technical assistants																	Project Steerin Committee/ Project Coordinator/DoE
Sub-activity 4 - Initiation & management of country project																	Project Steering Committee/ Project Coordinator/DoE/ TAC
Sub-activity 5 - Procure appropriate stationery, fixtures and monitoring tools/equipments																	TAC/DoE
Components/Sub-components/Activities																	

Project Name	*IWECO Antigua & Barbuda*	
Continent	Central America	
Climate	Tropical	
Moisture regime	Moist	
Dominant Regional Soil Type	Volcanic Soils	
Duration of the Project (Years)	Implementation phase	4
	Capitalisation phase	1
	Duration of accounting	5

Total acreage of direct investment				**15**	ha
2.2 Afforestation/reforestation conversion of "degraded areas" to "plantation zone 2"				**9**	**ha**
2.3 Other land use changes conversion of "degraded areas" to "perennial tree crop"				**6**	**ha**
	Gross fluxes tCO2eq (Positive = source / negative = sink)		**Results per year tCO2eq** (Positive = source / negative = sink)		
	Without project	**With project**	**Without project**	**With project**	**Balance**
Land Use Changes					
Deforestation	0.0	0.0	0.0	0.0	0.0
Afforestation	0.0	-878.0	0.0	-175.6	-175.6
Other	0.0	-190.0	0.0	-38.0	-38.0
Agriculture					
Annual	0.0	0.0	0.0	0.0	0.0
Perennial	0.0	-155.6	0.0	-31.1	-31.1
Rice	0.0	0.0	0.0	0.0	0.0
Grassland & Livestocks					
Grassland	0.0	0.0	0.0	0.0	0.0
Livestock	0.0	0.0	0.0	0.0	0.0
Degradation	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Inputs & Investments	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Total	**0.0**	**-1,223.5**	**0.0**	**-244.7**	**-244.7**
Per hectare	**0.0**	-81.569			
Per hectare per year	**0.0**	-16.3138	**0.0**	-16.3138	-16.3138

Annex 3.7 References

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