



COUNTY GOVERNMENT OF KILIFI



MUNICIPALITY OF MALINDI

Pre-Feasibility Study
for
Solid Waste Management/ Recycling plant in
Municipality of Malindi

FEBRUARY 2019

A. Background

The County Government of Kilifi (CGK) requested funding from the World Bank (WB) in the amount of US\$100 million to finance the “Solid Waste Management Improvement Project for Regional and Municipalities”. The project development objective is to support improvements to solid waste management in the Municipality through selective interventions including waste minimization, collection, transfer/transportation, treatment and/or final disposal in an integrated manner.

The CGK and WB readiness criteria for inclusion of projects presented by the selected cities for funding under the World Bank supported project are:

- 1- Feasibility Study;
- 2- Environmental and Social Impact Assessment (ESIA) Study;
- 3- Land Acquisition plan and / or resettlement, if needed;
- 4- Sanitation Strategy for the Municipality (SSK)/Sector Master Plan.
- 5- The completion of performance indicators of project implementation for monitoring purposes.
- 6- Commitment to allocate “Matching Funds” from local government for waste collection and transportation to open dumpsite, in accordance with the division of roles.
- 7- The guarantee of the availability of land.
- 8- The completion of Project Management Unit (PMU) and Project Implementing Unit (PIU)
- 9- The completion of project management plan (Project Management Manual).
- 10- The preparation of the organization that will operate the open dumpsite / proposed treatment plant.

Accordingly, the Municipality of Malindi developed a comprehensive plan for technical assistance in the solid waste management sector, with the following two broad objectives:

- a) Provide a recommended integrated and sustainable solid waste management system for the Municipality; and
- b) Prepare a pre-feasibility study for the most appropriate solid waste treatment technology for the Municipality.

The Municipality of Malindi took a very important action in 2019 and developed a comprehensive Master Plan for Solid Waste Collection and Disposal Plan (SWCDP) with the following broad outcomes:

- a) Assessment of the SWM chain from all perspectives including regulatory, institutional, technical, financial, environmental and social;
- b) Sampling program at the residential areas to come up with waste generation data and at the existing Mayungu open dumpsite site to come up with waste density, and
- c) Recommended optimization of Solid Waste (SW) minimization techniques (3R approach – Reduce, Reuse and Recycle) and efficient treatment of the organic portion of the waste for the whole Municipality, and its different income level communities (low, middle and high income), with the broad objective leading to the preservation of valuable land space and extension of the lifetime of the open dumpsite.

B. OBJECTIVE OF PRE-FEASIBILITY STUDY

The pre-feasibility study was designed to complement the efforts taken by the Municipality of Malindi, and bring the Municipality's vision of green Municipality, zero waste and sustainable development, as well as the Master Plan findings/recommendations to implementable concepts and pre-feasibility stage on a phased approach. The following specific objectives have been agreed upon with the Municipality to be developed under this study:

Objective 1: Detailed review and appraisal of existing SWM system for the Municipality of Malindi from collection to final disposal in order to provide recommendations and next steps for the Municipality to upgrade and substantially improve the SWM chain and operate a sustainable and integrated solid waste management system in line with the Municipality's vision, Master Plan findings/directions and Government of Kenya (GOK) directions/regulations;

Objective 2: Select the most appropriate treatment technology for the Municipality of Malindi;

Objective 3: Review the operation and performance of the Municipality's existing Mayungu open dumpsite and come up with recommendations for improving the operation and performance of the site.

Objective 4: Prepare a pre-feasibility study for the most appropriate solid waste treatment technology to serve the Municipality of Malindi for the next 30 years (up to 2050);

Objective 5: Additional objective has been added in order to present a comprehensive study for the whole sector which is preparing a pre-feasibility study for the whole solid waste management chain from collection to final disposal for the recommended ISWM system to serve the Municipality of Malindi for the next 30 years (up to 2050); and

Objective 6: Dividing the ISWM system into stand-alone investment packages, namely collection and transportation, waste bank / material recovery facilities (MRFs) at the local level and central treatment facility (anaerobic digestion to electricity generation and compost production) in order to assess separately the viability of each and the best implementation and operational arrangement.

C. TECHNICAL ASPECTS

Existing SWM condition at Municipality of Malindi:

Solid waste sources and composition: Based on the comprehensive 10 years SWM master plan developed by the CGK in 2018, residential waste generation rates are the highest at 75%, followed by market waste at 15% and all other wastes generate the remaining 10%. Solid waste composition is dominated by organics at an average of 67%, followed by plastics and paper / cardboard wastes at 14% and 6%, respectively. Based on the waste sampling program carried out at the dumpsite during the master plan study and other sampling programs carried out in Kilifi densities, Department of Energy project on waste to energy

Solid waste generation: The total waste generation at the Municipality of Malindi in 2018 according to the Department of Environment data is more than 400 tons with about 250 tons open dumping and about 150 tons unmanaged. This generation rate translates to average daily waste generation rate at the Municipality of Malindi for 2018 of 400 tons/day.

Solid waste collection and transportation:

Residential: Mostly every second day door to door or direct individual service of mixed MSW collection for the middle- and high-income residential areas is carried out using 6 m³ dump trucks. In the case of low-income areas, they are either served by dump trucks or tuk tuk, depending on

the accessibility, and the collection system is direct communal. roadside collection points are also provided with different design, material, and capacities, for few communities.

Non-residential: Daily collection of mixed MSW using communal collection system using 6 m³ dump trucks and waste is collected from different types of containers (fixed brick/concrete, steel, plastics, etc. and different sizing/capacity/design).

Markets: Daily collection of market wastes using communal collection system, either using the transfer station or 6 m³ arm roll containers.

Transportation: Dump trucks (6 m³ and 8 m³) and arm roll trucks (6 m³) are used for transportation to the final disposal site at Mayungu open dumpsite.

The collection and transportation fleet available at Municipality of Malindi as of February 2019 are as follows:

- 1- Dump Trucks (8 m³) ◇ 29 units
- 2- Dump Trucks (6 m³)◇ 16 units
- 3- Arm Roll Trucks◇ 6 units
- 4- Compactor trucks◇ 2 units

Treatment and Recycling Initiatives:

Municipality of Malindi developed several important initiatives at the pilot scale to promote 3R and treatment at the local/village level, namely Waste Banks. As of February 2019, the total number of recycling initiatives and waste banks sites are about 3, with the exception of the informal sector (2sites) which is at the small to medium scale level.

Mayungu open dumpsite site:

Designed and built as a open dumpsite, however operation is not up to the standards for sanitary open dumpsites, the site started operation in 2002 with total surface area of 25.1 Ha. The open dumpsite essentially needs to follow best operational practices for open dumpsites as well as its maintenance

D. MARKET SURVEY

A market survey was carried out during the midterm phase of the project, and the main findings are as follows:

-Recyclables: Quantities today that are segregated/sorted and recycled are estimated at 10%, which is very low. This amount can be increased significantly by providing an integrated system from source of generation upto well equipped processing facilities.

Waste pickers in the streets and at the open dumpsite are approximately 150 and 66, respectively. There are approximately 27 to 30 recyclables collectors, and 3 to 5 processors

The prices of the different recyclables per kg are as follows:

- | | | |
|----|----------------------|----------------|
| a. | Paper | KSHS. 70 – 100 |
| b. | Steel | KSHS. 50 – 70 |
| c. | Clear Plastic Sheets | KSHS. 40 – 60 |
| d. | Cleaned Aqua Bottle | KSHS. 5 –10 |
| e. | Iron sheet | KSHS. 150 –350 |
| f. | Aluminum | KSHS. 150 –200 |

E. GAP ANALYSIS

Waste collection and transportation: communal collection points are not sufficient; fleets and types of vehicles are not appropriate and efficient; collection and transportation points are not properly designed and not suitable neither for the fleets/crew to load the waste in a timely and EHS friendly manner, nor for the citizens to properly dispose of their waste; major Environment, Health and Safety (EHS) concerns/hazards to both the fleets’ crews and the citizens at collection points and on the trucks.

Waste treatment and recycling: very good waste bank initiatives in place, but no intermediate material recovery facilities (MRFs) exist to process and transport large quantities in a cost efficient manner at the Municipality scale makes the initiative not as efficient as expected/planned for.

Waste disposal: Major EHS hazards at the final disposal site for Municipality of Malindi, Mayungu open dumpsite. A comprehensive open dumping system is not properly functioning and requires major interventions to meet the discharge standards. In addition, precious open dumpsite space is being depleted, while acquisition of more open dumpsite space is extremely problematic and expensive.

EHS hazards: Major EHS hazards for the Operator's crew and Citizens at the collection and transportation points and the final disposal site. Environmental hazards from leachate and Green House Gasses (GHGs) emissions which negatively affects soil, groundwater / waterways and air; health hazards from GHG emissions, obnoxious odors, spread of insects, rodents and disease due to lack of cleanliness/containment of wastes; and safety hazards to the operator crew who are not properly equipped, waste pickers at the dumpsite and citizens at / around collection / transportation points, and living in close proximity to the open dumpsite site.

Social Aspects: Given the Municipality of Malindi is planning to upgrade the sector from collection to final disposal, the current method of operation of the informal sector and waste pickers will not be suitable and compatible with modernizing the sector, and cannot be continued in the same manner. The informal sector and specifically the waste pickers, whose livelihood depends solely on waste, have to be incorporated in the new system.

F. Recommended Integrated Solid Waste Management System

The Municipality of Malindi developed a SWCD system, from collection to final disposal, suitable and appropriate for the Municipality and its Citizens, and categorized as follows:

- i. Residential (divided into two systems for low income, and middle and high income);
- ii. Non-residential which comprises non-hazardous solid wastes generated from commercial, offices, institutions, industries, medical; and
- iii. Markets.

Residential areas:

Middle and high-income areas: each household will be provided with two 120 liters plastic containers, green and yellow, for segregated collection of organics and inorganics, respectively. Collection and transportation fleet used will be 6 m³ compactor trucks, practiced once every 2 days (fixed time range) and once every week (fixed time range) for organics and inorganics, respectively. Waste treatment and recycling will be carried out at the Proposed Solid Waste Recycling Facility (SWRF) located in Malindi informal settlements.

Low income areas: segregation waste containers will be located at 100 meters apart along the nearest main road, to be collected and transported to the SWRF in Malindi informal settlements using 6 m³ compactor trucks. Citizens will bring their recyclables to the waste banks directly, which are located in their neighborhoods. Citizens will get paid up to 50% of the market price of recyclables as an incentive / reward for bringing their recyclables. Recyclables will be transferred to the Material Recovery Facilities (MRFs) located in the area, to be cost efficiently processed and transported to the recycling site for sales on monthly basis.

Non-residential areas: non-residential areas include commercial, offices, institutions, non-hazardous industrial and medical solid wastes and street sweeping. Streets will be equipped on 50 meters intervals (collection points) with 1.2 m³ green containers and yellow containers for organics and inorganics, respectively. Collection and transportation will be carried out using 6m³ compactor trucks on daily basis (fixed timing). Large malls / shopping centers will be equipped with arm roll for the inorganics only, which will be removed on daily or every second day, depending on the size of the mall and the quantities of recyclables generated (to ensure at least 80% fully loaded arm roll).

Markets: Markets will be equipped with 6 m³ arm roll and 1.2 m³ green containers, for organics and inorganics, respectively. Collection and transportation fleet will be arm roll trucks and compactor trucks for organics and inorganics, respectively, on daily basis. Treatment of organics and processing of recyclables will be carried out at the SWRF and MRF located at the informal settlements.

Glass wastes: Given that it is a hazardous type of waste and that the Environment Agency has already a program in place for segregation of waste with glass one of them, The recommended

segregation at the household level and collection on monthly basis by the collection and transportation fleet separately. Glass wastes will be transported to the MRF site for storage and sale at the end of each month. CGK also recommends to Municipality of Malindi to cooperate with the glass bottles producers and Beverage companies such as Coca-Cola in regards to the Implementation of Reduce, Reuse and Recycle through Waste Bank, and the Extended User Responsibility (EPR) towards wastes generated. EPR is a policy that can be designed in order to integrate the environmental cost into the whole process of production of the goods until the product can no longer be used, so that the environmental protection becomes part of the cost component of the market price of the product.

Recommended Recycling system for Municipality of Malindi: Each region of the regions selected within the Municipality of Malindi will require one Material Recovery Facility (MRF), with a capacity of 11 tons / day (at year 2019 / 2020) to 18 tons / day (at year 2030) for each MRF during the 30 years lifetime of the facilities. Each MRF will require a total land of 900 m² for the 30 years, starting with at least 100 m² surface area. However, smaller land can be used if land availability is limited, but in that case more frequent transportation trips from the MRFs to the Mayungu site will be required as the storage capacity will decrease. MRFs will act as a cost efficient means of collecting and processing recyclables from waste collection points and low income areas to be compacted, bailed and transported to the Mayungu site for storage and sales at the end of each month. MRFs will contribute in significantly decreasing ongoing high transportation costs as well as extension of the lifetime of the open dumpsite.

Recommendation for Mayungu open dumpsite site:

The operation of the site has to be improved significantly to bring it to sanitary open dumpsite level. This includes a)- controlling the incoming waste, rejecting hazardous wastes; calibration of weighbridge following manufacturer's specifications to ensure accurate data is provided on waste quantities admitted to the site; b)- proper sanitary open dumpsite operation at the working face which includes spreading, compaction, daily cover of 10 to 15 cm, controllable working face dimensions (maximum 8 to 10 meters width), slope of working cell should not exceed 1 to 3

(vertical to horizontal) and intermediate cover of at least 0.3 meters of impermeable soil layer; c)- waste pickers are not allowed to access the working cell or the site, and to be provided jobs under the recommended SWM system, following proper rehabilitation training, on the job training for their new jobs, health and medical checkups, etc.; d)- continuous management and monitoring of leachate and gases; e)- ground and surface water monitoring; and f)- operation manual should be revised and followed, and an EHS manual should be prepared and strictly followed.

Open dumpsite lifetime analysis:

The open dumpsite lifetime analysis indicates that the total accumulation of waste pile including waste, daily cover, liner system and the total open dumpsite cell available at the site will provide open dumpsite operational capacity until 2020, 2021 and 2031 for business as usual, business as usual with 100% collection coverage and the recommended SWCD system, respectively. That means under the recommended SWCD system, the lifetime of the open dumpsite will be extended nearly 3 times more compared to the business as usual operation.

Land requirements for the SWM/SWCD system:

No new land requirements are needed. Detailed land requirements during the 30 years planning period for the various facilities for the Municipality of Malindi should be considered as a long term goal but shortly achieved.

H. Financial Analysis

Existing financial aspects for SWM sector:

The actual annual operation and maintenance expenditures for SWM sector according to CGK Department of Environment is Ksh. 3,000,000 per month. In conclusion, the budget for the SWM sector should increased by 20% annually from date of project implementation. Therefore, the unit costs for different aspects of SWM chain in street sweeping, collection and transportation and open

dumpsite operations will increase in time scheduled from the project implementation given all aspects constant.

SWM revenues and SWM service tariffs:

Most of the SWM billing and collection is carried out by the MAWASCO, Private waste collectors, CGK Department of Environment etc. in the form of a surcharge on the monthly water bill under an agreement.

Cost recovery is always too low compared to total budget required for SWM which always covers an approximation of between 8% to 11% of the total budget for SWM. To increase further solid waste service fees revenues, Municipality of Malindi need to increase tariff gradually, but this requires a willingness to pay survey to guide the Municipality of Malindi on the appropriate tariff increase for the different levels of income and other waste generators.

Identified Gaps on financial aspects:

Cost recovery: Despite the SWM services provided by CGK to the Citizens considered being sufficient, the cost recovery / SW service fees are on the very low side. That presents a major financial burden on the Municipality of Malindi to provide good service and complete coverage to all Citizens; Existing SWM tariffs to the various levels of income is very low, as well as the projected tariff is as well very low and fixed for all levels of income, which is not appropriate.

For the high income household the SWM fee are collected by the developer or residential area manager which has its own fleet or contract third party. The waste generated from that area are collected and then transported and disposed to the TPA. However there is no tipping fee to the fleet that disposes directly to TPA.

Other sources of finance: To date local government provides most of the total cost for SWM services. Given that the Municipality of Malindi is committed to the master plan ambitious targets in terms of full coverage of SWM, 3R approach and significant extension of the open dumpsite

lifetime, budget have to increase to cover all these aspects. The Municipality of Malindi has to tap into other sources of finance to support in modernizing and transforming the sector to a more sustainable and integrated sector.

The conclusions from the financial analysis of the Recommended SWM system are as follows:

- ✓ It is important to highlight that the BAU scenario is following the current SWM service coverage for the population of Municipality of Malindi, while the conservative and realistic scenarios are on the basis of 100% SW service coverage for the population of Municipality of Malindi.
- ✓ The realistic scenario of the recommended SWM system is a financially viable model which has very low annual gap, with efficient operating cost of 0.55 (<1), and a low payback period of 15 years.
- ✓ Despite the annual gap for the realistic scenario of the recommended SWM system, this model is the most cost efficient and best SWM service coverage and quality of service (3R approach and 25% disposal rate at the open dumpsite – 2.5 to 3 times longer lifetime of the open dumpsite) compared to the BAU which does not provide full coverage, 3R approach and 100% disposal of collected waste at the open dumpsite.

INVESTMENT PACKAGE 1 – collection and transportation:

It is recommended for the Municipality of Malindi to implement the recommended collection and transportation scheme in selected pilot areas (as first phase). Upon successful implementation and operation for a period of 6 months, expand the coverage gradually in the following 2 years to reach full capacity by year 2021.

INVESTMENT PACKAGE 2 – Material recovery facilities:

It is recommended for the Municipality of Malindi to implement the MRF investment package on phased approach following the same pattern of implementation of the investment package 1, to provide full service to the select pilot areas (new collection and transportation scheme, and new MRF facilities to cost efficiently process recyclables to be transported to the SWRF site (sites in the informal settlements) and expand gradually to cover the full the Municipality.

I. ECONOMIC ANALYSIS

Economic costs included in the calculations are a)- Capital costs of collection & transportation, MRF, SWRF, open dumpsite, and others excluding applicable taxes; and b)- Operating costs of collection & transportation, MRF, SWRF, open dumpsite, and others excluding applicable taxes.

Results of the economic analysis show that the SWM and Recycling system is 26.43% exceeding the threshold of 12%. The NPV is positive at the discount rate of 12%. The Benefit to cost ratio is 1.40 which is above the threshold of 1. In sum, the project is economically viable and generates net positive welfare to the society. It should be noted that several environmental benefits, especially local environmental benefits (cost of water resources pollution from leaked leachate, soil pollution, cost of valuable land used for open dumpsite, etc.) have not been quantified, the main reason being the limited time of the study to gather reliable data to carry out accurate estimations.

The Economic Analysis for the SWRF investment package is 19.57%. The NPV will be positive with a surplus. The B/C ratio is 1.39 which is above 1. In sum, the project is economically viable and generates net positive welfare to the society.

J. IMPLEMENTATION & OPERATIONAL ARRANGEMENTS

It is recommended that the Municipality of Malindi implements the SWM system in a phased approach, by selecting certain areas representing all the categories above, as PILOT areas. Upon the successful operation of the system for a period of 6 months in the pilot areas, the Municipality of Malindi should embark in spreading the recommended SWM system throughout the Municipality. Public awareness and community participation campaigns should start at least 3 months prior the implementation of the system and continues throughout the first 2 years of the implementation of the program to ensure that the public are well aware of the Municipality and the Citizens roles and responsibilities, for the successful implementation of the new SWM system.

Phased approach of waste segregation is also proposed. The reason being difficulty to ask citizens in any part of the world to move from one stream to more than three streams. Accordingly, two phased approach is recommended:

Phase 1: At least 1 successful year of operating three waste streams as follows:

- a) Stream 1: degradable waste (referred to as organic waste).
- b) Stream 2: waste that can be reused and recycled (referred to as inorganic waste).
- c) Stream 3: others (referred to glass and bulk waste).

Phase 2: After the successful implementation and operation of three streams segregation system for at least a period of 1 year, Municipality of Malindi can introduce to the citizens four streams segregation system by adding hazardous and toxic materials waste into the solid waste collection system.

Several implementation & operational arrangements could be used for the various SWM system packages, which includes a)- business as usual where the Municipality implements and operates the systems; b)- concession which gives an operator the long term right to use all utility assets, including responsibility for all operation and investment, however asset ownership remains with

the authority. Assets revert to the authority at the end of the concession period, including assets purchased by the operator. In a concession the operator typically obtains its revenues directly from the consumer and so it has a direct relationship with the consumer; c) build operate and transfer (BOT) project which is typically used to develop a discrete asset rather than a whole network and is generally entirely new or greenfield in nature. In a BOT Project the project company or operator generally obtains its revenues through a fee charged to the utility/ government rather than tariffs charged to consumers; and d)-Design-Build-Operate (DBO) project is where the public sector owns and finances the construction of a new project. The private sector designs, builds and operates the project to meet certain agreed outputs. The documentation for a DBO is typically simpler than a BOT or Concession as there are no financing documents and will typically consist of a civil works contract plus an operating contract. The Operator is taking no financing risk and will typically be paid a sum for the design-build of the plant and then an operating fee for the operating period.

INVESTMENT PACKAGE 1: Given that the Municipality of Malindi is operating the collection and transportation system and huge collection fleet is already owned by CGK as well as staff / crew, it is recommended to have the Municipality of Malindi implement and operate investment package 1, namely the purchase of the required collection and transportation fleet and auxiliary equipment and to be responsible for the operation of the collection and transportation system. Municipality of Malindi should have maintenance agreement with the compactor trucks supplier to carry out the preventive maintenance and any required mechanical or electrical fixing for period of 5 years including provision, installation and at least 1 year warranty of spare parts. Upon satisfactory performance, maintenance contracts should be extended, and at all times maintenance contracts should be in place during the lifetime of the trucks.

INVESTMENT PACKAGE 2: Given that the waste bank concept is primarily community driven program, with lots of interaction with the public, and the Municipality through the Environment Agency have implemented thus far all facilities and initiatives in place with successful experiences on the program, it is recommended to have the implementation of the investment package 2 by Municipality of Malindi , specifically the expansion of waste banks, construction of an MRF per

region and purchase and installation works of the recommended equipment and to be responsible for the operation and maintenance of the MRFs.

It is highly recommended that Municipality of Malindi have maintenance agreements with 2 to 3 third party maintenance facilities who will be responsible for preventative maintenance for the MRFs and any required mechanical or electrical fixing for period of 5 years including provision, installation and at least 1 year warranty of spare parts. Upon satisfactory performance, maintenance contracts should be extended, and at all times maintenance contracts should be in place during the lifetime of the MRFs.

Having said that, PPP is also a model that can be looked at, but requires a very comprehensive tender document to ensure a win – win agreement be reached for the Citizens, Municipality and the private operator.

K. RISK ASSESSMENT & MITIGATION MEASURES

INVESTMENT PACKAGE 1:

Three major risks are identified under the proposed collection and transportation package which are presented in the table below with the recommended mitigation measures.

Identified Risk	Recommended mitigation measures
Compactor trucks require regular maintenance	Municipality should have an after-sales maintenance contract with the manufacturer / supplier (part of the terms of the procurement of the trucks) during the operational lifetime of the equipment.
Compactor trucks require trained operator	Part of the contract should also include training program to the drivers and collection fleet for the truck (mainly driver and collection fleet).
Imported trucks are very expensive, and compact trucks are not manufactured locally	Major cost item of compactor truck is for the truck chassis which are available locally (Isuzu, Mitsubishi, etc.). Municipality has two options, either leave this upto the truck chassis manufacture to purchase and install from overseas, OR instruct in the tender documents compactor units to be locally manufactured under

	license. The later has advantage that the local manufacturer would be the capable entity to provide maintenance and training.
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INVESTMENT PACKAGE 2 – MRFs:

A major risk is identified under the proposed MRF package which is presented in the table below with the recommended mitigation measures.

Identified Risk	Recommended mitigation measures
Market prices influence by third party traders	Municipality should sell the recyclables on monthly or quarterly basis locally and country wide. Regional sales should also be exercised but quantities have to be larger, thus sales on quarterly basis may make more financial sense to attract overseas buyers. That would even bring the prices higher.

L. ENVIRONMENTAL ASPECTS

Under the recommended SWM system, standard operating procedures will be developed, on the job training provided to the operators and continuous monitoring and supervision for all aspects of SWM scheme to ensure proper operation. Tender and bidding documents for all new facilities to be build under the SWM system will include complying with the environmental standards for Kenya and / or international standards, to ensure that all effluent discharges, indoor and outdoor air emissions, etc. does not negatively affect the environment. Health and safety during construction and operation phases will also be included and addressed in the bidding and tendering documents. Monitoring plans following the environmental monitoring plans (EMPs) for all the facilities will be part of the operators’ responsibilities, and relevant authorities will supervise this works. The reasons being ensuring maximum EHS standards are maintained and safeguarding the

environment, as well as the expensive systems and technologies installed from breakdown and ensuring maximum performance and lifetime following manufacturers' specifications.

M. SOCIAL ASPECTS

In total it is estimated that over 500 jobs will be created through the implementation of the SWM system proposed, with an addition of over 200 jobs during the 30 years planning period. Employment creation for low-income population of the Municipality will directly contribute to poverty reduction and increased welfare by providing safety working environment, better working conditions and increases in income. Waste pickers and informal sector will be included under this SWM system, after undergoing adequate rehabilitation programs, health and medical checkups and on the job training.