Tetra Tech International Development

SL-01 Project Fiche
Transform Freetown Solid Waste Management and Sanitation Project (Sierra Leone)

October 2021

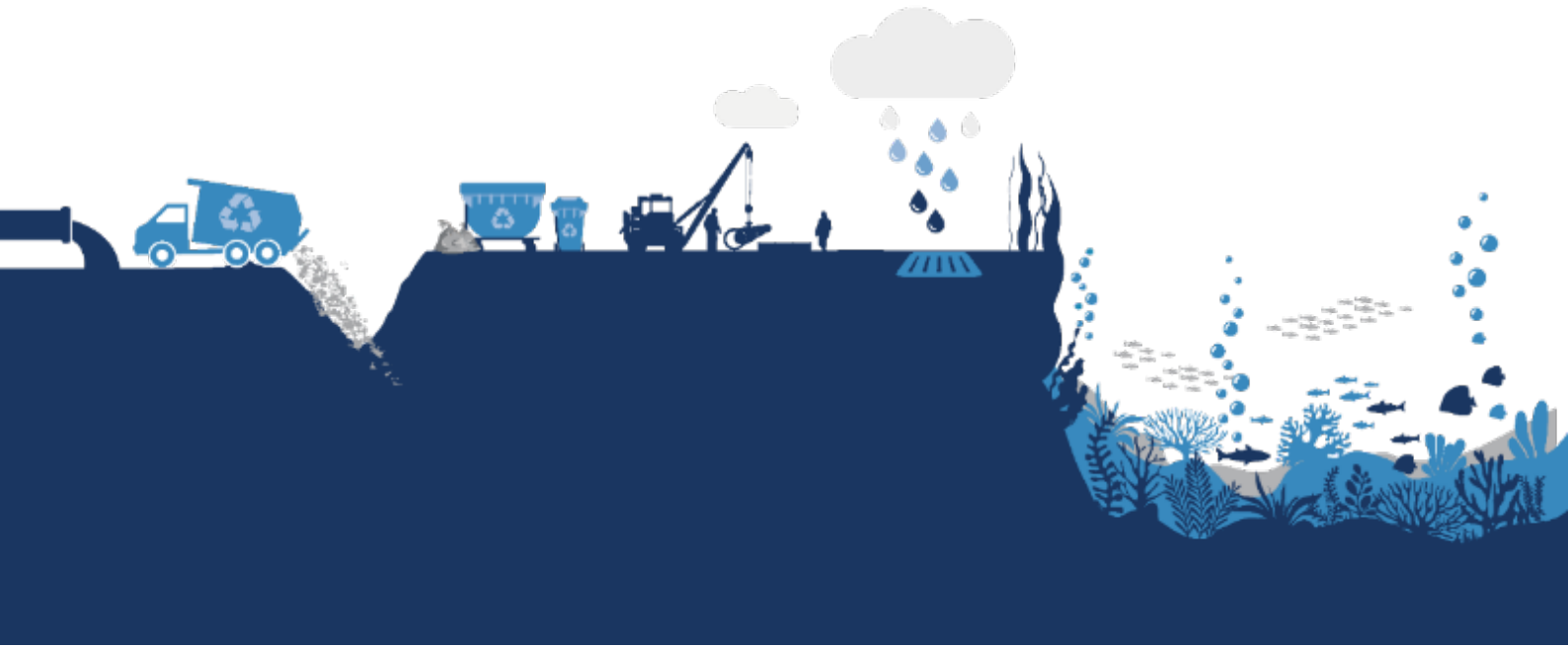


Table of Contents

Disclaimer

The authors take full responsibility for the contents of this report. The opinions expressed do not necessarily reflect the view of the European Investment Bank.

The contents of this report are the sole responsibility of the Tetra Tech COPIP Consortium and can in no way be taken to reflect the views of the European Investment Bank or the European Union.

This document is issued for the party which commissioned it and for specific purposes connected with the above-captioned project only. It should not be relied upon by any other party or used for any other purpose.

We accept no responsibility for the consequences of this document being relied upon by any other party, or being used for any other purpose, or containing any error or omission which is due to an error or omission in data supplied to us by other parties.

This document contains confidential information and proprietary intellectual property. It should not be shown to other parties without consent from us and from the party which commissioned it.

Client Name: European Investment Bank (EIB)]

Project Name: Clean Oceans Project Identification and Preparation Programme for Sub Saharan Africa

Contract Number:

Partners

Revision	1	2	3	4
Date	26.05.21	10.06.21	25.06.21	07.10.21
Detail	Draft for submission to EIB	Final following EIB comments	Final following EIB comments (Approved version)	Updates made after fiche approval
Prepared By	Eva Röben (lead author) Stephen Pattle Andreas Enzinger	Eva Röben (lead author)	Eva Röben (lead author)	Eva Röben (lead author)
Checked By	Klaus Buchholz Jeremy Lazenby	Stephen Pattle Klaus Buchholz	Klaus Buchholz	Klaus Buchholz
Approved By	Charles Reeve	Charles Reeve	Charles Reeve	Charles Reeve

07 October 2021

Tetra Tech International Development Europe Ltd (BV)

92C Jan Luijkenstraat, 1071 CT Amsterdam, The Netherlands
T (+44) (0) 1189 566 066 F (+44) (0) 1189 576 066 www.tetratecheurope.com
Registered at the Netherlands Chamber of Commerce Business Register under no: 68702132
Vat Number: NL 857555546B01

Egis Eau

889, rue de la Vieille Poste 34965 Montpellier France
T (+44) (0) 1189 566 066 F (+44) (0) 1189 576 066 www.egis-group.com
Registered Office: 889, rue de la Vieille Poste – CS 89017 – 34965 Montpelier Cedex 2, France
Registered in France No: 493 378 038 00266 (RCS Montpellier)

1. Introduction

1.1. Name of the project

Transform Freetown Solid Waste Management and Sanitation Project.

1.2. Sector(s) concerned

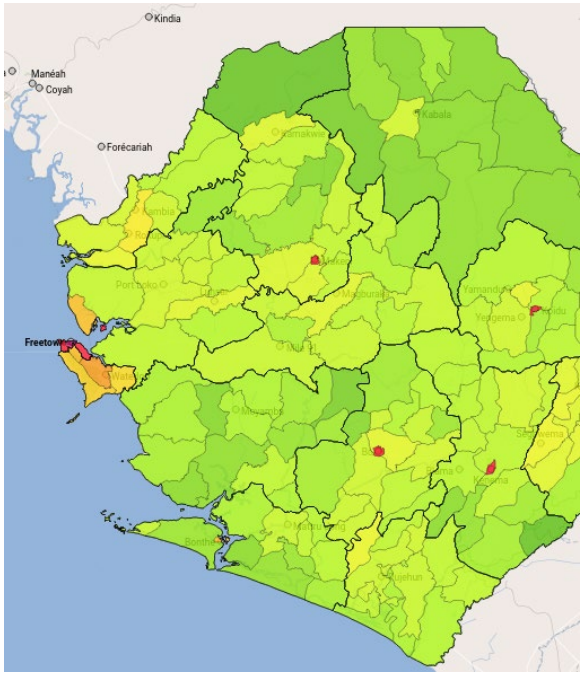
The project concerns:

1. Solid waste management
2. Wastewater

1.3. Location

Project location is Greater Freetown in Sierra Leone.

Figure 1 Project Location and Data



Population map of Sierra Leone[1]

The city of Freetown constitutes the administrative district Western Area Urban, located on a peninsula and is organised in 8 wards:

Table 1 Freetown Wards

Ward	Population	Density (habitants/km²)
Central 1	62 499	27 256
Central 2	21 413	27 003
East 1	61 244	35 177
East 2	89 530	49 192
East 3	448 572	9 909
West 1	53 981	24 327
West 2	130 149	19 527

[1] Source: http://www.citypopulation.de/en/sierraleone/admin/

West 3	188 576	9 119
Total	1 055 964	

Greater Freetown also encompasses Western area Rural, with the following wards:

Table 2 Freetown Wards

Ward	Population	Density (habitants/km²)
Koya Rural	70 423	423.2
Mountain Rural	30 488	786.6
Waterloo Rural	213 778	1.286
York Rural	129 581	536.2
Total	**444 270**	

The population projection for Freetown is as follows (in million inhabitants)[2]:

Table 3 Population of Freetown (in million inhabitants)

Year	2025	2030	2035	2040	2045	2050
Western Area Urban	1.3	1.5	1.7	1.9	2.1	2.3
Western Area Rural	0.6	0.6	0.7	0.8	0.9	1.0
Total	1.9	2.1	2.4	2.7	3.0	3.3

In order to ensure a more regional approach, it might also be interesting to include the neighbouring chiefdom of Kaffu Bullom, on the other side of the Tagrin Bay, where the Lungi airport is located. Kaffu Bullom has a population of 120 490 people (2015 census).

Sierra Leone is classified as a “least developed country”, with a gross domestic product of € 3.359 billion/year, which corresponds to a nominal GDP of € 443.6/(capita*year). Since the end of the civil war in 2002, the economy is growing with 4 – 7 % /year but suffered a serious contraction of over 20 % in 2015, due to the Ebola pandemic. With the effects of the COVID-19 pandemic, public deficit is expected to increase from 2.9 % of GDP to 8.2 %. Sierra Leone is a country with high over-indebtment risk; public debt is currently 77.2 % of the country’s gross domestic product. Economy mainly relies on subsistence agriculture and extractive industry[3], the importance of which having tripled since 2008.

Although the business climate has improved in recent years, much remains to be done. The country ranks 156th out of 190 countries worldwide in the Doing Business 2020 ranking. Business climate remains undermined by a weak legal framework, inadequate energy and transport infrastructure, red tape and corrupt practices[4].

Freetown is the economic and financial centre of Sierra Leone. Many of the country's largest corporations locate their headquarters' home offices in Freetown as well as the majority of international companies. The city's economy revolves largely around its port, which is the largest natural harbour on the continent of Africa and the third largest in the world[5].

1.4. Promoter

1.4.1 Institution

The project promoter is Freetown City Council (FCC), which is the municipal government of the city of Freetown. It was established in 1893 and is one of the oldest municipal governments in Africa. In order to improve governance

[2] Source: Waste Flow Modelling Report, Support to Freetown City Council – Waste Management, ICED Facility, July 2019
[3] Source:summarised from https://en.wikipedia.org/wiki/Economy_of_Sierra_Leone
[4] Translated from: https://www.tresor.economie.gouv.fr/PagesInternationales/Pages/d161ff5e-1329-4029-b8dc-3c64426ccd13/files/71cf980e-0100-41af-a875-4a0588c5be8a
[5] Summarised from: http://www.freetowncity.com/economy/4544165078

and make the city more liveable and resilient, Freetown City Council is currently working on the "Transform Freetown" process[6].

The Sierra Leone Environment Protection Authority (EPA) supports the project application.

For the integration of the other localities in the Greater Freetown area (Western rural and Kaffu Bullom towns), different options for intercommunal cooperation in line with the new Sierra Leonean decentralisation policy[7] will be assessed at pre-feasibility stage.

1.4.2. Contact person

Mayor's Delivery Unit, Freetown City Council

2. Planning Framework

2.1. Relevant policies and plans and reflection of project in these

Sierra Leone has elaborated several key documents governing the sectors of solid waste management, water management and sanitation:

- National Integrated Waste Management Strategic Plan, 2012 – 2016.
- Integrated National Waste Management Policy.
- National Policy Roadmap on Integrated Waste Management, Ministry of Health and Sanitation, 2015, with the objective "to accelerate the delivery of (…) sanitation and solid waste infrastructure (…) by 2030.
- National Water and Sanitation Policy, Ministry of Health and Sanitation, 2015.

The policy roadmap for integrated waste management is quite ambitious, both for solid and for liquid waste. For faecal sludge management, an overall improvement of the sanitation chain as well as quantitative targets and monitoring are foreseen; for solid waste management, the roadmap aims at reducing the quantities of waste to be landfilled or dumped to 10 %. The roadmap states that responsibility for SWM is under the responsibility of city councils [8].

A national Plastics and Plastic Waste Policy is in elaboration, under EPA responsibility. The policy does, for the moment, not mention a ban on certain single-use plastics but rather aims at setting the legal and institutional framework to improve plastics and plastic waste management. A Plastics and Plastic Waste Management Act is foreseen for this purpose.

On local level, the Freetown City Council has issued an ambitious plan, called "Transform Freetown". This plan covers the period 2018 – 2022 and aims, among others, at:

- Target 1: Safe collection, management and disposal of 60 % of Freetown's annual solid & liquid waste generation.
- Target 2: Ensure that 40 % of all Freetown's plastic waste is recycled by 2022[9], which is perfectly in line with the principles of the COPIP programme.

2.2 Relevant key legislation

Environmental legislation in Sierra Leone is scarce, and industrial pollution control is mainly handled via EIA licenses. There is no legislation ruling stormwater management. Technical decrees are not existing. The table below gives an overview of legal texts in the area of environment.

Table 4 Key Legislation Summary

Sector	Name	Date	Subject
Environment	Environment Protection Agency Act	2008	

[6] See: https://fcc.gov.sl/transform-freetown/
[7] See: National Decentralisaton Policy, July 2021, Ministry of Local Government and Rural Development.
[8] Source: summarised from Waste Flow Modelling Report, Support to Freetown City Council – Waste Management, ICED Facility, July 2019
[9] See https://fcc.gov.sl/transform-freetown/

Sector	Name	Date	Subject
	Amendment of EPA Act	2010	Establishment of EPA, EIA and ozone depleting substances. The EPA Act is the main document governing environmental management
Water	National Water Resources Management Agency Act	2017	Establishment of National Water Resources Management Agency, principles of water management and catchment water resource management
Governance	Public Private Partnership Act	2014	Promotion, facilitation and streamlining of public private partnerships
	Local Government Act	2004	Mandate and responsibilities of local governments
Sanitation	Freetown City Council Solid and Liquid Waste Collection By-laws	2019	Obligation for regular emptying of latrines/ cesspools, obligation to use an approved service provider

Apparently, by-laws related to waste management exist for Freetown; more information is needed. Freetown City Council (FCC) also stated its willingness to improve the local legislative environment for recycled products, for example, via green public procurement rules, that will ensure that a certain proportion of FCC construction projects be procured from eco-friendly producers, among others, from recyclers[10].

2.3 Documentation supplied by the Promoter

The project promoter sent the following documents:

- Freetown Recycling project, Freetown City Council/ Equatorial Coca-Cola Bottling Company, 20 January 2020.
- Freetown Flood Mitigation Plan 2020, FCC, RSLAE, SLRA, ONS, Mow.
- Safe Collection and Disposal of Municipal Solid Waste in Western Area Districts, Sierra Leone.
- Recommendations for Rehabilitation & Management of Solid Waste Disposal Sites and Pre-feasibility of New Landfill Sites, iMC Worldwide, December 2018.
- Problue (World Bank) proposal: Reducing land-based and marine sources of plastic pollution in Sierra Leone/ resilient Sierra Leone Project, March 2019.
- Integrated Solid Waste Management in Freetown, Robert Reid, Tiguist Fisseha, Thiery Martin, World Bank Group, April 2020.
- Waste Flow Modelling Report, Support to Freetown City Council – Waste Management, ICED Facility, July 2019.
- Draft Plastics and Plastic Waste Management Policy (EPA, 2021).

EPA submitted the completed questionnaire sent out to ministries of environment in countries eligible for COPIP.

3. Existing situation and needs assessment

3.1 Solid waste management in Greater Freetown Area

Only estimations are available concerning waste generation in Freetown. Overall waste generation is estimated to be 550 000 t/year (for 2021), 422 000 t/year of which being household waste. A study of 2017, however, arrives at the conclusion that Freetown generates 550 t/day of waste, which is less than half of the above-mentioned

[10] Source: Freetown Recycling Project, Freetown City council and Equatorial Coca-Cola Bottling Company, 2020

amount[11]; another study of 2004, however, comes to 745 t/day[12]. Uncertainty is very high. The Transform Freetown project calculates with 539 t/day for 2022. A weighbridge is to be installed at Kingtom dumpsite in the first quarter of 2021, which will improve the knowledge about waste quantities.

The Foreign Commonwealth and Development Office (FCDO), formerly the Department for International Development (DFID), commissioned study of 2019 made the following projections based on estimations for population growth and increase in waste production per capita[13].

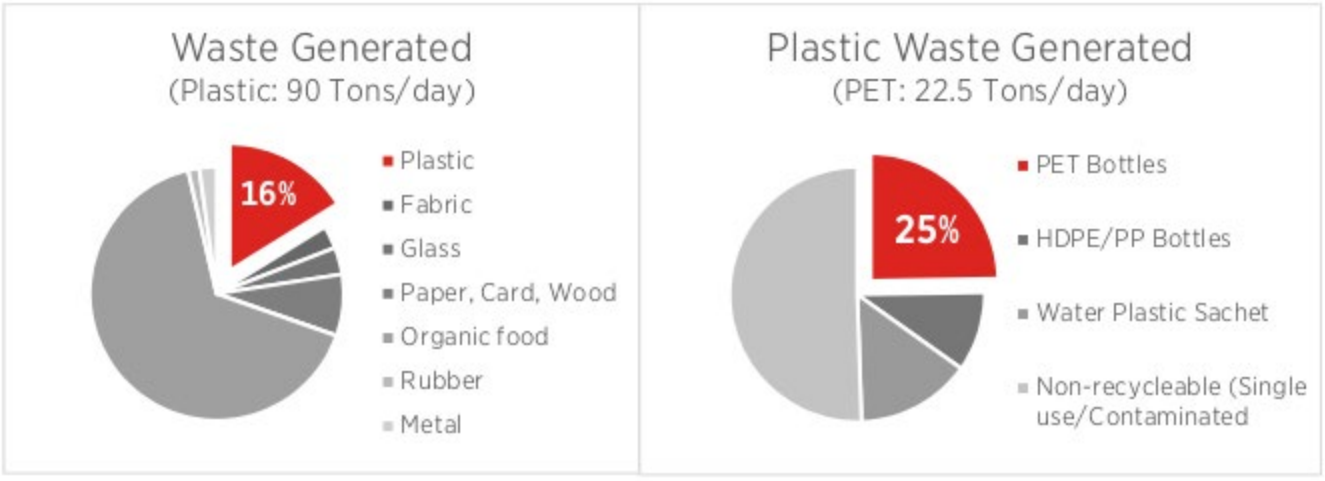
Table 5 Solid Waste Projections

Year	2025	2030	2035	2040	2045	2050
Western Area Urban (t/year)	237 394	271 600	326 431	390 423	464 973	551 683
Western Area Rural (t/year)	99 720	114 997	139 339	168 012	198 039	241 292
Total (t/year)	337 114	386 596	465 770	558 435	663 012	792 975

According to this estimation, waste generation will surpass 1 000 t/day in 2030, and 2 000 t/day in 2050, assuming that no measures are taken to curb demographic growth and waste generation.

Waste composition is as follows[14]:

Figure 2 Waste Composition



According to the quite comprehensive waste characterisation study of 2017, there is an important difference in waste coming from higher income wards (brought in by trucks) and poorer areas (wheelbarrow/ tricycle)[15]:

Table 6 Breakdown of waste by area

Type of waste	Waste from high income areas (%)	Waste from low income areas (%)
Organic	72.81	79.39
Plastics	18.32	15.61
Metals	2.42	1.23
Glass	3.81	1.48
Textile	2.65	1.66

11 Source: Waste characterisation by Premier Enviro Solutions Ltd., Prof. Ronnie Frazer, 2017
12 Source: Solid waste management study for Freetown, Sierra Leone, World Bank Project P078389, Dave Sood, 2004
13 Source: Waste Flow Modelling Report, Support to Freetown City Council – Waste Management, ICED Facility, July 2019
14 Source: Solid waste management study for Freetown, Sierra Leone, World Bank Project P078389, Dave Sood, 2004
15 Source: Waste characterisation study at Kingtom and Granville Brook dumpsites, Ronnie A.D. Frazer-Williams, 2017

Type of waste	Waste from high income areas (%)	Waste from low income areas (%)
WEEE		0.06
Medical		0.58

Solid waste management in Freetown is currently carried out at a very basic level, or not at all. The situation can be summarised as follows:

- Sierra Leone produces over 96 000 tonnes of plastic waste per year, 84 % of which being mismanaged. Plastic waste generation is estimated to be 0.14 kg/(capita*day)[16];
- Institutional capacities in the SWM sector, control and law enforcement mechanisms are weak, but the private sector seems well established[17].
- Average household waste collection rate is approximately 21 %, for industrial and commercial waste around 35 %; this is also an estimation. This corresponds roughly to 31 000 households being subscribed to waste collection; existing waste collectors do not have the capacity to expand. Informal settlements are not covered.
- The informal sector is very active in recycling, especially of metal and paper. 8 large recycling companies are purchasing these materials; approximately 7.6 % of waste is estimated to be derived for recycling before collection. Waste pickers take out plastic waste on the dumpsites; this is estimated to amount to 5.1 % of collected waste.
- A pilot project on sorting, composting and recycling of mixed waste in the wards of Dwarzack, Moyeba and Firestone is implemented by an association of waste pre-collectors. Hangars are currently in construction and will be finalised by May 2021. During the site visit end of March 2021, it was not possible to visit these pilots, since they were not yet ready.
- A recycling project for 0.5 t/day of PET has been prepared by a Sierra Leonean start-up, and is supported by FCC and Coca-Cola[18];
- Waste from Central I, Central II, West I, West III districts, a part of Mountain Rural and York areas goes to Kingtom dumpsite, waste from East I, East II, East III and another part of Mountain Rural goes to Granville Brook dump, and waste from Waterloo area and the remainder of Mountain Rural is dumped at Waterloo dump.
- The Kingtom dumpsite is in the densely urbanised north of Freetown. Informal settlements encroach the slopes of the waste body. The site is poorly managed (by a private company), and leachate ponds are invading the neighbourhood.
- Similarly, the Granville Brook dumpsite occupies a part of the Granville Brook catchment; the brook flows through the waste body before crossing residential areas on its way to the estuary. The area is densely populated. Landslides are probable, due to excessive height and inclination. In fact, a collapse in 2016 caused several thousand cubic meters to be washed to the Sea.
- The Waterloo dumpsite is less problematic in terms of nuisances to residential neighbourhood but is located adjacent to a mangrove swamp and exposed to tidal flooding.
- None of the sites is properly managed. Informal waste pickers and informal urban farmers are active on all dumpsites.

The satellite photos in Figure 3 give an impression of the three main dumpsites [19]. Vicinity to surface waters can be observed for all three sites.

In addition to the legal dumpsites, the city suffers from a large number of illegal dumpsites, 68 of which being considered as “major”. In 2020, FCC closed down 38 dumpsites; more than 100 are still awaiting clean-up [20]. Approximately 14 % of waste collected by tricycles is dumped illegally; the reason is mainly the time and cost due to the distance to the dumpsites.

Figure 3 Imagery of Site

16 Source: Draft Plastic and Plastic Waste Policy, EPA SL 2021
17 The entire list is summarised from: Safe Collection and Disposal of Municipal Solid Waste in Western Area District, Sierra Leone; Recommendations for Rehabilitation & Management of Solid Waste Disposal Sites and Pre-feasibility of New Landfill Sites, IMC Worldwide, December 2018
18 Source: Freetown Recycling Project, Freetown City council and Equatorial Coca-Cola Bottling Company, 2020
19 Source: Google Earth
20 Source: Mayor’s speech during Transform Freedom workshop, 01/02/2021

Above: Waterloo dump site (right upper corner: Mangrove swamp)
Left: Granville Brook dumpsite
Below: Kingtom dumpsite

Three major slum settlements are located on the Freetown shore: Susan Bay, Kroo Bay and Rokuper. These sites are built on land reclaimed by backfilling of the Sea with solid waste and are inhabited by a total of approximately 50.000 people. On 25 March 2021, 4 days prior to the project visit, a major fire breakout destroyed a large part of the Susan Bay dwelling and made several thousands of people homeless.

The photos in Figure 4 give an impression of the situation at Susan Bay.

Figure 4 Photos of Susan Bay

Red Crescent tents erected after fire outbreak

Creek filled with plastic waste passing through Susan Bay

Several small watercourses pass through Freetown, and each of these transports continuously waste to the ocean. Beaches in Freetown as well as in Lungi, on the other side of Tagrin Bay are polluted with plastics over kilometers. Similarly, clusters of waste are regularly observed in the open waters.

Right: brook crossing Sanders Street and flowing towards Kroo Bay.

Below: Fisher nets and plastic waste on Kroo Bay beach

3.2. Wastewater

Freetown does not have a central sewerage and wastewater treatment system. Only 6 % of liquid waste is currently managed[21]. Approximately 160 businesses are connected to a central sewer network in the downtown area (King Jimmy market and surroundings); wastewater is evacuated and discharged at Kroo Bay into the Sea without

[21] Source: Mayor's statement during Transform Freetown workshop on 01/02/2021

treatment. Very probably, there are major leakages in the sewer network since the discharged wastewater is nearly clear.

Around 30 % of Freetown's population use septic tanks, 60 % use pit latrines. Latrines are emptied by pumping trucks; sludge is then spread on polders on the dump sites, dried, covered with soil and used as fertiliser[22].

The capacity of the polder has been exceeded, and overflowing sewage is transferred through a connecting pipe to an unlined pit, from where it is taken to the Sea by tidal water. Several houses have been constructed near to the tidal outlet and are regularly flooded by untreated sewage[23].

Adjacent to Kingtom landfill, a first treatment facility for liquid waste based on the Geobag system has been established recently but is not yet operational. The capacity is not known; the responsible consultant indicates that this facility would treat 30 % of Freetown's latrine sludge.

Figure 5 Geobag

Geobag is a woven textile bag, which is filled with sediment laden sludge. Clear effluent is filtered through the fabric; the thickened solid can be evacuated mechanically after several cycles. Filtration is done by force of gravity; it is a simple, low-cost method.

However, the Consultant has some reserves concerning its application on raw latrine sludge; the system is usually applied for municipal WWTP sludge or industrial sludges rich in suspended solids.

4. Project scope and cost

4.1. Proposed project scope and estimated cost

4.1.1 Solid waste management

The following project components are proposed in the pre-feasibility study elaborated by IMC Worldwide:

Table 7 Summary of Components

[22] Source: Solid waste management study for Freetown, Sierra Leone, World Bank Project P078389, Dave Sood, 2004

[23] Source: A situational Analysis of Waste Management in Freetown, Sierra Leine, Alhaji Brima Gogra, Jun Yao, Victor Tamba Simbay Kubba, Edward Hnga Sandy, Gyula Zaray, Solomon Peter Gbanie and Tamba Samuel Bandagba, Journal or American Science, 6/2010

No.	Project component	Capacity	No of units	Investment cost		EIB eligibility[24]
				Million SLL	€	
1	Upgrading and extension of lifespan for Kingtom dump, including storage area for waste pickers and waste mining to recover plastics from historic waste	160 000 tons in 5 years	1	29.921	2 413 000	(√)
2	Closure and rehabilitation of Granville Brook site, protection against landslides		1	7.144	576 100	√
	(estimation by FCC)				2 600 000	
	Installation of waste sorting and transfer station	60 t/day	1	8.674	699 550	(√)
3	Waterloo dumpsite closure and rehabilitation					√
4	Construction of new engineered landfill					
	~~Alternative 1: Magbafti site~~[25]	1 100 000 m³	1	97.970	7 900 800	(√)
	~~Alternative 2: Madonkeh site~~	2 800 000 m³	1	152.057	12 262 700	(√)

Within the context of the World Bank's Resilient Urban Sierra Leone Project, which has an overall budget of €49.1 million, a € 16.5 million package is foreseen for solid waste management, and a € 1.6 million budget for flood and landslide risk mitigation. This project is a grant, not a loan.

The World Bank project proposes the following investments:

Table 8 World Bank Proposed Investments

No.	Project component	Capacity	No of units	Investment cost		EIB eligibility[26]
				Million SLL	€	
1	Construction of 20 – 30 waste transfer cum sorting stations and purchase of new skip trucks					(√)
2	Construction of a Material Recovery Facility	80 t/day		13.119	1 058 000	(√)
3	Construction of a landfill site at Hastings	2 700 000 m³	1			√
	TOTAL				**16 000 000**	

A long-term technical assistance programme, institutional strengthening, capacity building, awareness building and optimisation of waste collection routes would accompany this project.

Currently, preparatory studies for the World Bank project are ongoing and it is not yet clear if the rehabilitation components proposed in the IMC feasibility study will also be included. The final scope of a potential COPIP project can be determined only once it is clear which components will be financed and which ones will not be.

Eligibility of the project components according to the EIB climate roadmap may present a challenge since the project, in its current setup, focuses entirely on the collection of mixed waste; sorting and recycling will be done in the material recovery facility, from mixed waste coming in. There is a need to stress that given the poor current situation with regard to low waste collection coverage and adverse impact from non-collected waste, even linear waste management will have major positive impact. When planning developments towards more circular waste management approach, it is also necessary to consider the capacity of the promoter to manage such developments and related collection systems and treatment facilities.

[24] Eligibility according to EIB climate roadmap
[25] Proposed landfills become obsolete with the construction of the new landfill at the Hastings site.
[26] Eligibility according to EIB climate roadmap

4.1.2 Wastewater treatment and stormwater drainage

The existing Geobag system has been installed at pilot size, and FCC expressed its willingness to expand the system to cover more latrine sludge.

More technical assessment is needed to determine the suitability of the technology and the possibilities for either extension or installation of a complementary wastewater treatment system.

FCC also is interested in the rehabilitation of the central sewage network, which seems not to be functional anymore.

However, the Consultant has some reservations concerning the rehabilitation, taking into consideration that only 6% of liquid waste is currently managed. An extension would be necessary and also in this case the construction of a WWTP.

4.2. Assessment of project scope and alternative/complementary options

4.2.1 Introduction of waste (pre-) collection in inaccessible peripheral areas

In order to increase the coverage of waste collection in Freetown and prevent plastic pollution of the oceans, the inaccessible hilly and/or slum areas of the city also need to be connected to a waste collection system. By 2022, the Transform Freetown programme foresees 60 % of waste collection coverage. In the years after 2022, this coverage needs to be increased further, which is not possible without reaching the suburbs and slums.

Given that these areas are very poor and often not accessible for tricycles and push carts, another type of waste collection system needs to be established. A bring system with containers or equivalent might be adequate; more options with their respective advantages or disadvantages need to be assessed during the (pre-) feasibility phase.

4.2.2 Transition to circular economy

We notice that the projects proposed in the feasibility study and in the World Bank document concentrate very much on linear economy, i.e., improvement of waste collection and waste disposal. 5.1 % of waste are reported to be picked out of mixed waste at the landfill; with the introduction of a Material Recovery Facility with 80t/day capacity, the recovery rate might slightly be improved. This depends on the concept of the MRF – does 80 t/day mean

- 80 t/day of mixed waste entering the facility, or
- 80 t/day of recyclable waste to be extracted?

More clarification is necessary on this topic. World Bank is currently conducting a study on operational costs and cost coverage; after completion of this study, more information will be available on circular economy elements already considered in the project. However, the MRF will be on Hastings's landfill, which will, according to FCC, receive waste mainly from Waterloo, not from Freetown, and therefore it does not really enter into the COPIP project.

Another important point is that all projects proposed both in the feasibility study and in the World Bank document seem to rely on collection and recovery of mixed waste.

In order to increase the contribution of the project to circular economy, we propose adding the following components:

- Pilot project for separate collection of waste and MRF to be integrated in the existing transfer stations.
- Co-digestion facility for Geobag output, market and slaughterhouse waste.
- Modular composting facility.

Private sector recycling projects are existing. Some intermediaries commercialise plastic waste to Guinea. A private company has established a pilot plant for producing construction bricks and tiles from non-recyclable plastic waste with cement; the product has been tested by a laboratory in Lagos and found to be of good quality. The investor now contemplates upscaling. This facility might become an important outlet for a part of the MRF output.

4.2.3 Sustainable reconstruction of Susan Bay

Freetown City Council plans to reconstruct the burned dwellings at Susan Bay in a sustainable way. The Consultant proposes contributing to the reconstruction with a specific COI focus:

- Stabilisation of the polder (ex. Backfilling with rubble from construction waste) and removal of waste banks.
- Construction of a sufficient number of communal toilets (latrines with urine/ faeces separation system) and connection to an aerobic co-digestion reactor for fresh latrine sludge and kitchen waste; treatment and bottling of biogas for use of the Susan Bay households.
- Establishment of a bring system for dry waste.

4.2.4 Estimated costs of the proposed COPIP project

The estimated costs for the proposed COPIP project are included in Table 9 below. This includes additional projects and the landfill rehabilitation proposed by IMC, but not included in the scope of the World Bank project.

Table 9 High level cost estimates

No.	Project component	EIB eligibility[27]
A1	Introduction of waste collection in the informal and/or inaccessible settlement areas of Freetown	√
	Introduction and improvement of waste collection in Western rural and Kaffu Bullom towns	√
	Transfer stations for Greater Freetown peri-urban area	√
	Collection/ transport equipment for Greater Freetown peri-urban area	
	Pilot project on separate collection of waste (wet/ dry, bring centre for specific recyclable material, other) for Greater Freetown and neighbourhood	√
A2	MRF equipment for the World Bank and additional transfer stations	√
A3	Co-digestion facility for Geobag treated septic tank sludge, biodegradable market waste and slaughterhouse waste	√
A4	Modular composting facility for green waste and biodegradable household waste	√
	Alternative: Smaller composting facility + community based manual composting projects	
A5	Extension of Geobag system and subsequent hygienisation of dried sludge	√
A6	Assessment and rehabilitation of central sewer network	√
A7	Community based co-digestion latrines for Susan Bay reconstruction	√
A8	Rehabilitation of Kingtom and Kissy dumpsites	√
A9	Potentially: Clean-up of waste polder and reconstruction of stable underground	√
A10	Comprehensive, long term capacity building and technical assistance	√
TOTAL - 27 000 000 Euro		

All costs are based on very rough estimations; more detailed research needs to be done during the (pre-) feasibility stage.

[27] Eligibility according to EIB climate roadmap

4.3. Proposed pilot projects

4.3.1 Mobile application to improve waste pre-collection

A local organisation (Think Africa) has developed a mobile application to improve waste pre-collection, in order to ensure better coordination between clients (households) and waste collectors.

It might be interesting for COPIP to support this application and help its rollout and further development, also in view of transition to segregation at the source (wet/ dry or other).

4.3.2 Cleaning the urban creeks

Several small watercourses pass through Freetown and each of these transports continuously waste to the ocean (see Section 3.1 last paragraph where pictures illustrate the situation).

It might be interesting for COPIP to start a pilot project for trapping this waste, particularly the plastic waste.

During the pre-feasibility study different solutions have to be studied to trap the waste flow (nets…) to harvest and then to treat particularly the plastic waste.

5. Project contribution to COI objectives

The project contributes to the objectives of COI as follows:

The waste component:

- Increasing the waste collection rate, which is currently very low. This will allow to reduce plastic and other waste leakages to the Freetown rivers and the Sea.
- Rehabilitation of the dumpsites, all of which are connected to surface waters and the Sea.
- Supporting and strengthening recycling initiatives.

The water and sanitation component:

- Rehabilitation of the central sewer network.
- Public toilets for Susan Bay habitants.
- Extension and improvement of the Geobag system.

It should be noted that the project will start from a very low level and aims at targets, which could be considered as extremely basic in a more advanced context but are really ambitious when taking into account Sierra Leone conditions.

6. Project financing plans

6.1 Current Revenues

Despite the level of poverty in Sierra Leone, several instruments are implemented to finance solid waste management:

- Households pay a waste fee of SLL 166/kg, corresponding to 0.013 €/kg[28]
- Commercial and institutional customers pay around SLL 220/kg, or 0.018 €/kg.
- Fines for illegal disposal are recovered by FCC enforcement mechanism (Metpol).

[28] Weight is estimated, no weighing is done.

With a collection rate of 21 %, the overall revenue generated from waste collection fees reaches 610 000 €/year [29]. This amount is equal to the portion of pre-collection fees transmitted by the private collection operators to FCC (tipping fee for tricycles and hand carts at the dumpsites).

In addition to this, FCC has started a census of all properties in Freetown in order to recover property tax. Property tax is the largest part of FCC revenue and amounted, before the 2019 reform, to SLL 7 billion/year (€ 583 000 /year). Income from property tax is meant to cross-subsidise solid waste management costs. Property tax is varying from SLL 100 000 – 1 000 000 /year, depending on the site and quality of the dwelling to be taxed. With overall 106 000 households in Freetown, an additional SLL 37 billion /year (€ 3.083 million) of income from property tax could be reached in theory, if all households pay this tax.

6.2 Estimated real cost

With a waste generation of currently 576 t/day in Freetown (FCC) and an estimated administration/ awareness building, collection/ transfer + landfilling cost of € 25 /tonne[30], costs of waste management are expected to rise as per the data in Table 10[31]:

Table 10 Estimated real cost

Year	Waste generation (t/day)	Cost (€/year)	Income from waste tax (€/year)	Income from property tax (€/year)	Financing gap (€/year)
2022	576	5 256 000	610 000	1 079 050	3 566 950
2030	1 200	10 950 000	1 270 833	1 510 670	8 168 497
2040	1 500	13 687 500	1 588 542	1 942 290	10 156 668

Available financial means are therefore by far too low to ensure sustainable financing of SWM operational costs.

For the other towns of Greater Freetown area and Kaffu Bullom, no information on financing of solid waste management is available. This will have to be researched during the (pre-) feasibility stage.

6.3 Potential for revenue generation

6.3.1 Increase of revenues from household and commerce/ industry taxes

To be investigated during pre-feasibility stage.

Given that a ceiling on revenues could be reached rather quickly it may be possible as a partial alternative to identify opportunities for improving efficiencies and reducing costs, by leveraging the competitive forces of the private sector in PPP mode, amongst other means.

In addition to the potential opportunities for leveraging finance through green/blue bonds tied to specific revenue streams could also be investigated.

The Project has also been interacting with the Circular Economy and Blue Economy networks in a bid to identify additional contacts and for the purpose of exploring novel financing modalities, such as green bonds and blue bonds which to date have not gained much traction in Sub Saharan Africa but are increasingly being discussed at high level conferences attended by the EIB, World Bank, UN and the WWF.

The actual cost, affordability and pricing options require further study in the pre-feasibility phase. This research will also include commercial and industrial waste, for which other pricing options may be applicable.

[29] Source: Safe Collection and Disposal of Municipal Solid Waste in Western Area District, Sierra Leone; Recommendations for Rehabilitation & Management of Solid Waste Disposal Sites and Pre-feasibility of New Landfill Sites, iMC Worldwide, December 2018

[30] Landfilling is expected to be more expensive, but with the assumption that 40 % of waste will be recovered, and that recovery will at least allow to break even, or be profitable, this number has been assumed. It includes amortisation/ re-investment costs. Increase in waste generation is a first assumption based on experiences from other countries. More realistic figures will be calculated in the (pre-) feasibility stage.

[31] Coverage of property tax assumed to increase from 50 % in 2022 to 90 % in 2040, and 70 % of this income to be spent to cover SWM costs

In the new project, all revenues created downstream (recycling, composting, bio-methanisation) should also contribute to the financing of the activity. The authorities have not yet established a model for financing, and they indicate the need for technical assistance to develop the right financing model.

7. Project implementation plan

7.1 Role and responsibilities of promoter and key stakeholders

Table 11: Roles and Responsibilities

Stakeholder	Mandate and responsibility in target sector	Role in the project
FCC	Coordination and implementation of SWM policy and activities Financing of SWM	Project promoter
City councils of Western rural and Kaffu Bullom		Project associates/ participants to intercommunal SWM entity
EPA	Environmental legislation and policy, monitoring and control	Political support for the project
Private sector	Waste (pre-) collection, transport, recycling	Cooperation with FCC; contribution for diversion from landfill

Responsibility for waste management has changed frequently in the last decades, which made it difficult for responsible institutions to accumulate knowledge and create institutional capacities. In the last 20 years, the following institutions have been mandated with waste management:

Table 12: Responsibilities in Freetown

Date	Organisation responsible for waste management
Before 2003	Environmental Health Division under Ministry of Health, with assistance from Freetown Infrastructure Rehabilitation Project
May 2003 – March 2005	National Youth Multi-Purpose Cooperative Society under Ministry of Youth and Sports
March 2005 – February 2008	Freetown City Council
February 2008	Freetown Waste Management Company
2009 - present	Freetown City Council

In addition to the local stakeholders, the World Bank and EU Delegation to Freetown are important actors in the field of solid waste management. A potential COPIP project needs to be coordinated with the World Bank in order to avoid conflicts and duplications; the EUD has expressed its willingness to contribute with a grant for Technical Assistance in the context of a COPIP project in Greater Freetown and its neighbourhood.

7.2 Time schedule for project preparation and implementation

The preparation of the project can be done within the time frame of the COPIP programme. For the implementation, at least 60 months should be foreseen, allowing a thorough preparation and taking into consideration lengthy administrative and procurement procedures. An accompanying technical assistance project should not only cover the preparation and construction phase, but also the first years of operation of new facilities and systems. More detailed recommendations for the technical assistance part are to be elaborated during the pre-feasibility and feasibility studies.

7.3 Key aspects to consider in pre-feasibility study

The pre-feasibility study needs to concentrate on the following aspects:

- Exact dimensions, capacity and technology of project elements brought in by COPIP.
- Household income and affordability study to determine possibilities of SWM cost recovery.
- Modalities of COPIP project financing (grant/ loan/ loan conditions).
- Renewal of waste characterisation study and market analysis for recyclable materials, compost and biogas
- Assessment of decentralised manual composting/ biodigestion vs. centralised treatment.
- Assessment of existing wastewater sewage system and needs of rehabilitation.
- Assessment of Susan Bay reconstruction needs.
- Assessment of legal and administrative context for solar cross subsidy project.
- Needs for technical assistance (human and financial resources).
- Household income and expenditure surveys to facilitate an affordability study which will determine the potential for SWM cost recovery utilizing existing as well as other potential economic instruments, e.g., collection tariffs, landfill gate fee, property tax, other taxes, fines/penalties, potential revenue from re-cycling options, composting, biogas, potential revenue, surplus from a solar project for cross subsidy.
- Assess the funding gap in the context of project costs, affordable tariffs, and other financial instruments highlighted above.
- Identify any other potential economic, environmental and social benefits which could be utilized to justify bridging the funding gap.
- Conduct a financial analysis of project cost and revenue streams (discounted cost and revenue streams over 20-25 years).
- Conduct a cost benefit analysis of potential economic, environmental and social impacts (quantifying these impacts to the extent feasible).
- Estimate financial and economic rates of return. Here the financial rate of return will almost certainly be negative, but the economic rate of return may be positive as it would incorporate quantified economic, environmental and social benefits.
- Identify COPIP project financing modalities (grant/ loan/ loan conditions) to fill the funding gap.
- Identify needs for technical assistance to determine beneficial institutional delegations and responsibilities (O&M, financial management). In this context determine any potential policy and governance conflicts arising from the solar project revenue cross subsidy.

7.4 Key aspects to consider in feasibility study

To be determined during pre-feasibility study.

8. Environmental and social aspects

8.1 Key environmental and social aspects

Solid waste management problems in Freetown exceed “normal” environmental and social concerns; in the Consultant’s eyes, they need to be considered as a humanitarian and environmental urgency and be treated with the priority corresponding to the alarming situation. This concerns both the very large quantities of waste that are swept into the ocean by the different Freetown brooks and creeks and the extremely high health and safety risk constituted by the waste poldering practice, the complete absence of any sanitation services and the very precarious housing constructed in these areas.

The costs and benefits of environmental and social aspects (impacts) need to be expressed more scientifically and quantified as far as possible to justify the subsidies required to bridge the funding gap as discussed in 7.3 above. From this point of view, they will need to be clearly defined and will need the attention of environmental and social

specialists to consider more carefully. e.g. improved health and productivity of contiguous populations, reduced environmental degradation caused by plastic and other waste, reduction in greenhouse gases resulting from relevant investments, improved sustainability of land based and ocean resources etc.

Habitants of Susan Bay and the other waste polder wards reject any tentative to resettle them in social housing near Waterloo or Hastings, given that their jobs and their social network is in Freetown. The sustainable reconstruction of their homesteads, with elimination of the current environmental and health hazards is a key question for the (pre-) feasibility study.

Informal settlements in the hilly areas of Freetown also do not benefit from any waste collection system. They are inaccessible for tricycles and “onomalankay” (push carts). An adequate waste collection system taking into consideration affordability for the citizens and cost recovery for FCC needs to be planned for these areas.

8.2 Key topics to cover in the ESIA

8.2.1 Continuity of waste landfilling at Kingtom site

Freetown City Council wishes to continue using the Kingtom dumpsite after rehabilitation and technical improvement, in order to keep waste transfer costs low and ensure direct accessibility for tricycles and push carts. The new Hastings dumpsite constructed by the World Bank should be used for waste from Waterloo according to FCC experts.

Given that Kingtom dumpsite is in central Freetown, the suitability of continuing the use of this site, even after rehabilitation, should be pondered against the financial implications of transfer to Hastings’s landfill. If possible, additional measures to reduce environmental nuisances of a future Kingtom landfill should be assessed.

8.2.2. Livelihood of waste pickers on Kissy (Granville Brook) and Kingtom site

Approximately 400 waste pickers are working and, some of them, living permanently on the two dumpsites in central Freetown. Closure of Kissy and rehabilitation of Kingtom dumpsites will deprive them of their source of revenue. The ESIA needs to assess in how far adequate alternatives can be provided by jobs in the material recovery facility, waste (pre-) collection and/ or recycling and composting facilities. Resettlement of the people living on the dumpsites also needs to be considered.