BLUE BOX

5 EVALUATION AND MONITORING

FACT SHEET: WASTE FLOW DIAGRAM (WFD)

A PRODUCT DEVELOPED WITHIN THE FRAMEWORK OF:

PROMAR Prevención de Residuos Marinos

On behalf of:
Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection
of the Federal Republic of Germany

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ABOUT THE PROMAR PROJECT

The PROMAR - Prevention of Marine Litter in the Caribbean Sea project aims to reduce the flow of plastic waste (mainly plastic packaging and single-use plastics) reaching the Caribbean Sea by promoting circular economy solutions in the Dominican Republic, Costa Rica and Colombia. The project is funded by the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV) and led by the German organization adelphi.

Within the framework of the project, the PROMAR BlueBox was created, a collection of various tools, guidelines, tutorials and materials that will help you implement circular economy solutions to reduce marine litter in your municipality. This fact sheet for the Waste Flow Diagram (WFD) that you will find on the following pages is included in the PROMAR BlueBox as an introduction and recommendation to the tool developed by the German Society for International Cooperation (GIZ).

The objective of the tool is to enable a quick assessment to map waste flows in a municipal solid waste management system, including the sources and destinations of each type of waste.

The Waste Flow Diagram is aimed at local authorities, development agencies, NGOs or other parties interested in solid waste management. The publication of this tool is expected to encourage its use in coastal communities and thereby contribute to the reduction of land-based waste streams that reach marine environments, such as plastic waste.

INTRODUCTION

The BlueBox has been designed to provide a detailed overview of effective tools for combating marine pollution. This factsheet describes the use and benefits of the Waste Flow Diagram, a tool developed by the GIZ.

The main cause of marine litter is the mismanagement of land-based solid waste. Land-based sources account for 80% of marine litter, of which approximately 85% is plastic. To address the problem of marine litter at the municipal level, it is essential to understand how and why waste is released into the environment from municipal waste management.

Waste management is a complex process involving multiple actors, stages and activities, so it can be difficult to map the entire system and the parties involved. For this reason, the WFD was created, a tool that has the objective of calculating the quantities of solid waste released into nature from various sources.

The main objectives of the Waste Flow Diagram established by GIZ are to:

- *Provide a rapid assessment of a city or municipality's municipal solid waste management system and visualize waste streams, including information for SDG 11.6.1 sub-indicators*
- *Assess and quantify plastic leakage from the municipal solid waste system and determine the fate of uncontrolled wastes*
- *Identify priority sources of plastic pollution for informed intervention*
- *Enable benchmarking between cities*
- *Develop scenarios to better understand the impact of proposed interventions on waste management and plastics pollution*
- *Quantify the effectiveness of implemented interventions*

The Waste Flow Diagram allows a quick assessment to map waste flows in a municipal solid waste management system, including the sources and destinations of each type of waste.

Within the context of PROMAR and the utilization of the BlueBox, the findings prove highly valuable in collaboratively identifying intervention points with stakeholders to diminish plastic influx into water bodies. Moreover, these results can serve as effective tools in initiatives to raise awareness about local pollution and engage in discussions with municipal or national decision-makers to enhance understanding of the issue.

The tool works with a simulation of scenarios that feed into known qualitative and quantitative factors of waste management in the municipality, including the activities of the municipal administration, such as informal activities. By separating the possible release scenarios during the entire waste management process, the tool is able to calculate the amount of waste released at each stage. With the simulation of the present scenario it is also possible to simulate possible improvements to the system to visualize how a better waste management is able to reduce environmental pollution in the municipality.

Experts from the PROMAR team used the Waste Flow Diagram as part of the project to analyze on-site conditions and establish a baseline to understand and improve the situation. Due to the success of its application, it was decided to include WFD as a tool in the PROMAR BlueBox, in the Diagnosis and Baseline Establishment phase. This factsheet briefly presents the tool and shows its use in the PROMAR project, specifically in the municipality of El Limón, Costa Rica. For more information, training materials and use of the tool itself, please visit the GIZ website.

APPLICATION OF THE WASTE FLOW DIAGRAM (WFD)

Photo 1. Cieneguita river bank. Limón, Costa Rica

To make use of the WFD, it is necessary to collect primary and secondary data to feed the simulation of the present scenario. This information is gathered through direct observations, interviews and field visits from each stage of waste management (generation, collection, transportation, treatment/recovery and disposal). The tool requires a Material Flow Analysis (MFA) and systematic qualitative assessment based on observation to obtain the necessary data. These data are entered into the WFD within five sections: waste generation, waste treatment and disposal, waste management in controlled facilities, plastic leakage and fate of plastic leakage.

The accuracy and reliability of the data generated by the WFD depends on the level of dedicated resources, as well as the quality and accuracy of the data provided to feed the tool's database. It is crucial to set the system boundaries correctly during the investigation in order to obtain precise and accurate results. Experience shows, for example, that small municipalities often share waste management systems with neighboring municipalities. In these cases it is more effective to perform an analysis that includes all municipalities involved in the same system, otherwise it is not possible to separate the different waste streams from their exact generation.

Photo 2. Contamination Río Manzanares Colombia

To quantify plastic leakage through the various stages of municipal solid waste management, potential leakage and management at the final destination are taken into account. Factors influencing leakage through the waste management system (e.g., formal and informal waste sorting facilities) are systematically evaluated to determine release levels at each leakage point. The model determines how much of the uncollected or filtered plastic ends up at each of four destinations: open burning, land dumping, release to storm drains, and release to water bodies.

Click here to access the Waste Flow Diagram online portal!

CASE STUDY: EL LIMÓN, COSTA RICA

1. GENERAL REMARKS

Within the framework of the PROMAR project, three studies were carried out using the Waste Flow Diagram: Santo Domingo Este, Dominican Republic; Santa Marta, Colombia and El Limón, Costa Rica. The full reports are available here.

The first analysis made it possible to map the solid waste flow system in the municipality of El Limón in Costa Rica, in order to determine the amount of land-based plastic waste that is released into the Caribbean Sea from this municipality. Although the official demonstration site of the project is the community of Cieneguita, it was necessary to expand the geographic delimitations of the study area since the Cieneguita neighborhood receives solid waste from other neighboring communities, all of which belong to the municipality of El Limón.

Photo 3. Illegal waste incineration, Limón Costa Rica

Photo 4. Contaminated shoreline, Limón

The model allowed to:

- Estimate the amount of plastic waste released into the environment annually from the study area.
- Identify the main destinations of solid waste within the study area.
- Trace each part and actor involved in the solid waste management system in the study area, in order to identify possible leaks throughout the process.

2. DATA COLLECTION

Data collection should take into account all stages of solid waste management, from its generation to its final disposal. Qualitative and quantitative data were obtained through reliable sources or direct observation and analysis in the study area. It is necessary to take the time to investigate all the actors involved in the different stages of waste management to know what information is available and what has to be collected in the field.

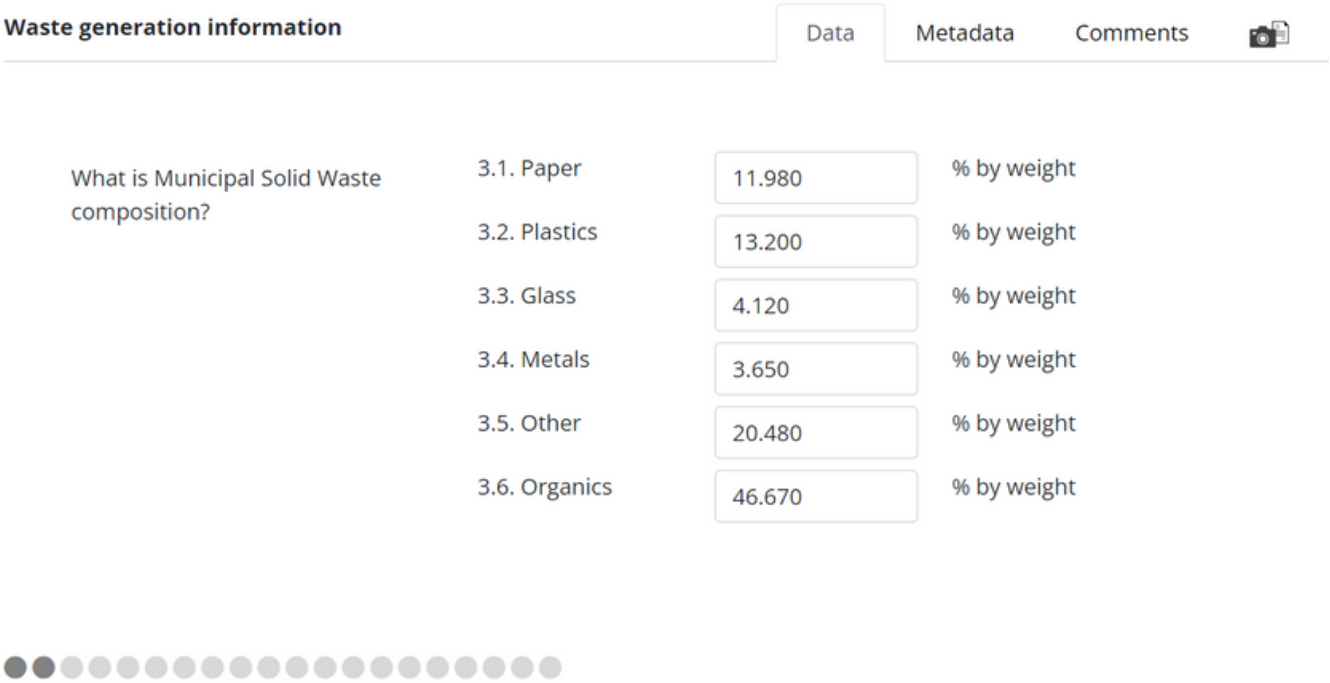

Figure 5. Extract from the online portal, Source: GIZ (2023)

The per capita waste generation rates, for example, were obtained from the Municipal Plan for Integrated Solid Waste Management of the canton of Limón. On the other hand, it was necessary to analyze the municipality's collection routes to determine which days the trucks from the study area arrived at the landfill.

In this case, trucks were received on Wednesdays only from areas outside the study area, so the quantities of waste entering the landfill on Wednesdays were eliminated from the databases. Once the total amount of waste corresponding to the study area was determined, the amount of each type of waste was calculated using the composition percentages documented in the Municipal Integrated Solid Waste Management Plan (MSWMP).

For data on possible leaks in the waste management system, qualitative information was collected during a field visit with the support of the Operations Department of the Municipality of Limón, during which different collection routes were observed to determine characteristics of disposal at the source, quality of the implements used for collection and transportation, participation of the formal and informal sectors, and final disposal practices in the study area.

Be careful!

Difficulties that may arise in data collection

Define system boundaries: When the geography studied is part of a city (as in the case of Santo Domingo, PROMAR's work focused on Santo Domingo East), collecting the necessary data can be challenging. Often, waste generated in the area under study may flow and reach facilities located outside the geographic boundaries (e.g., landfills, recycling facilities, transfer stations, informal buyers). In this case, when interviewing facility managers, it is difficult for them to trace back the amount of waste coming from the study area. Therefore, it is suggested to define the geographical boundaries of the study at an administrative level where most of the facility is included.

Estimating waste collected by the informal sector: In many cities, the amount of plastics collected by the informal sector is so significant that it cannot be excluded from the WFD. Given the informal nature of these businesses, collecting accurate data is quite difficult. However, an approximation is possible if intensive field work is carried out. Interviewing informal buyers, formal waste aggregators and recyclers can help to find out the quantities of waste managed informally. This also helps to triangulate the data collected and understand its reliability.

3. RESULTS

The results obtained on plastic solid waste flows, including the quantities reaching water bodies, in the municipality of El Limón are presented in Figure 6 below.

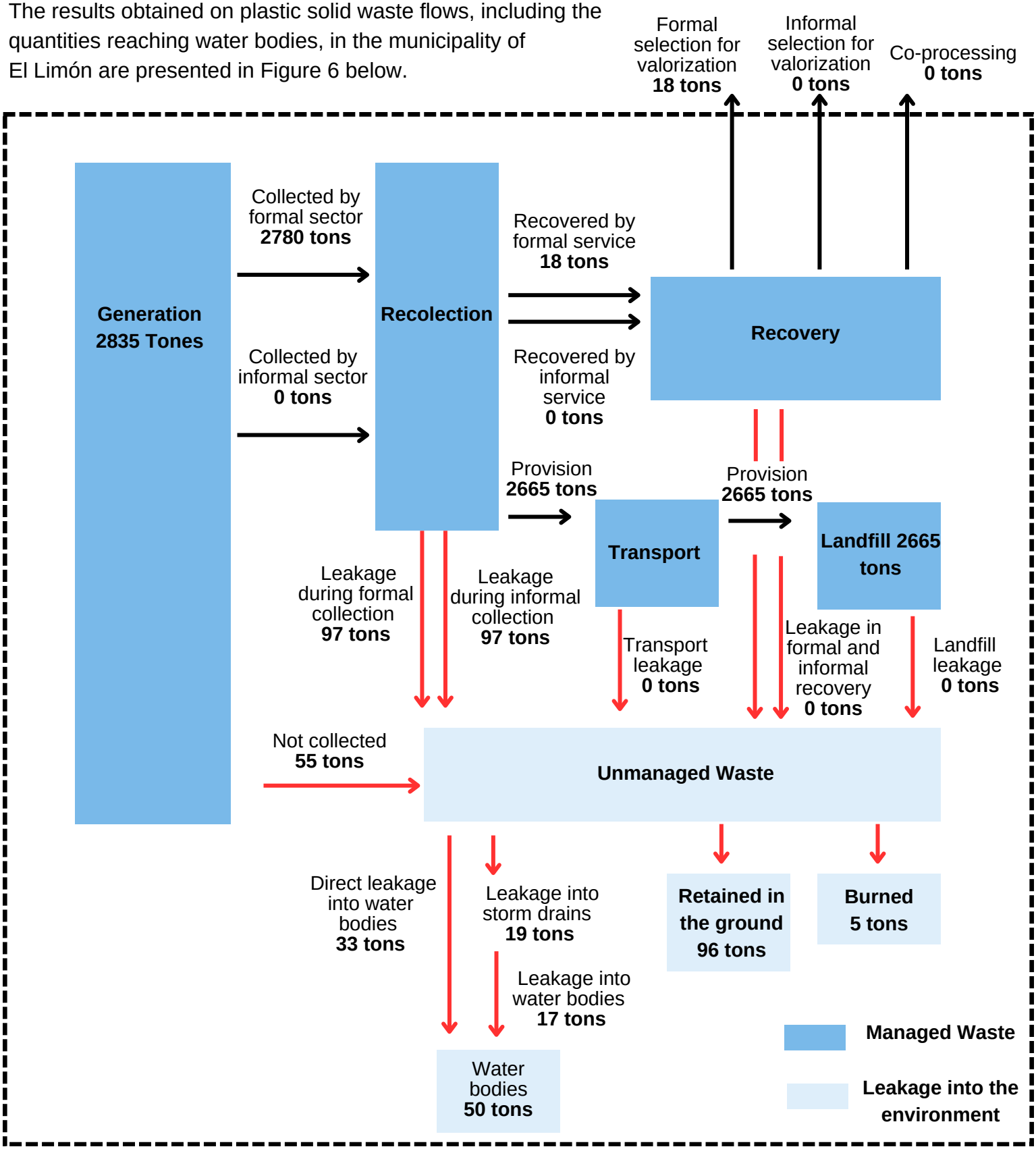

Figure 6. Waste Flow Diagram obtained from the municipality of El Limón, Costa Rica

Some 2835 tons of plastic waste are generated in the municipality of El Limón, Costa Rica annually. Of this waste generated, only 2,780 tons of plastic are collected and enter the municipality's waste management system.

A substantial 93.6% (2665 tons) of waste within the management system finds its way to landfills, while a mere 0.65% (18 tons) undergoes recycling. Unaccounted for in the management system and during collection, 5.2% (152 tons) of annually generated plastic waste is discharged into the environment. Notably, 32.9% (50 tons) of this unregulated release is directed exclusively into bodies of water through sewers or direct discharge.

Collection is the only stage within the waste management system in which release into the environment was detected, with a release of about 97 tons annually. The main causes of the release during the collection of solid waste are based on the disposal of this waste from the moment it is generated. The inhabitants of the municipality dispose of their waste on public roads on days when there is no collection service and deposit the waste on riverbanks without any type of containment or retention to protect the bags from animals and climatic factors that facilitate its release.

Finally, it was determined that the plastic waste recycling rate in the study area is very low, achieving the recovery of only 0.65% of the total amount of plastic waste disposed of in the waste management system.

4. RECOMMENDATIONS

Taking into account the results obtained on possible leaks in the waste management system of the municipality of El Limón, Costa Rica, the following measures are proposed to prevent the release of solid waste into the environment:

- Place containment structures in riverside communities to prevent the waste from being exposed on the ground to animals and runoff.
- Conduct education and awareness campaigns focused on changing the habits of the population when it comes to removing waste from public roads: a.) Take out waste only on days when there is collection service at their homes. b.) Deposit waste in front of their homes and not on the river bank.
- Implement strategies aimed at significantly increasing the amount of waste, especially plastics, that is separated from ordinary waste and enters the formal recovery (recycling) stream.
- Share results with authorities to drive improvements in the system.
- Use the results in awareness campaigns to illustrate the negative local impacts of current practices.
- Present the results to local stakeholders to identify joint strategies to reduce plastic leakage from the system.

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