

Project Proposals on Pollution

MANAGEMENT OF MUNICIPAL SEWAGE IN SUB SAHARAN AFRICA THROUGH APPROPRIATE TECHNOLOGIES

1. IDENTIFIERS

Project Number: POL – 2

Project Title: **Management of Municipal Sewage in sub Saharan Africa Through Appropriate Technologies**

Requesting Countries: The Gambia, Ghana, Kenya, Mozambique, Nigeria, Senegal, South Africa and Tanzania

Requesting Regional or National Organization

The Gambia: Ministry of Environment
 Ghana: Ministry of Works and Housing-
 Ministry of Environment and Science-
 Ministry for Local Government and Rural Development
 Kenya: Ministry of Environment and Natural Resources
 Mozambique: Ministry of Public Works and Housing
 Nigeria: Federal Ministry of Environment
 Senegal: Ministry of Environment
 South Africa: Department of Environmental Affairs and Tourism (DEAT)
 Tanzania: Ministry of Water and Livestock Development
 Ministry of Land and Settlements,
 Commission of Land and Environment

Proposed Executing Agencies:

The Gambia	-National Electricity and Water Company (NAWEC)
Ghana	Densu Basin Management Board- Accra Metropolitan Authority- District Assemblies
Kenya -	Mombasa Municipal Council, Ministry of Local Government, Coastal Development Authority
Mozambique	National directorate of water (DNA) Ministry of Public Works and Housing
Nigeria -	Federal Ministry of Environment Centre for Environmental Protection and Natural Resources
Senegal- South Africa	Directorate of Environment and classified Establishment Department of Environmental Affairs and Tourism (DEAT) Coastal Provincial departments
Tanzania	Urban Water Supply and Sewerage Authorities of Dar es Salaam and Tanga Zanzibar Municipal Council

Required National Partners:

The Gambia	-Municipalities and the private sector
Ghana -	Water Resources Commission- Environment Protection Agency - Council for Scientific and Industrial Research District Assemblies- University of Science and Technology of Kumasi, Department of Civil Engineering
Kenya -	National Environment Management Authority, Private sector, Ministry of Local Government, Coastal Development Authority, Kenya Marine and Fisheries Research Institute (KMFRI)

Mozambique	Local (Municipal) authorities, Urban Environmental Management Department (MICOA) Private sector and NGOs
Nigeria -	Federal Ministry of Environment- University of Ibadan- Financial Institutions
Senegal	Industry patronage (SPIDS, CNES, CNP, CRODT, UCAD, ONG, ONAD), Residents Association
South Africa	-Department of Water Affairs and Forestry, Department of Housing,- Department of Provincial and Local Government- Civil Society Organisations,
Tanzania	-Ministry of Water and Livestock Development- Ministry of Land and Settlement- National Environment Management Council- Urban Water Supply and Sewerage Authorities, Municipal Council- Zanzibar- University of Dar es Salaam, Department of Civil Engineering

Priority Issue Addressed: Microbial Pollution

Regional Scope: Sub Saharan African (including Togo, Benin and Cameroon)

Project Locations:

The Gambia	Greater Banjul Area (GBA)
Ghana	Nsawam, in the River Densu Basin Selected Low-Income Areas in Accra Metropolitan Area
Kenya	Mombasa City
Mozambique	Necole, Xai-Xai, Inhambane
Nigeria	Lagos, Warri, Port Harcourt, Calabar, Eket
Senegal	Hann Bay
South Africa	-Selected hot and sensitive spots in all coastal provinces
Tanzania	Selected Low-Income Areas in Dar es Salaam, Zanzibar and Tanga Municipalities

Project Duration: Four years

Working Group: Pollution

2. SUMMARY

This project addressing the *Management of Municipal Sewage in SSA through Appropriate Technologies* has the primary objective restoring the health and protect environmental integrity of the coastal and marine ecosystems by adequately managing the municipal waste through the use of appropriate technologies. Three main objectives have developed for this African process project: Develop base data in impacts, extent of pollution and classified range of appropriate technologies, Reduction of sewage pollution through installation of affordable technologies for the local community and strengthen the capacity management and legal basis for prevention and reduction of untreated sewage including creation of awareness among all participating stakeholders.

The project would be linked to current national efforts to address the issue of continuous pollution of coastal waters. The project has taken into cognisance the existing regional efforts and therefore provides complementing results while duplication of efforts is not foreseen.

It is expected at the end of this project that the risk of human health due to water borne diseases and decline of water quality will be reduced to the minimum as a result of the installed sewage treatment facilities and rehabilitation of the old ones. Other identifiable results the development of waste water standards and objectives at national and regional levels as well as the formulation of relevant regulatory framework.

Furthermore the public is expected to have changes its attitude towards its responsibility for cleaner marine and coastal waters and also increased willingness to pay for the pollution caused. The private sector has a role to play in this project and thus forms one of the major focal points for cooperation, this is because they hold the key for long-term sustainability of the implemented actions.

3. COSTS AND FINANCING (MILLIONS US \$)¹

The estimated cost of the project is US \$11.14 million for the eight participating countries. This is however subject to the confirmation of in-country activities. (A detailed breakdown of activities is contained in Item 9).

4. GOVERNMENT ENDORSEMENTS

The Gambia	Ministry for Environmental Affairs
Ghana -	Ministry of Environment and Science: CONFIRMED
Kenya -	Ministry of Environment and Natural Resources
Mozambique-	Ministry for Coordination of Environmental Affairs
Nigeria –	Federal Ministry of Environment: CONFIRMED
Senegal-	Ministry for Environmental Affairs
South Africa –	Ministry of Environmental Affairs and Tourism
Tanzania -	Ministry, Ministry of Natural Resources and Environment

5. GOVERNMENT FOCAL POINTS

The Gambia –	Natinal Electricity and water Company (NAWEC)
Ghana -	Julius, Wellens-Mensah, Hydrological Services Department
Kenya -	Ali Mohammed, Ministry of Environment and Natural Resources
Mozambique-	Mr. Mviange, National Director of Water
Nigeria –	Larry, Awosika, Nigerian Institute for Oceanography and Marine Research
South Africa –	Director General, Department of Environmental Affairs and Tourism (DEAT)
Tanzania -	Director of Environment, President’s Office for Environment and Poverty Alleviation

AFRICAN PROCESS WORKING GROUP FOCAL POINTS

Working Group : Pollution

Regional Coordinator:	Aka, Marcel Koussa, Centre de Recherches Oceanologiques, Cote d’Ivoire
Natural Science Expert:	Emmanuel, O. Oyewo, Nigerian Institute for Oceanography and Marine Research Nigeria
Socio-Economic Expert:	Sylvia, S. Temu, University of Dar es Salaam, Tanzania

¹ This budget is preliminary and has not undergone a full consultation process with the respective countries. Therefore, it does not indicate the actual financial commitment that would be provided by participating countries once the project proposal and its components are finalised.

PROJECT DESCRIPTION

1. Background and Justification

In the case of most large urban centres, sewerage facilities have remained the same while the population has increased, leading to decline in percentage population served by the facilities. Today only a few countries are equipped with adequate facility, and the majority of the population use septic tanks and pit latrines.

Disposal of untreated sewage offshore is a common practice along the SSA coast. In West Africa, the untreated sewage is transported along the coast by the west-to-east longshore currents and further dispersed by other currents and waves. This is a widespread problem and would require education and provision of adequate disposal facilities. Health implications like cholera outbreaks cannot be over-emphasized.

In east Africa the disposal of untreated sewage poses threat to several species in the marine and coastal environment, particularly threatened are mangrove habitats. In Mombasa, Kenya only 20% population is connected to sewage system and in Dar es Salaam, in Tanzania with a population of over 4 million less than 15 percent of it is connected to central sewage system (UNEP Report 1998). Threats to human health in terms of diseases outbreak such as cholera, dysentery leading to loss of lives are very common.

The immediate causes of the microbial pollution are several and their intensity differ from country to country. However, the major common source of pollution is the direct discharge of untreated waste water into the coastal and marine environment. The main technical problem is the lack of financial resources, materials and equipment to either install the necessary facilities, improve or maintain the treatments facilities and disposal systems. The component for provision of sewage infrastructure and rehabilitation of the existing ones through external donor financing is essential because most of the requesting countries are economically weak and cannot meet the high cost of this capital intensive project. To make the project affordable to the requesting countries an alternative for low cost sewage technologies and demonstrative activities is advocated.

At regional level, the lack of regional water agreements, waste water standards and objectives and also lack of coastal zone planning and management systems make the problem of water pollution to continue unabated. At national level, absence of economic instruments to control freshwater usage (metering) and pollution (polluter-pay principle) coupled with lack of or ineffective national policies, laws and regulations governing pollution of waters are intensifying the level of waste water pollution. The lack of awareness on public on the need and their responsibility for proper sewage treatment both their own health and the environment in general needs to strongly addressed as this forms the basis for community contribution in this capital intensive project.

The increase population pressure on the inadequate sewage facilities and increased coastal tourism without accompanying water and sewage facilities pose the greatest threats to public health, coastal habitats and economic development in the East, West and Central African Regions (UNEP, 2001). In most of the coastal urban centres only very small part of the population is connected to sewage. For example in Nigeria coastal cities only 80%, in the Gambia no sewage services are available, in Ghana untreated sewage is discharged into Korle lagoon which has rendered unfit for any economic use. In East African coastal cities of Mombasa and Dar es Salaam only 20 and 15 percent of the population is connected to sewage.

Various wastewater constituents have serious impacts on marine and coastal environments (UNEP/GPA, 2001). For example, high levels of suspended solids may cause excessive turbidity and shading of sea grasses. Fine particles may be associated with toxic organics, metals and pathogens. Biological degradation of organic matter leads to hypoxia and anoxia, resulting in fish deaths and anaerobic conditions. Nutrients, such as nitrogen and phosphorus, can cause nuisance and toxic algal blooms, dieback of coral and sea grasses and eutrophication that can lead to hypoxia and anoxia. Massive die-off of algal matter will result in additional organic matter.

The major socio-economic impact arising from this microbial pollution will be the contamination of waters thus reduced quality of water. Having clean coastal environment is crucial in maintaining health and ensuring continued success of beach hotels in attracting tourists and the associated income. If the problem

continues un-attended which is very likely without external international donor support the adverse impacts will be numerous ranging from loss of income from tourism, loss of cultural heritage, deterioration of water quality, increased death of marine organisms and eutrophication. Other includes the higher and increasing financial burden in terms of cost of mitigation on government budgets.

Human exposure to pathogens via contact with contaminated water or consumption of contaminated shellfish can result in infection and diseases. Many toxic materials are suspected carcinogens and mutagens, which can concentrate in fish tissue putting humans at risk through consumption. Bioaccumulation also affects fish and wildlife at higher eutrophic levels. Furthermore, metals can be toxic to humans and various marine organisms, shellfishes being especially vulnerable in areas of high sediment contamination. The resulting socio-economic impacts include increased risk to human health, increased costs for medical treatment, loss of income due to illness and subsequent deaths (GESAMP, 1999).

In the Eastern African coastal zone for example, important habitats including mangrove forests, coral reefs and seagrass meadows. These ecosystems sustain a great diversity of marine life and are an important food source for most coastal communities. They also provide shelter for an array of birds and marine animals. The release of untreated domestic sewage has been associated with eutrophication, phytoplankton blooms, degradation of coastal habitats and reduced fish catches. The direct socio economic impacts include reduction of income from fisheries, loss of cultural heritage loss of recreational value and changes in employment.

Of peculiar transboundary relevance in sewage pollution and thus calling for regional intervention in effecting mitigating measures are the coastal environmental impacts related to contamination of beaches, transport of fine particles may be associated with toxic organics and pathogens in water bodies.

Within the framework of the UNEP Regional Seas Programme, an overview of land-based activities in the East African Region identified the lack of infrastructure and treatment facilities to handle the large quantities of domestic sewage generated as one of the major problems.

Amongst strategies and measures proposed by countries of both Abidjan and Nairobi Conventions include the development and installation of adequate sewage treatment facilities and possible recycling (UNEP, 2001). In many developing countries such as those of the Nairobi and Abidjan Conventions, drinking water has typically enjoyed a far higher priority than waste water management. (UNEP/GPA, 2001). The main constraints to addressing wastewater pollution are the costs involved as well as lacking stakeholder awareness and involvement and either absence of relevant regulations or poor enforcement. Allowing pollution to continue at the unprecedented current rate imposes great in terms of costs on present and future generations that would invariably lead to increased poverty and poorer health population. Urban wastewater management is thus a necessity in order to maintain the environmental integrity and economic functions of coastal areas.

Since most of the low-income requesting countries such as Ghana, Mozambique, Tanzania, etc. cannot afford the cost of technologies used in conventional sewage collection and treatment in the industrial countries, there is the need to seek low-cost and sustainable technologies for sewage treatment that would also target pollution prevention and water conservation. This is in line with paragraph 21.29 of Agenda 21 which states:

“Governments, according to their capacities and available resources and with the cooperation of the United Nations and other relevant organizations, as appropriate, should:

- (a) By the year 2000, establish waste treatment and disposal quality criteria, objectives and standards based on the nature and assimilative capacity of the receiving environment,
- (b) By the year 2000, establish sufficient capacity to undertake waste-related pollution impact monitoring and conduct regular surveillance, including epidemiological surveillance, where appropriate,
- (d) By the year 2025, dispose of all sewage, waste waters and solid wastes in conformity with national or international environmental quality guidelines.”

Specifically, this project on has been requested by eight countries which are either members of the Nairobi Convention or the Abidjan Convention. In each of these countries untreated waste water discharge into either the coastal marine environment, lagoons and estuaries has been identified as a serious environmental

microbial pollution threat of the coastal waters and communities. The extent of the seriousness of the sewage problem for each country is described below.

In the Gambia, there is no sewage treatment plant and the domestic wastewaters are discharged directly into the main estuary and rivers. The National Electricity and Water Company (NAWEC) empties raw untreated sewage into the ocean adjacent to certain tourist hotels. This pollutes the environment and certainly lowers the tourist aesthetic value of tourist resources and thus a threat to source of livelihood of the majority of the coastal population that depends on tourism. Private operators using appropriate trucks are hired by household to empty their septic tanks. The sewage is however emptied into the estuaries within the Greater Banjul Area (GBA). The major socio-economic impact is the loss of value of tourist attraction, thus loss of the associated economic activities and eventually the deepening of poverty pandemic.

In Ghana, the Densu Delta, which is a Ramsar Site because of its important bird population and other biodiversity characteristics, is undergoing rapid degradation because of improper land use and water pollution activities in the river basin. Some 200 settlements and an estimated population of 460,000 depend on the water resources of the basin for farming, fishing and potable water supply. Degradation of land and water quality in the Densu basin arises from, among other activities, farming along the banks of the river, sand mining and quarrying, soil erosion, sedimentation of river and stream channels and poor management of urban wastes, such as human excreta and other wastes from households and industries.

A modern treatment plant, Upflow Anaerobic Sludge Blanket (UASB), began operation in the year 2000. It processes 16,000 cm³/day of effluents that conforms to standards of 20 mg BOD/litre. The treated effluent is discharged close to the seaward end of the Korle Lagoon. The Korle lagoon in the heart of the capital city of Accra of Ghana has over the past four decades suffered various levels of pollution which has led to the “death” of the lagoon. The “death” of the lagoon is evident from the drastic decline of economic activities such as fishing and tourism in the area. As a result of the dumping of waste and other pollutants into the lagoon and its riverine system the Government of Ghana has been compelled to commit over US \$40 million to a project called Korle Lagoon Ecological Restoration Project (KLERP). After KLERP if no effort is made to curb the dumping of waste in the Korle lagoon then the restoration would have been useless.

Treatment facilities are virtually non-existent in the Sakumo 1 wetland and in AVEAMC area. This notwithstanding, no studies have been carried out on microbiological contamination of both the Sakumo 1 wetlands and AVEAMC. The absence of treatment facilities, however, means that human wastes from the communities enter the wetland area (outside the salt pans). The harvesting of the oyster, agar, in large quantities as well as fish in the lagoon for human consumption would need careful examination and proper cooking to forestall outbreaks of paralytic shellfish diseases.

In Mombasa, Kenya only 20% of the municipal population has sewer services. There is very minimal private especially in sewage sludge collection and disposal, which is normally dumped at designated sites, often in mangrove areas e.g. Lamu and Mombasa. Some tourist hotels have established their own sewage treatment facilities. However, a number of beach hotels discharge wastewater in inshore water areas, which is a potential problem to sensitive marine habitats. Major constraints towards further addressing of the issue include the lack or inadequate facilities and similar to all other countries is poor maintenance of disposal systems

In Mozambique, Maputo is the only city with a central sewage system for collection and treatment of domestic sewage. However, it is estimated that only 50% of Maputo’s sewage is treated leaving the rest of the untreated waste water discharged directly into the coastal waters.

In Nigeria, it is estimated that 80% of industrial effluents and emissions are discharged without any form of treatment. Major coastal towns and cities in Nigeria such as Lagos, Warri and Port Harcourt have large human populations but invariably lack sewage treatment plants except in a few relatively new and isolated residential or industrial estates. Most residents use septic tanks whose contents when dislodged are discharged into coastal rivers, lagoons and near shore waters without further treatment. The associated problems include increases in BOD and the introduction of pathogenic micro-organisms and intestinal parasites which pose risks to swimmers and fishermen as well as the general public.

Various studies conducted in the Bay of Hann of Senegal, in particular those financed by the International Maritime Organisation and The Office of Environment and Classified Establishments have strongly recommended for the rehabilitation, protection and planning of the Bays of Dakar. In particular it has been recommended to promote a clean production within industries, to clean the Port of Dakar and to improve the healthy conditions as well as food security of the residents. This is particularly so because the Bay harbours about 60% of the processing industries in Senegal. Because of the low capacity of the existing main sewage and waste treatment facility, most of the domestic and urban waste effluents are dumped directly into the coastal waters. The fact that the bay is also densely populated area it offers an insecure and unhealthy dwellings to the residents.

Municipal wastewater pollution in Tanzania is principally caused by poor waste collection and disposal practices. These include direct discharge of untreated sewage onto coastal habitats such as mangroves and beaches and discharge of untreated or inadequately treated wastewater into coastal waters through sewers, streams and storm water drains. The coastal waters off major towns and cities such as Dar es Salaam, Tanga, Mtwara and Zanzibar are thus recipients of untreated municipal and industrial wastes. Measurements of pollution loads and pollutants (coliform bacteria, BOD, COD, heavy metals, suspended solids and inorganic nutrients) both in the marine environment and in streams flowing into the ocean have shown high concentrations in these areas. Risk to humans is a concern in Tanzania. As a consequence, waterborne diseases such as cholera, dysentery, gastro enteritis and diarrhea are prevalent in Zanzibar and Dar es Salaam.

The available information indicates the number of incidences of diseases typically attributed mainly to poor water quality, which accounts for most of the incidences of diseases in Dar es Salaam. Different surveys have shown that both surface water and groundwater sources in the Dar es Salaam area are heavily polluted. With more than 118,822 tons of polluted water discharged to the ground each day, the majority of groundwater sources within the built up area are contaminated as a result of poor sanitary arrangements. In Dar es Salaam, Munissi (2000) showed that, with increasing distance from the sewage pipe at Ocean Road, dissolved oxygen increased significantly from 5.79 to 12.93 mg O₂/l (randomized block analysis of variance: $F = 61.73$, $p \ll 0.0005$), while BOD decreased significantly from 4.4 to 1.88 mg O₂/l ($F = 4.60$, $0.025 \ll p \ll 0.05$). *Ulva* spp. and *Enteromorpha* spp., used as bioindicators showed a marginally significant difference at various distances from the sewage pipe (Friedman's test: $X^2_r = 9.333$, $p = 0.0533$). *Ulva* was most abundant at the site closest to the sewage pipe, while *Enteromorpha* was most abundant at the site second closest to the sewage pipe.

Groundwater in Zanzibar Town area is contaminated with organic pollutants. High coliform levels are also found in surface streams running across the town area. Faecal and total coliform levels of 1555 and 5500 cells per ml have been recorded in Mto Upepo, 62000 and 96000 cells per ml in Mto Mpepo, and 29000 and 73000 cells per ml at Gulioni, respectively (van Bruggen, 1990). In Zanzibar, faecal coliform and total coliform levels of up to 70/100 ml and numerous thousands per ml of seawater, respectively, have been reported in the waters fronting the Zanzibar Municipality (Mohammed, 1997). Nutrient levels are also higher than normal for tropical seawaters, indicating anthropogenic inputs. Concentrations of nitrate of up to 7.8 μ -at N/l and phosphate levels of 4.0 μ -at N/l have been reported (Anderson, 1994). Likewise, it has been reported that there is a proliferation of macroalgae in Tanga coastal waters due to excess nutrient loadings from discharges from a fertiliser factory and from the municipality (Munissi, 1999). Coastal pollution in Tanga is also caused by discharge of effluents from sisal decorticating plants in the area. Up to twenty plants discharge their wastes onto the coast via the Pangani, Sigi, Mruazi/Mnyuzi and Mkurumzi Rivers (Shilungushela, 1993).

Effects of excessive loading of nutrients on reefs, that include decrease in coralline algal cover, increased community metabolism and gross production and general stress on corals, have been reported in several studies. Eutrophication associated with the release of inorganic nutrients (phosphate, nitrate and ammonia) into coastal waters from domestic sewage around Zanzibar has been identified as one of the main causes of the decreased cover of coral-reef-building algae (Bjork et al., 1995). Furthermore, Bjork et al. (1996) showed that calcified algae are sensitive to phosphate and they disappear from phosphate-rich areas. In Zanzibar, high coliform levels in the waters fronting the historic Stone Town have rendered these waters unfit for bathing (van Bruggen, 1990).

Ferletta et al. (1996), who conducted a baseline study on heavy metal contents in seaweeds collected from different parts of Zanzibar and Dar es Salaam close to and away from the source of waste effluents, found that in some algal species the heavy metal content had increased ten times since 1989. Significant levels of aluminium and cadmium have been observed in the macroalgae collected from Chapwani and Changuu Islands off Zanzibar (Engdahl et al., 1998).

Urbanisation is the most dynamic factor underlying most of the immediate causes of environmental degradation in Tanzania. Rapid urban population growth imposes heavy demands on the already densely inhabited housing areas, most of which are unplanned and lack organised sanitary and wastewater infrastructure systems. Urban population growth in Dar Es Salaam is currently around 8% per year outpacing the limited capacities of municipal authorities to supply adequate infrastructure facilities. It is estimated that 70% of the population live in over 40 unplanned communities covering an area of 10,000 ha. Uncontrolled disposal of wastewater and solid wastes is a common problem affecting water sources and living conditions in all unplanned settlements, particularly in settlements such as Manzese and Vingunguti. Outbreaks of water-borne diseases are frequent during the rainy seasons.

Summing from the above country specific sewage problems and the associated environmental and socio-economic impacts in particular the increased risk to humane health and the direct effect on natural habitats mitigating measures cannot be overemphasized. The suggested measures of installing low cost technologies coupled with public awareness and capacity building are advocated in this project due to the fact that most of the requesting countries such as Tanzania and Ghana are economically poor to be able to raise the required capital funds.

The regional approach to solving the sewage pollution-associated problems is several and they include:

- The transboundary nature of the environmental impacts namely the contamination of coastal beaches, coastal waters, seafood and thereby affecting human health beyond country boundaries
- The variety of experiences from individual country efforts that can be disseminating among the participating countries and thus a quick replication of best practices in the region.
- The need to undertake joint regional researches on the waste water pollution which will then serve as a basis for overall regional coastal planning and management.
- The recognition of the importance of developing regional wastewater standards and the necessity to assist individual countries to ratify, enforce and monitor the implementation of regional and international conventions on protection of international waters.

2. Objectives and Expected Results

Project Objectives

The overall objective of this project is to reduce the health and ecosystem damage and to protect environmental integrity of the coastal and marine ecosystems of the various countries including lagoon and riverine systems.

The specific objectives are:

- i. To assess the level of pollution due to sewage and the economic impacts on health of the coastal communities, waters and property values**

Expected Output

- Data base on the current situation on the sources of pollution and levels
- Impact studies undertaken and reports available on health and economic impacts of sewage-related pollution
- Classified information about available low cost technologies for waste water treatment and recycling e.g. the existing and successful models of low cost localised sewage treatment and recycling plants in hotel clusters.

- ii. To reduce the extent of pollution resulting from discharge of coastal municipal waste water especially faecal matter to the bearest minimum, through provision of low cost and appropriate waste water management and treatment, the establishment of recycling facilities and the rehabilitation of existing treatment plants.**

Expected Output

Appropriate technologies installed in participating countries on pilot projects in two hot spots in every participating country

- Constructed treatment plants in those parts of cities where the sewage network as well as laterals without treatment already exist
- Rehabilitated treatment plants in catchment areas
- At least 500 Poor households enabled to catch up with the introduced low cost technologies by a way of micro credit in large cities

iii. To build capacities at municipal and local community levels for the management, maintenance, restoration/rehabilitation of sewage treatment plants

Expected Output

- Relevant regulatory framework identified and monitoring and enforcement mechanisms established in particular, the industrial waste water discharge and disposal regulations in place
- Regular monitoring reports on the impact of mitigating measures
Regional research capacities built in research institutes/ Universities on waste water treatment and monitoring aspects
- Professionals, municipal management and technical professionals to manage the installed facilities. Training to take place at regional level for faster information exchange
- Private sector partnerships and community based cost recovery mechanisms developed and practised for sustainability of the projects.
- Regional municipal network built for experience exchange

iv. To create awareness among various stakeholders especially the local communities, hotels and the rest of the public sector on the benefits sewage treatment to appropriate disposal of waste water

Expected Output

- Awareness created among all stakeholders namely the government, private sector and the local communities. Concrete outputs are seminars, workshops and public meetings.
- Promotional materials for reuse of treated effluents brochures, leaflets, books made in an local languages for easy understanding

3. Project Components/Activities

In order to achieve the expected outputs outlined above three components and several activities need to be undertaken. The components are:

1. Reduction of untreated waste water discharge through provision and use of the low cost sewage treatment and recycling facilities/ plants.
2. Assessment of the levels of pollution due to untreated waste water discharge and impact on health and coastal and marine ecosystems.
3. Capacity building and awareness raising.

The activities under each component are as follows:

Component 1: Development, provision and/or rehabilitation of the treatment and recycling facilities/plants. It should be realized that the primary responsibility for provision of sewage treatment and disposal facilities rests in the hands of the respective governments through direct investments (loan financing or grants) and in collaboration with the private sector. It is the government which has to ensure through its machinery and agencies that the polluter-pay principle is adhered to.

Activities under this component include:

- 1.1 Study and identification of available sewage treatment facilities and recycling technologies applicable to low income countries

- 1.2 Identify appropriate low cost waste water treatment and recycling technologies catering for high to low income population taking into cognizance the ability and willingness to pay. Pilot the technologies in the respective participating countries in a maximum of two hot spots per country.
- 1.3 Rehabilitation of sewage treatment plants.
- 1.4 Provision of micro credit facilities to some communities to convert from their current pit latrine sewage disposal practices to water closets

Component 2: Assessment of the levels of pollution due to untreated waste water discharge and impact on health and coastal and marine ecosystems

- 2.1 Identification of information available in each country to describe the current situation, including the sources and levels of pollution.
- 2.2 Assessment of the health and economic impacts of pollution arising from discharge of untreated waste water on communities, coastal and marine ecosystems and property
- 2.3 Identify extent of relevant national, regional and international regulatory framework, monitoring and enforcement.
- 2.4 Regional monitoring of coastal and marine ecosystems to evaluate impact of mitigation

1.1.1.1 Component 3: Capacity building and awareness raising

This component is meant for ensuring that all stakeholders are involved and informed of the project from its inception to implementation and participate, as appropriate in activities and implementation. The intentions are to encourage the local community, private sector and the government to take the pollution issue related to waste water seriously and to see the need to take active part in the project as well as building sustainable capacities to manage, maintain and rehabilitate the technical facilities provided.

Activities hereunder will be:

- 3.1 Awareness creation, public education campaign through seminars, workshops and public meetings including the promotion of the reuse of treated effluents for the conservation of water resources e.g. fertiliser or biogas energy
- 3.2 Establishment of research programmes will take place at regional and national levels as various experiences exist within individual countries. This needs to be taped and replicated elsewhere in order to improve upon current waste treatment technologies.
- 3.3 Provision of technical assistance to municipalities and cities to develop framework and conducive environment for involvement of the private sector in municipal wastewater management (i.e. waste water management as an economic activity or cost saving options). This activity includes also the cost recovery mechanism for sustainability of facilities.
- 3.4 Strengthen human capacities and regulations compliance
- 3.5 Develop at regional level waste water environmental objectives and standards that will continuously monitored and reviewed.
- 3.6 Capacity building at regional level through building of institutional network, establishment of information exchanges processes which include study tours and visits amongst the municipal management or staff of the participating countries.

4. Linkages to Other National or Regional Activities / Transboundary Aspects

This project has links to the UNEP Regional Seas Programme, specifically, the East African Region and the West and Central African Region, the governments of which have adopted the Nairobi and Abidjan Conventions respectively. In both areas, reviews of land-based sources and activities affecting coastal and marine environments have identified discharges of municipal wastes as probably the most important threat. In addition the project builds on the regional and global priorities identified under agenda 21 (Chapter 17) the Convention on Biological Diversity, the Pan-African Conference on Sustainable Integrated Coastal Management (Mozambique, 1998).

This particular project builds on the recognised priorities for action proposed in regional approach to implementing the Global Programme of Action for Protection of the Marine Environment from Land-based activities (GPA/LBA) in the East, Central and Western Africa. The GPA/LBA components include the strengthening of regional cooperative arrangements, strategies and programs for the identification of the

problems and causes and need to identify the elements required to support the proposed actions. The sewage treatment project will significantly contribute towards realizing the GPA/LBA priorities through the research findings, establishment of regional networks for training, regulatory development and enforcement and information exchange.

Linkages at National level

In Cote d'Ivoire efforts where, within the framework of the National Environmental Action Plan, two new Outline Laws, Code of the Environment and Water Code, have been promulgated to address water pollution and water management issues respectively. Recently, the government has established a National Environment Fund, National Agency for the Environment and an Environmental Impact Assessment Bureau. In all cases, the expected results will be supportive of national development objectives. In Cote d'Ivoire, the results will enhance the recently initiated Sanitation Programme for the City of Abidjan which includes rehabilitation and protection of the Ebrie Lagoon. It will also support efforts to expand private sector participation in urban management as well as activate the various NGOs involved in environmental protection who are financially-handicapped.

In the Gambia, NAWEC empties raw untreated sewage into the ocean adjacent to certain tourist hotels. There is an involvement of the private operators using appropriate trucks in emptying septic tanks at household levels. The appropriate technologies for pre-treatment prior to disposal in the open sea will be a valuable link to be offered by this project.

In Ghana, the results of the project will contribute to the sustainability of the Korle Lagoon Ecological Restoration Project on which more than US\$ 40 million have been spent by the Government. The newly established Densu Management Board, tasked to rehabilitate the River Densu Basin, will also be a beneficiary.

In Kenya in Mombasa Municipality, the private sector has started private initiatives in the Hotel Industry of constructing own waste water treatment and recycling. The practical example is that of Hotel Severine Sea Lodge, which has constructed a micro waste water treatment and recycling plant at a cost of about US\$ 150,000 with a capacity to serve 10 medium sized hotels. Such initiatives offer practical lessons for the private sector in the region. Such initiatives could be combined with those of eco-tourism to promote eco-labeling.

There are also ongoing initiatives for construction of sewage systems for the medium –income communities i.e. Mwembelegeza Scheme, whereby households contribute towards the capital costs, a model which appears to work. The major deficiency of all these efforts is however the old age of main sewer and treatment ponds which need immediate repair to cope with the current initiatives. This project through its specific activities will contribute towards existing efforts in particular the rehabilitation of the main sewer and laterals as well as on going efforts being undertaken by Mombasa West Sewage Treatment Works.

In Senegal, this project will directly address the Government's policy on the implementation of actions to long term rehabilitate the Bay of Hann (policy resolution in February, 2002) and also respond to the demands of the Residents Association on the protection rehabilitation and socio-economic of the Bay area.

In as far as capacity building is concerned, the project is going to support the industrialists to set better pollution control evaluation, undertake pre-treatment and treatment of waste water. It is expected that the project will reinforce the capacities of the coordination institutions, namely the Office of Environment and National Sanitation Office (ONAS) in project management and in setting up facilities and equipment to valorize the domestic waste water respectively.

The Department of Environmental Affairs and Tourism in South Africa, has ongoing activities in sewage treatment. Similarly local authorities are currently running activities on sewage treatment. The Government of South Africa has started implementing her White Paper on Integrated Pollution and Waste Management. Obviously this project will offer significant contribution towards the implementation of the current government efforts in the country especially in the low income and poor coastal cities and towns.

In Tanzania the Urban Sector Rehabilitation Project coming to an end in year 2003 and the Department of Civil Engineering, University of Dar es Salaam, offer some lessons that could be useful in management experience and limitations of waste stabilisation ponds.

5. Demonstrative Value and Replicability

Through the development of appropriate and low-cost sewage treatment facilities as well as the community-based pilot activities, the project offers a good opportunity to demonstrate strategies for waste management, control of pollution and protection of coastal and marine environments and offer useful lessons for replication in both rural and urban areas. In Ghana for example, a successful project could be replicated at District or community level inline with the implementation of the Government's decentralization policy

The project can be replicated in many coastal African countries as the problems of waste disposal are similar.

6. Risks and Sustainability

Project sustainability will rest on the overall commitment of the Governments and their institutions and the overall political will to protect the environment against pollution from municipal wastewater discharges. Thus political instability and bureaucratic tendencies at institutional levels may delay and negatively influence the project implementation. The government political commitment in terms of concrete endorsement and financial contribution is necessary right from the kick off through the implementation of the project. To reduce the risk level and gain acceptability and government ownership of the project, the awareness campaign component of the project is therefore essential for ensuring the sustainability of this project.

The provision and operation of waste management facilities need to be financially self-sustainable. Low incomes of the population and lack of requisite manpower and resources to manage the facilities could pose serious threats to sustainability of such facilities. It is envisaged that local authorities such as District Assemblies will accept ownership of the pilot projects and budget for operation and maintenance of facilities to supplement charges that will be paid by the local populations. Returns on initial investment and cost recovered could also be ploughed back to maintain facilities.

In addition the encouragement of the private sector participation via promotion of business opportunities in sewage treatment, recycling and re-use of the treated effluents will contribute towards sustainability of the project.

Also with regard to sustainability, regulatory measures to control pollution and degradation of coastal and marine ecosystems will be developed and, where necessary to ensure institutional coordination for monitoring of compliance and enforcement be put in place.

7. Stakeholder Participation

Possible stakeholders and beneficiaries include a whole range of various stakeholders from Governments, private sector, Non-governmental and community-based organizations. Appropriate mechanisms will thus be adopted to involve civil society and the private sector in the implementation of the proposed activities. In Tanzania for example, emphasis on community management of coastal and marine resources is currently supported as an integral feature of many legislations and regulations.

The international community and donor agencies are an essential stakeholders component as they will be approached and requested to provide financial and technical support for the implementation of the project.

Specific examples of stakeholders include:

Ghana

- Ministries of Local Government and Rural Development, Tourism and Works and Housing
- Accra Metropolitan Authority
- District Assemblies

- Environmental Protection Agency
- Water Resources Commission
- Landlords/House owners
- NGOs
- Densu Basin Management Board
- Academia and the private sector

Nigeria

- Federal and States Ministries of Environment
- Federal Ministry of Health
- Federal Ministry of Works and Housing
- Federal and States Environmental Protection Agencies
- National Conservation Foundation
- NGOs and private sector
- Communities in coastal areas

Tanzania

- Ministries of, Health, Lands and settlements, Water and Livestock Development, Natural Resources and Management
- President's Office regional Administration and Local Government
- Confederation of Tanzanian Industrialists
- Tanzania Chamber of Commerce, Agriculture and Industries
- National Environment Management Council
- NGOs and the private sector,
- Coastal Communities
- Academia

8. Project Management and Implementation Arrangements

1.1.1.2

At regional level there shall be a Regional Co-ordinating cum advisory Office (RCO) that will be responsible for the regional co-ordination of the project. It will be a very lean unit with a maximum of three experts, who will be in charge of monitoring of all technical, socio-economic and regional aspects of the project implementation progress, regional monitoring and impact assessment. It will get access to information from individual ministries in countries. Due to the high capital costs involved in the project there is a need of having a Project office in the respective countries which will be solely responsible for the implementation. However the project office the respective countries will be answerable.

1.1.1.3 National Arrangement

Within countries, no new institutions will be formed since the project is considered as building on existing capacity and activities to manage waste water. Project management office headed by a Project manager appointed by the Executing Agency, will be constituted to oversee project implementation and link up with the RCO.

Each participating country will work out implementation arrangements. The following institutional arrangement has been foreseen in the participating countries:

- In *Cote d'Ivoire*, the Centre for Oceanographic Research will be in charge of the project fro the overall coordination.
 - In the Gambia, National Environment Agency will co-ordinate the project.
 - In Ghana the Accra Metropolitan Authority will assume the co-ordinating responsibility and the District assemblies will in Densu Basin be involved in the direct implementation.
 - In Kenya, The Mombasa Municipal Council will assume the overall responsibility of the project .
 - In Mozambique the Directorate for the of Environment Management will be responsible for the overall project management and implementation.
- *In Ghana*, the Ministry of Local Government and Rural Development will be assume the oversight function while the Accra Metropolitan Authority will assume the responsibility for actual project implementation.

- In Kenya, it is the Municipal Council of Mombasa under the Department of environment that will implement the project.
- Nigeria, the Federal Ministry of Environment will be in charge of the project; The City Authorities of Lagos, Port Harcourt will be responsible for implementation.
- Senegal: The Directorate of the Environment and Classified Establishments will be in charge of the project.
- South Africa: The Department of environmental Affairs and Tourism (DEAT) will be responsible for the project management and implementation.
- Tanzania: The Directorate for Urban Water Supply and Sewerage services will be responsible for the overall management of the project. The actual implementation of the project will be vested in the Urban Water Supply Authorities of Dar es Salaam; Tanga and Municipal of Zanzibar.

1.1.1.4

9. Project Financing and Duration

The estimated cost of the project is US \$11.14 million for each of the eight participating countries within a five-year period. Thus in total the project will cost will amount to US \$89.12 million for all the eight participating countries. This budget is preliminary and has not undergone a full consultation process with the respective countries. Therefore, it does not indicate the actual financial commitment that would be provided by participating countries once the project proposal and its components are finalised.

Project and Components Financing in US\$

Sn	Components/Activity	External Sources of Funds			National Government(s) 10%		TOTAL US\$
		Source1	Source2	Source3	Cash	In-kind	
Component 1: Reduction of untreated waste water discharge through provision and use of the low cost sewage treatment and recycling facilities/ plants.							
A 1.1	Appraisal and identification of the available low cost technologies for waste water treatment and recycling	45,000				5,000	50,000
A 1.2	Pilot projects in two hot spots	270,000				30,000	300,000
A 1.3	Rehabilitation of sewage treatment plants in the catchment area.	9,000,000				1,000,000	10,000,000
Subtotal		9,315,000				1,035,000	10,350,000
Component 2: Assessment of the levels of pollution due to untreated waste water discharge and impact on health and coastal and marine ecosystems							
A 2.1	Establishment of data base on microbial pollution status and impact in participating countries	45,000				5,000	50,000
A 2.2	Assessment of health and economic impacts on communities and marine and coastal ecosystems	9,000				1,000	10,000
A2.3	Establishment, monitoring and enforcement of regulatory framework	18,000				2,000	20,000
A2.4	Monitoring of mitigating measures	54,000				6,000	60,000
Subtotal		126,000				14,000	140,000
Component 3: Capacity building and awareness raising							
A3.1	Awareness creation and public campaign on waste water reduction and management	180,000				20,000	200,000
A3.2	Conducting of research programmes to improve waste treatment technologies.	54,000				6,000	60,000
A3.3	Provision of technical assistance districts and municipals to develop private-public partnerships in sewage treatment and management, cost recovery modalities	54,000				6,000	60,000
A3.4	Capacity building in regulations and standards setting monitoring and regulations compliance	72,000				8,000	80,000
A3.5	Provision of micro credit facilities to poor households to facilitate connections	225,000				25,000	250,000
Subtotal		585,000				65,000	650,000
GRAND TOTAL PROJECT COST		10,026,000				1,114,000	11,140,000

Note: This budget is preliminary and has not undergone a full consultation process with the respective countries. Therefore, does not indicate the actual financial commitment that would be provided by participating countries once the project proposal and its components are finalised.

10. Monitoring, Evaluation and Dissemination

The monitoring of project implementation would be undertaken by multi-disciplinary project implementation units in each participating country. Standardized procedures for monitoring and evaluation of the

implementation of the proposed activities will be developed. These procedures will include preparation of a well-defined set of environmental and social indicators to support evaluation. They will facilitate effective implementation of the planned activities by providing for assessment of impacts from interventions undertaken, by supporting identification and documentation of successes, failures and lessons learnt, and by identifying needed adjustment and improvements. Evaluation would also include follow-up appraisal of behavioural change of beneficiary populations.

11. Work Plan and Timetable

Component and Activities	Year 1				Year 2				Year 3				Year 4			
Component 1: Reduction of untreated waste water discharge through provision and use of the low cost sewage treatment and recycling facilities/ plants.																
1. Appraisal and identification of the available low cost technologies for waste water treatment and recycling	■	■														
2. Pilot projects in two hot spots		■	■	■	■	■	■	■								
3. Rehabilitation of sewage treatment plants in the catchment area.		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Component 2: Assessment of the levels of pollution due to untreated waste water discharge and impact on health and coastal and marine ecosystems																
1. Establishment of data base on microbial pollution status and impact in participating countries	■	■	■	■	■	■	■	■								
2. Assessment of health and economic impacts on communities and marine and coastal ecosystems		■	■	■	■											
3. Establishment, monitoring and enforcement of regulatory framework	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
4. Monitoring of mitigating measures					■								■			■
1.1.1.5 Component 3: 1.1.1.6 Capacity building and awareness raising																
1. Awareness creation and public campaign on waste water reduction and management	■	■	■	■	■	■	■	■								
2. Conducting of regional research programmes to improve waste treatment technologies.		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
3. Provision of technical assistance to district/authorities to develop private-public partnerships in sewage treatment and management, maintenance and cost recovery modalities of installed facilities		■	■	■	■	■	■	■								
4. Strengthening human capacities in regulations and standards setting, monitoring and regulations compliance at national and regional levels	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
5. Provision of micro credit facilities to poor households to facilitate connections									■	■	■	■	■	■	■	■

12. Logical Framework Matrix

Goal	Objectively Verifiable Indicators	Means of Verification	Critical Assumptions
Reduce the health and ecosystem damage and to protect environmental integrity of the coastal and marine ecosystems	Improved human Health Cleaner coastal and marine ecosystems	Field surveys, Reviews by the national and regional monitoring teams	Availability of funds and commitment by the national governments of the participating countries
Objectives and Outputs			
1. Assess the level of pollution, economic impacts on health of the coastal communities, waters and property values			
1.1 Establishment of data base on the current situation on the sources of pollution and levels 1.2 Impact studies undertaken and reports available on health and economic impacts 1.3 Classified information alternative and appropriate low cost technologies for waste water treatment and recycling	<ul style="list-style-type: none"> ▪ Usable data in place to serve as reference for monitoring ▪ Health and economic impact studies reports ▪ Study tours as well as engineering designs including tests undertaken 	<ul style="list-style-type: none"> ▪ Field visits and actual usage of the data base ▪ Number of acceptable reports ▪ Technologies tested in respective individual environment 	<ul style="list-style-type: none"> ▪ Adequate human resources and financial resources. ▪ Commitment by the national government
2. Reduce the extent of pollution resulting from discharge of coastal municipal waste water			
2.1 Appropriate technologies installed in participating countries 2.2 Pilot projects in two hot spots in every participating country 2.3 Constructed plants treatment 2.4 Rehabilitated treatment plants in catchment areas 2.5 At least 500 Micro credit provision to poor household to connect to sewers	<p>Number of functioning technologies</p> <p>Constructed projects in existence</p> <p>Coverage of the rehabilitated plants and sewer network</p> <p>Number of loan recipients</p>	<p>Health reports</p> <p>Field visits</p> <p>Projects reports and records</p> <p>Filed visits and repayment records</p>	<ul style="list-style-type: none"> ▪ Adequate human resources and financial resources. ▪ Commitment by the national government ▪ Community acceptance of the technologies
Build capacities at municipal and local community levels			
3. Relevant regulatory framework, monitoring and enforcement mechanisms established 3.2 Regular monitoring of the impact of mitigating measures 3.3 Research capacities built 3.4 Trained staff for monitoring compliance and enforcement 3.5 Trained management and technical staff to manage the installed facilities. 3.6 Private sector partnerships built and community based 3.7 Regional municipal network formed	<ul style="list-style-type: none"> ▪ Laws passed with regard to waste water disposal ▪ Standards set and compliance measures set ▪ Research report available ▪ Technical and management staff attending relevant training within and outside their countries 	<p>National documents on the regulations</p> <p>Monitoring reports and project records, national reports</p> <p>Regular field visit reports Number of people trained</p> <p>Research findings disseminated in meetings and to the industry</p> <p>Environmental audit reports in industries and hotels</p>	<ul style="list-style-type: none"> ▪ Adequate human and financial resources by the governments ▪ Co-operation from all expected stakeholders especially the private sector available ▪ Adequate income and cost savings for the private sector

	<ul style="list-style-type: none"> ▪ No of private sector agencies involved <p>No of active networks in place</p>	<p>Cost effective management of facilities through increased income</p> <p>Private sector running some facilities</p> <p>Project reports</p>	<p>Willingness to cooperate and exchange and ability to pay fro tours, visits</p>
Create awareness among various stakeholders			
Awareness created among all stakeholders namely the government, private sector and the local communities..	<p>Number of campaigns, seminars, workshops and public meetings,</p> <p>Level of awareness</p>	<p>Survey reports</p> <p>Field visits</p> <p>Project records</p>	<p>Sustained change in public attitude</p> <p>Appropriate sewage treatment supported by all stakeholders.</p>