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

PROMAR Prevention of Marine Litter

BASELINE WASTE CHARACTERIZATION STUDY

Leonsberg

Paramaribo, Suriname

SEPTEMBER 2025

Prepared For :
Green Heritage Fund Suriname

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Baseline Waste Characterization Study Leonsberg, Parmaribo, Suriname

September 2025

On Behalf of Green Heritage Fund Suriname

By J. F. van Klaveren and C. S. Samson

Edited by E. Wirjotaroeno

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Project Contribution to SDGs:

8 DECENT WORK AND ECONOMIC GROWTH
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
17 PARTNERSHIPS FOR THE GOALS

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Introduction

Marine ecosystems provide a wide range of ecosystem services. Any threat to marine ecosystems can have significant consequences for these services and, consequently, for human well-being worldwide. Such threats can lead to reduced health and food security, as well as the loss of livelihoods and income sources (Beaumont et al. 2019).

Unfortunately, marine environments are under pressure from multiple hazards, including overexploitation, habitat destruction, climate change, and pollution (Henderson & Green, 2020). Over the past decades, marine litter has become a global problem with no geographical or political boundaries (Hartley et al. 2018; UNIDO 2019; Beaumont et al. 2019). Due to its harmful ecological and socio-economic impacts, marine litter is recognised as one of the world's most significant pollution challenges, threatening both marine and coastal environments (G7 Leaders 2015; Veiga et al. 2016; UN Environment 2017).

One of the main drivers of marine plastic pollution is the rise in single-use plastics (SUPs). In 2015, packaging alone accounted for half of all plastic waste generated, and in 2018, it was estimated that 60–95% of marine plastic pollution came from disposable items (Tekman et al. 2022). Land-based sources, especially those near coasts and rivers, are the largest contributors. Several coastal cities in the world are responsible for the plastic pollution that enters the ocean; however, various studies show that higher volumes of plastics enter the ocean from cities located in developing countries in Asia, South America and Africa (Jambeck et al. 2015; Sandu et al. 2020).

In Suriname, similarly to many other countries in the world, plastic is a major waste stream. The landfill receives approximately 195,220 cubic meters of waste per year (ABS 2020). A 2017 study found that plastic waste was the second-largest category of household solid waste in Paramaribo (16.7%) (ILACO 2022). Recycling remains minimal, with only 8–10% of plastic waste being recycled, primarily by a small number of private companies. Most plastic ends up in open dumps, is burned, or is discharged into rivers. Annual plastic litter leakage into the ocean is estimated at 1,530–10,508 tonnes (OECD 2022).

The *Prevention of Marine Litter in the Caribbean Sea* (PROMAR) is dedicated to preventing marine litter in the Caribbean Sea, facilitating local action and supporting policy to promote a circular economy for plastics, with a focus on packaging and single-use plastics. This project is funded by the German government (BMUV, the German Federal Ministry for the Environment) and implemented by Adelphi and the United Nations Environment Programme's Cartagena Convention Secretariat (CCS) from 2020 to 2026 in close collaboration with national partners in the region. The first phase of the project ran from 2020 – 2024 in Costa Rica, Colombia and the Dominican Republic and the second phase from 2024 – 2026 in the British Virgin Islands, Suriname, Guyana, Trinidad & Tobago and Saint Kitts & Nevis.

In Suriname, the project is implemented by the Green Heritage Fund Suriname (GHFS) in partnership with a political counterpart, the Ministry of Oil, Gas, and Environment, formerly known as the Ministry of Spatial Planning and Environment.

PROMAR is structured around four work packages:

- WP I: Implementing a waste stream monitoring system in collaboration with local authorities.
- WP II: Testing and replicating circular economy solutions.
- WP III: Promoting Extended Producer Responsibility and facilitating policy dialogue at both the national and regional levels
- WP IV: Raising stakeholder awareness of marine litter issues.

In an effort to establish a baseline of the litter problem, two demonstration sites were selected for a waste characterisation study. During this study, an assessment was made of the amount and type of waste at these locations as well as the potential sources and pathways of this waste. This data will be used to set up a waste stream monitoring system as well as select and implement circular economy solutions in areas linked to the demonstration sites.

Paramaribo, the capital of Suriname, has the highest population density of any district in the country and consequently generates a large volume of municipal solid waste. Due to its geographic location along the Suriname River and its direct connection to the Atlantic Ocean, the city is of particular relevance for this study. The selected demonstration site is primarily used for tourism-related activities; however, it also functions as a popular nighttime gathering spot for residents.

Methodology

Site selection

The former government partner, the Ministry of Spatial Planning and Environment, initially identified ten potential demonstration sites. Of these, five were eliminated due to budget constraints, primarily related to their distance from Paramaribo. The remaining five sites, all located in or near Paramaribo, were presented to stakeholders for feedback and additional suggestions at both the project inception meeting in September 2024 and the project launch meeting in November 2024.

Following this input, the GHFS team and local experts conducted field visits to the various sites to assess the feasibility of data collection and monitoring, based on the criteria established by Adelphi. After several rounds of consultation with local experts and the Adelphi team, two sites were selected as the most suitable demonstration locations: the area behind the Vreedzaam Market and the Leonsberg Jetty.

Leonsberg Jetty

The Leonsberg Jetty (figure 1), also known as the Ferry Terminal Leonsberg, is located in the Blauwgrond resort area in northern Paramaribo along the Suriname River (Coordinates: 5.86984, -55.09818) (Figure 3). Built in 1913 to support crossings between plantations, the jetty has evolved into a multifunctional site. Today it is used for informal ferry services, dolphin-spotting excursions, and as a gathering point for residents and tourists. Small eateries and informal seating areas around the terminal make it a popular space for both daily transport and leisure (figure 2).

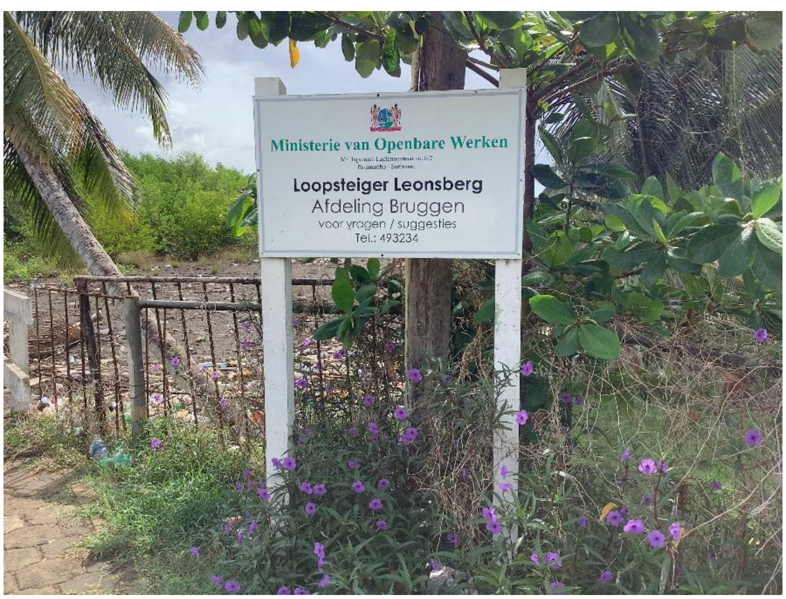

Figure 1 Entrance Leonsberg Jetty

A river protection study in 2009 recommended constructing a dyke along the left bank of the Suriname River, from Leonsberg to the Saramacca Canal, to reinforce the historic inner city (IADB

2018). This project was never implemented. In the meantime, a substantial mangrove forest has developed adjacent to the jetty, providing important ecosystem services. The mangroves stabilise the shoreline by retaining mud and sediments, while also acting as a sink for waste carried by the river. Despite its importance, the site faces several environmental and infrastructural challenges. The open area near the jetty lacks sufficient public waste infrastructure and is prone to illegal dumping. Combined with high visitor traffic and limited oversight, this has led to visible littering along the jetty and its surroundings. Waste accumulation poses risks to both public health and the river ecosystem.

Despite its social and ecological value, the jetty faces persistent waste management challenges. Plastics, food packaging, glass, and organic waste accumulate due to the lack of permanent bins, irregular collection, and informal activities. Proximity to the river allows waste to enter aquatic environments, fragmenting into microplastics that threaten ecosystems and food safety. Various community groups, NGOs, and environmental organisations have organized cleanups to remove waste and highlight the issue of pollution at the location; however, the absence of structural waste management at the site has allowed littering and illegal dumping to persist. The need for regular,

Figure 2 Leonsberg Jetty facing the road (a) and facing the Suriname river (b)

coordinated waste collection and infrastructural improvements remains critical to prevent waste from entering the river ecosystem.

Planned interventions under Suriname's 2025–2050 Sustainable Infrastructure Development Plan (Ministry of Public Works 2025) aim to strengthen riverbanks, enhance structural integrity, and improve passenger safety and accessibility. These upgrades will enable resilient waste infrastructure, increase public oversight, and support long-term litter prevention. The PROMAR waste characterisation baseline study provides critical data on waste volumes, composition, and disposal behaviours, guiding evidence-based interventions aligned with Integrated Solid Waste Management (ISWM) principles. Together, these measures support sustainable waterfront development and the protection of both public and environmental health.

Figure 3 Satellite image of Leonsberg and the study area (red dot)

Sampling methodology

On the 10th and 24th of May, and on the 7th of June, the PROMAR team carried out three cleanups (one every two weeks) and conducted daily site observations at the demonstration site. The objective of these activities was to measure the quantity, composition, and potential sources of litter. By comparing waste accumulation during daily monitoring with cleanup results, the approach provides insights into waste generation rates and probable sources.

The sampling methodology used was adapted from the *Methodological Guide for Conducting Solid Waste Sampling on Beaches* (adelphi 2025) and refined through feedback from the Adelphi team.

Timeframe of the field activity Leonsberg

Table 1 Timetable field activities study Leonsberg

Component	Duration	Details
		1st Clean-up (baseline): 10 May 2025

Waste collection, sorting, weighing / photo documentation	3 days (3 clean-ups)	2nd Clean-up (baseline) 24 May 2025 3rd Clean-up (baseline) 7 June 2025
Observations/photo documentation	28 days	Between each clean-up, an observation period of two weeks. 1st observation period: 11 May – 23 May 2025 2nd observation period: 25 May - 6 June 2025
Total Field Duration	31 days	

Site preparation

A preparatory site visit was conducted on May 5th 2025, to assess conditions and determine the layout of the study and waste characterisation areas. Due to soft mud near the mangrove forest, the endpoint was adjusted to the first medium-sized vegetation patch. It was agreed that wooden planks would be essential for navigating the muddy site safely and efficiently.

For the waste baseline survey, the monitoring area at Leonsberg Jetty was divided into zones to enhance the accuracy and representativeness of the data collected. The selected area lies on the right side of the jetty bridge, near a cluster of coconut trees, and was visibly affected by informal dumping and natural waste accumulation.

The site was divided into two zones, based on location and usage (Figure 4):

- Zone 1 (Front): Closest to the riverbank and coconut trees, with a high concentration of organic and bulky waste.
- Zone 2 (Rear): Slightly inland, flatter and partially vegetated, with scattered lightweight waste.

During the orientation, it was noted that the area was relatively dry. However, given the ongoing rainy season, the team anticipated worsening ground conditions and agreed to use the planks to avoid participants sinking into the mud. A shaded space under a tree was identified for waste characterisation. During the orientation, the waste bins on site were already full, and one large green bin had fallen over. Many of the original waste bins were missing, leaving only their metal frames. The immediate area near the pier was heavily littered, and the grass had grown tall.

Wooden planks were placed to delineate the study area and facilitate movement in the mud, while locally found sticks marked specific points within the sites. The sticks remained in place throughout the study to indicate the site boundaries. Initially, the planks were removed after the first cleanup, but following the second cleanup, they were left in the study area. Although some were displaced by water, most remained in place, saving time during subsequent cleanups.

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Table 2 Zone dimensions of study area

Sampled areas			
Name	Dimensions		
	Length (m)	Width (m)	Area (m2)
Zone 1	7.00	10.00	70.00
Zone 2	9.00	10.00	90.00
		Total	**160.00**

Figure 4 Zone 1 and 2 of the study area at Leonsberg

Cleanup procedure

Photographs were taken before and after each cleanup for documentation and comparison (Figure 4). Cleanups occurred during low tide, allowing optimal access. All visible inorganic waste was collected, while organic materials (coconuts, wooden sticks, and planks) were excluded. Large or embedded items that could not be safely removed were documented but left in place. At the end of each cleanup, the site represented a zero-waste baseline for monitoring.

Waste Sampling and Characterisation

Waste characterisation took place immediately after the cleanup. The team consisted of:

- Waste sorters: identified type, brand, and weight of items.
- Note-takers: recorded counts and data.

Sorting began once all the waste had been removed from the entire study site. Data was recorded in the Solid Waste Sampling on Beaches Data Recording and Analysis Tool. After characterisation (figure 5), waste was bagged and stored at a central collection point (figure 5), from where it was removed by the Directorate of Waste Collection and Processing (Ministry of Public Works).

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Figure 5 Waste placed at collection point at the end of the activities

During the baseline cleanup, the weather had been sunny and the study area was dry; however, the second and last cleanup happened after heavy rains, resulting in a very muddy study area with waste that was caked in mud. In order to get somewhat accurate weights, the waste was washed in the river during the second cleanup and in a large tub during the third cleanup (figure 6). This also had an impact on the weight of the waste.

Figure 6 Waste being washed in the Suriname river

Daily Monitoring (14 days)

Following the baseline cleanup and the first measurement, the demonstration site was observed for a two-week period. Every day, the site was visited to document accumulated waste and any additional activities through photographs (figure 8).

Figure 7 Picture of zone 2 taken during observation period

Data analysis

Quantitative Analysis

The total weight and volume of waste generated were calculated per category and subcategory. Statistical analysis was performed using Excel to compute:

- Waste generation rates
- Percentage composition by weight
- Estimation of waste by brand

Clean Coast Index (CCI)

The pollution levels at the site were determined using the Coastal Pollution Index (CCI: Clean Coast Index). This index is a tool used for the assessment of beach cleanliness based on the total weight of plastic waste found within a defined area. Based on the results, the area can be categorised into levels ranging from very clean to very dirty (Alkalay et al. 2007). The calculation of the index is carried out as follows:

Equation 1 Calculation of the CCI

$$CCI = \frac{total\ amount\ of\ items\ collected\ (plastic\ and\ foam)}{sampling\ area} \times K$$

Where K = 20 for interpretability.

To interpret the values assigned through the CCI, they are categorised using the following scale (figure 8):

Clean Coast Index (CCI)	**(1) Very clean** No plastic waste is observed in the coastal region	**(2) Clean** No plastic waste observed in most of the coastal region	**(3) Moderate** Some plastic waste is observed in the coastal region	**(4) Dirty** Plastic waste observed in most of the coastal region	**(5) Very dirty** Plastic waste is observed covering the coastal region
Numerical Index	0-2	2-5	5-10	10-20	20+

Figure 8 Categories CCI

Results

Waste collection

Waste was collected at the Leonsberg monitoring area during three consecutive baseline sampling rounds:

- 1st Baseline: 10 May 2025
- 2nd Baseline: 24 May 2025
- 3rd Baseline: 7 June 2025

For each round, all visible waste within Zone 1 and Zone 2 was collected, placed into labelled plastic bags corresponding to the zone of origin, and weighed in the field. After weighing, the bags were transported to the field tent, where they were sorted and categorised according to PROMAR protocols.

Table 3 Waste collected (in kg) before washing on 10-05-2025

Weights collected by area 10-05-2025	
Name	**Weight (kg)**
Zone 1	35.37
Zone 2	10.17
Total	**45.54**

Table 4 Waste collected (in kg) before washing on 24-05-2025

Weights collected by area 24-05-2025	
Name	**Weight (kg)**
Zone 1	12.45
Zone 2	23.16
Total	**35.60**

Table 5 Waste collected (in kg) before washing on 07-06-2025

Weights collected by area	
Name	**Weight (kg)**
Zone 1	3.30
Zone 2	14.05
Total	**17.35**

While a total of 45.54 kg waste had been collected during the first baseline cleanup (Table 3), during the second baseline (24 May), a total of 35.60 kg of waste had accumulated over a 14-day period (Table 4), equivalent to an average daily accumulation of 2.54 kg/day. By the third baseline (7 June), the total dropped to 17.35 kg (Table 5), corresponding to a much lower average of 0.72 kg/day.

For the first baseline (10 May), the precise duration of waste accumulation was unknown, and therefore, an average daily rate could not be calculated. However, in both later samplings, a two-week observation period was deliberately applied, providing a more reliable measure of accumulation and enabling comparisons across time.

Preliminary observations during the collections confirmed that plastics and organic matter were dominant along the riverbank. Some debris appeared to be washed in by tides, while other items had clearly been dumped directly on-site, suggesting that both land-based and waterborne inputs contribute to the waste load.

Waste separation

For each sampling round, the collected waste bags from Zone 1 and Zone 2 were emptied and separated according to the PROMAR guidelines. The collected waste was fully sorted and characterised on-site, including collection, weighing, sorting, and registration. Figure 9 shows impressions from the sorting activities. During the sorting activities, any items containing liquid were emptied, and items covered in mud were cleaned prior to weighing and categorisation.

Figure 9 Field impressions of the sorting and waste characterization process

All separation activities were conducted at the field station using plastic sheets, gloves, and standardized sorting protocols. Waste was grouped by material type, weighed, counted, and recorded for further analysis in accordance with the PROMAR-adapted BlueBox methodology.

Waste characterization

The waste characterization study at Leonsberg Jetty recorded a total of 1,770 items weighing 69.48 kg across three sampling rounds (10 May, 24 May, and 7 June 2025). The collected materials were categorized into plastics (fishing-related, consumption-related, everyday-use, and particulate), rubber, fabric, paper and cardboard, wood, metal, glass, ceramics, health and medical waste, and "other".

After weighing, the waste bags were washed in the river to remove mud and debris. This process helped ensure that items were cleaner and that excess soil did not distort the measurements. However, since the waste remained wet when weighed, the recorded weights were likely affected by water absorption, potentially resulting in a slight overestimation. The quantities and weights collected during each field activity are presented in Tables 6, 7, and 8.

Table 6 Amounts and weights of waste collected by type of material collected 10-05-2025

Summary by type of material collected 10-05-2025				
Material	**Quantity**		**Weight (gr)**	
Plastic (Fishing)	1	0.16%	67	0.17%
Pl. (Consumption)	339	55.30%	15020	37.40%
Pl. (Everyday use)	52	8.48%	9835	24.49%
Pl. Particulate	31	5.06%	394	0.98%
Rubber	9	1.47%	1380	3.44%
Fabric	1	0.16%	380	0.95%
Paper and cardboard	12	1.96%	140	0.35%
Wood	49	7.99%	0	0.00%
Metal	95	15.50%	4940	12.30%
Glass	22	3.59%	8000	19.92%
Ceramics	0	0.00%	0	0.00%
health and medical	0	0.00%	0	0.00%
Others	2	0.33%	0	0.00%
Total	**613**	**100%**	**40156**	**100%**

Table 7 Amounts and weights of waste collected by type of material collected 24-05-2025

Summary by type of material collected 24-05-2025				
Material	**Quantity**		**Weight (gr)**	
Plastic (Fishing)	0	0.00%	0	0.00%
Pl. (Consumption)	102	23.39%	1690	12.91%
Pl. (Everyday use)	63	14.45%	3560	27.19%
Pl. Particulate	95	21.79%	1310	10.00%
Rubber	1	0.23%	155	1.18%
Fabric	1	0.23%	380	2.90%
Paper and cardboard	6	1.38%	150	1.15%
Wood	119	27.29%	0	0.00%
Metal	25	5.73%	610	4.66%
Glass	22	5.05%	4690	35.82%
Ceramics	1	0.23%	260	1.99%
health and medical	1	0.23%	290	2.21%
Others	0	0.00%	0	0.00%
Total	**436**	**100%**	**13095**	**100%**

Table 8 Amounts and weights of waste collected by type of material collected 07-06-2025

Summary by type of material collected 07-06-2025				
Material	**Quantity**		**Weight (gr)**	
Plastic (Fishing)	2	0.45%	50	0.31%
Pl. (Consumption)	107	23.83%	1945	11.99%
Pl. (Everyday use)	78	17.37%	6390	39.38%
Pl. Particulate	61	13.59%	695	4.28%
Rubber	2	0.45%	170	1.05%
Fabric	2	0.45%	81	0.50%
Paper and cardboard	12	2.67%	720	4.44%
Wood	144	32.07%	1	0.01%
Metal	21	4.68%	610	3.76%
Glass	9	2.00%	4690	28.91%
Ceramics	1	0.22%	742	4.57%
health and medical	4	0.89%	77	0.47%
Others	6	1.34%	54	0.33%
Total	**449**	**100%**	**16225**	**100%**

Plastics were the most commonly found category across all three rounds, consistently making up more than half of the total waste by count (between 51% and 70%). Within this category, consumption-related plastics, such as bottles, cups, wrappers, and bags, were the most prevalent, followed by everyday-use plastics, including household packaging and containers. Plastic particulates, small fragments detached from larger pieces, were also consistently present, reflecting both the fragmentation of older debris and the persistence of secondary plastic pollution.

Glass and metals, although less frequent in number, contributed disproportionately to the total weight. For instance, glass accounted for nearly one-fifth of the total weight in May and over a third in late May, despite relatively low item counts. Wood waste, initially limited, became increasingly prominent in subsequent rounds, with undefined fragments and planks accounting for more than 30% of all items by early June. While the wood pieces at the study site were counted, they were not collected and therefore not included in the weight measurements.

Top Waste Items and Brands

The composition of the top ten waste items varied across the three sampling periods. On 10 May, beverage containers were the most prevalent waste item, with drink bottles representing 32.6% of items and aluminium cans 15%. Wood planks, disposable plastic cups, and plastic bags followed as other key contributors (Table 9). By 24 May, the composition shifted significantly: undefined wood fragments emerged as the largest group at 27.3%, while plastic bags (13.3%), loose plastic fragments (14.5%), and disposable plastic cups (11.5%) also featured strongly (Table 10). On 7 June, wood waste remained the dominant category (31.9%), followed by plastic bags (14.5%), loose plastic fragments (10.5%), and disposable plastic cups (8.7%) (Table 11). This progression shows a shift from beverage container dominance to larger-scale bulky wood debris, while plastics remained a consistent and pervasive feature throughout.

Table 9 Top 10 items collected in % on 10-05-2025

Top 10 items collected 10-05-2025		
No.	**Item**	**Quantity**
1	drink bottles	32.63%
2	aluminum cans (drinks)	15.01%
3	Wood planks	7.99%
4	disposable cups (plastic)	6.69%
5	plastic bags	4.57%
6	unidentified plastic fragments (loose)	3.59%
7	glass bottles in fragments	3.43%
8	bottle rings	3.26%
9	cigarette butts	3.26%
10	food packaging (bag type)	3.10%

Table 10 Top 10 items collected in % on 24-05-2025

Top 10 items collected 24-05-2025		
No.	**Item**	**Quantity**
1	undefined wood fragments	27.29%
2	unidentified plastic fragments (loose)	14.45%
3	plastic bags	13.30%
4	disposable cups (plastic)	11.47%
5	unidentified plastic fragments (hard)	7.34%
6	glass bottles in fragments	5.05%
7	aluminum cans (drinks)	4.59%
8	food packaging (bag type)	3.21%

9	plastic wrappers and packaging	3.21%
10	drink bottles	2.75%

Table 11 Top 10 items collected in % on 07-06-2025

Top 10 items collected 07-06-2025		
No.	**Item**	**Quantity**
1	undefined wood fragments	31.85%
2	plastic bags	14.48%
3	unidentified plastic fragments (loose)	10.47%
4	disposable cups (plastic)	8.69%
5	food packaging (bag type)	5.12%
6	drink bottles	4.90%
7	aluminum cans (drinks)	4.23%
8	unidentified plastic fragments (hard)	3.12%
9	bottle rings	1.56%
10	straws	1.56%

During the cleanup on 10 May, 305 items were found with identifiable brands, and a total of 66 brands were identified (Figure 10). On 24 May, 81 items were found with identifiable brands, and 39 brands were identified (Figure 11). During the last cleanup on 7 June, 77 items were found with identifiable brands and 34 brands were identified (Figure 12).

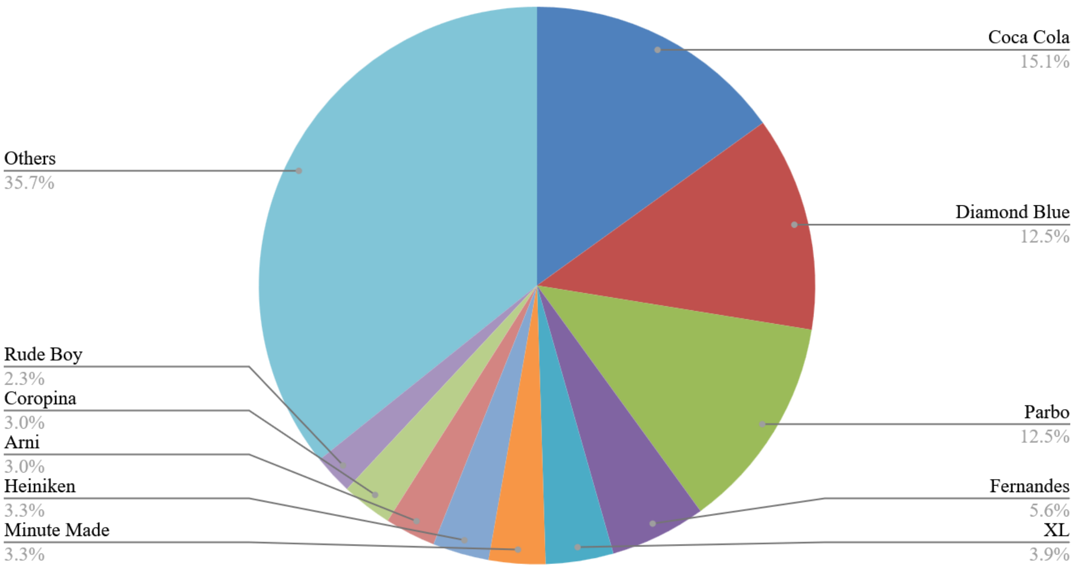

Figure 10 Top 10 Brands identified (in %) 10-05-2025

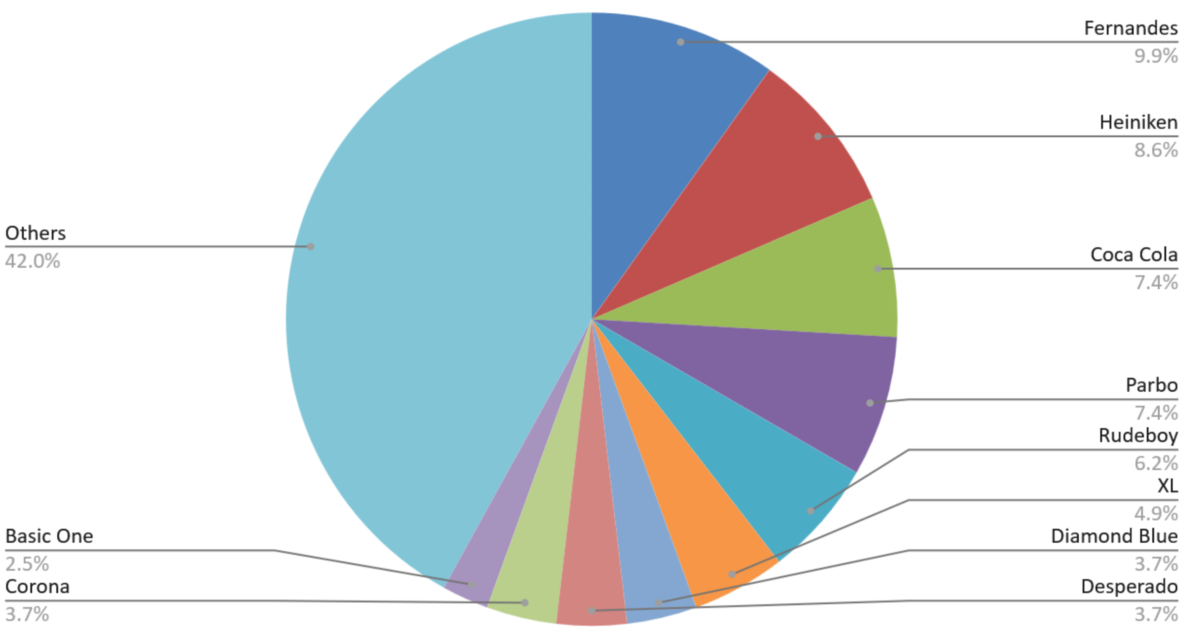

Figure 11 Top 10 Brands identified (in %) 24-05-2025

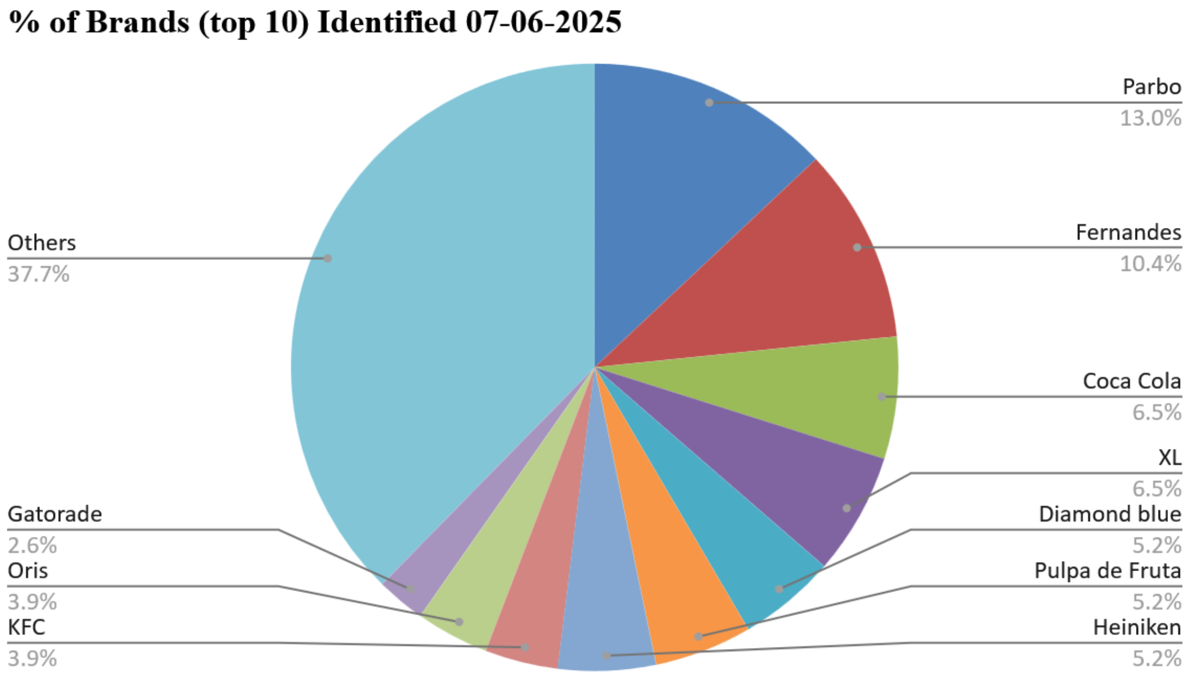

Figure 12 Top 10 Brands identified (in %) 07-06-2025

CCI

The Clean Coast Index (CCI) was used to assess the cleanliness levels of the Leonsberg monitoring area; the results are presented in Table 12.

Table 12 Assessment of cleanliness levels of the VZM monitoring area (amount of items) using CCI

	Baseline clean-up 1 **10 May 2025**	**Baseline clean-up 2** **24 May 2025**	**Baseline clean-up 3** **7 June 2025**
Measured CCI	τ ω (ρ σ σ ω ς / ρ φ π) x20	32.5 (٥ ي٨٠٤ ٨٧ ٣ / ٥ ٤ ي) x20	σ ρ (ς ρ π χχ ψ φ ρ / ρ φ π) x20
Standard CCI classification	Scale >20: **Monitoring site is very dirty**		

The monitoring area is classified as very dirty (20+). By the third clean-up, the area showed a lower Cleanliness Condition Index (CCI), indicating that the clean-up had some impact. However, cleaning alone is not enough to create a sustainable, clean demonstration site; additional interventions are necessary. The reduction in CCI could also be due to waste being moved out of the study area into nearby mangroves or river. Although fewer plastic items were collected during the third clean-up, the site remains “very dirty.” This highlights the need to continue these efforts and implement other measures to reduce the score into the “lower 10” range.

Discussion

The waste characterisation study at Leonsberg Jetty provides important insights into both the composition and dynamics of waste accumulation at this riverside location. Across three monitoring rounds, notable trends were observed in the quantity, type, and potential sources of waste. These findings highlight both localised behaviours and broader structural challenges in waste management that affect the site and, by extension, the Suriname River ecosystem. While the overall number of items and total weight decreased over time, the composition of waste showed notable shifts that reflect both site-specific dynamics and broader patterns of plastic and solid waste pollution.

Temporal Patterns in Waste Accumulation

A clear decline in total waste quantities was recorded between May and June 2025, with daily accumulation rates dropping from 2.54 kg/day to 0.72 kg/day. This reduction suggests that repeated clean-ups may have temporarily discouraged illegal dumping while also removing large waste stockpiles. Environmental factors (tidal activity, rainfall, and river currents) likely contributed to the dispersal of lighter debris such as plastics and paper. However, the decline should not be misinterpreted as a reduction in waste generation; rather, it reflects a combination of active removal and natural redistribution.

Waste Composition and Dominant Materials

Plastics were the dominant category across all samplings, representing more than half of the items collected (51–70%). Within plastics, consumption-related packaging such as bottles, cups, wrappers, and bags consistently ranked highest, underscoring their persistence in the litter stream and their role as key drivers of pollution at public waterfront spaces. Everyday-use plastics, including household packaging and containers, also contributed significantly, while particulates highlighted the ongoing fragmentation of plastics already present in the environment. These results align with regional findings that identify single-use plastics as a critical driver of marine and riverine pollution.

Glass and metal, although lower in frequency, made up a disproportionate share of total weight. Glass bottles in particular accounted for nearly 20–36% of the total mass in the first two rounds. This highlights the heavy, non-biodegradable burden posed by beverage packaging, which can persist in the environment for decades if unmanaged. Metal cans showed a similar but smaller pattern, reflecting habitual disposal of drinks on-site.

Wood waste became increasingly prominent by June, with undefined fragments and planks accounting for more than 30% of items. This shift suggests episodic dumping of bulky materials, possibly linked to construction, boat maintenance, or fishing activities.

Brands and Item-level Trends

The analysis of branded waste provides further insight. Coca-Cola, Diamond Blue, Parbo, Fernandes, and Heineken were repeatedly identified, pointing to both local and international beverage companies as significant contributors to the waste stream. However, the overall proportion of branded items declined significantly after the first round, with unbranded materials increasing from 50% to more than 80%. This suggests two important dynamics: first, that visible beverage packaging is only a fraction of the total waste problem, and second, that unbranded or degraded plastics, difficult to trace back to producers, make up the bulk of environmental litter. These findings reinforce the need for interventions that go beyond brand accountability to include systemic improvements in local waste collection and disposal.

The waste profile shifted over time. Early collections were dominated by beverage packaging, drink bottles and aluminium cans, reflecting on-site recreational and transport-related consumption. By June, bulky wood and unbranded plastics overtook beverage containers. This transition highlights the fluidity of local dumping practices and the influence of seasonal or activity-based patterns. However, further research is needed to better assess this. Plastics, meanwhile, remained constant throughout, reflecting their pervasive and persistent nature.

Clean Coast Index (CCI) Results

The Clean Coast Index provided a quantitative measure of the site's overall cleanliness. All three rounds classified the site as "very dirty" (CCI values above 20). While the score showed some decline by the third clean-up, indicating a positive effect of repeated waste removal, the classification did not improve beyond the "very dirty" threshold. This suggests that although clean-ups can temporarily reduce visible waste, the site remains heavily polluted due to continuous inputs and redistribution by natural forces.

The persistence of a "very dirty" status, despite significant weight reductions between May and June, highlights a critical issue: lightweight plastics remain abundant even after larger items (e.g., glass and wood) are reduced. This underscores the resilience of plastics in the environment and their disproportionate impact on coastal cleanliness ratings. The CCI, therefore, complements the item-level analysis by showing that plastics are not only numerically dominant but also the main driver of poor environmental quality at the site.

Site-specific observations

The site's proximity to the Suriname River makes it highly vulnerable to both direct dumping and inflows of waste transported by tides and rainfall. Observations confirmed that informal disposal by visitors and ferry users is a major source of pollution, compounded by the absence of permanent bins and irregular waste collection services. Once in the environment, lightweight plastics fragment into microplastics, adding long-term ecological risks.

The site's proximity to the Suriname River and daily use by visitors, ferrymen, and informal vendors make it highly vulnerable to both direct dumping and tide-driven inflows. Absence of permanent waste bins and irregular collection services exacerbate litter accumulation, while plastic debris further fragments into microplastics, creating long-term ecological risks.

While the study provides a comprehensive baseline, several methodological limitations should be noted. Daily site observations lacked standardised protocols, making temporal comparisons less precise. Bulky wood was counted but not weighed, leading to potential underestimation of total mass. Degradation of branded packaging limited identification in later rounds. Despite these challenges, the study establishes clear patterns of material prevalence, temporal accumulation, and key sources, providing important insights for future monitoring and interventions.

Conclusion

This baseline report presents an in-depth assessment of the Leonsberg Jetty monitoring site, carried out as part of the PROMAR project's efforts to reduce land-based plastic leakage into marine environments. The methodology applied included three structured clean-up and waste characterisation sessions, interspersed with two-week observation periods, enabling both quantitative and qualitative insights into local pollution dynamics.

The monitoring area, located adjacent to the Suriname River, is subject to daily public use, informal waste disposal. A total of 69.48 kg of solid waste was collected and analysed across the three baseline activities. The waste types most commonly found were plastic packaging, organic matter, and foam food containers, with a notable presence of branded litter from beverage and snack companies.

The Clean Coast Index (CCI) values for all three sampling rounds categorised the site as "Very Dirty", with scores consistently exceeding the threshold of 20. The persistent presence of lightweight plastic items underscores an ongoing pollution risk.

Observations between sampling sessions revealed that waste reaccumulated quickly, especially after rainfall events. The absence of permanent bins and formal waste collection infrastructure contributes to this recurring issue.

The study faced limitations, such as the absence of standardised observation protocols and difficulty in brand identification due to degraded packaging. Despite these challenges, the data collected provides a clear picture: Leonsberg Jetty is a hotspot for land-based marine litter and in need of targeted interventions.

The Leonsberg Jetty baseline study establishes a foundation for action. It highlights the urgency of integrated solid waste management solutions and reinforces the need for circular economy practices in waterfront public spaces. Moving forward, continuous monitoring and multi-stakeholder engagement will be vital to ensure sustainable change and to protect Suriname's coastal and marine ecosystems from further plastic pollution.

Recommendations

For future repetitions of this study, clear guidelines and instructions should be provided to observers to ensure consistent and comparable data collection. Waste sorters and note-takers should also receive in-depth training beforehand, focusing on:

- Accurate classification of waste types within each category.
- The importance of systematically recording brand information.

Future studies may also benefit from incorporating environmental data (rainfall, tides, river flow), microplastic quantification, and detailed human activity records to further contextualize litter dynamics.

A structured waste management system should be designed and implemented for Leonsberg Jetty. Waste management interventions at the site should include additional general and recycling bins, scheduled waste collection, and targeted awareness campaigns for visitors, ferrymen, and other frequent users. Government authorities should assume a more active role in maintaining site cleanliness, including infrastructure provision and regular monitoring. Integration of these measures with national and regional marine litter strategies under the PROMAR project will contribute to both local environmental quality and broader marine litter reduction objectives. The findings of this study and the subsequent recommendations have direct implications for national and regional policy frameworks under the PROMAR project. Addressing the waste management challenges at the Leonsberg Jetty not only improves local hygiene and aesthetics but also contributes to the broader goals of marine litter reduction and the promotion of a circular economy in Suriname.

In conclusion, the Leonsberg Jetty baseline study confirms that the site is a hotspot for land-based marine litter. Plastics, glass, metal, and wood are the most prevalent materials, with plastics posing the greatest long-term environmental threat. While clean-ups temporarily reduce waste, structural interventions, continuous monitoring, and multi-stakeholder engagement are essential to achieve sustainable improvements and protect the Suriname River ecosystem from ongoing pollution.

The findings of this study and the subsequent recommendations have direct implications for national and regional policy frameworks under the PROMAR project. Addressing the waste management challenges at Leonsberg Jetty not only improves local hygiene and aesthetics but also contributes to the broader goals of marine litter reduction and the promotion of a circular economy in Suriname, namely:

Integration into Municipal Waste Policy
The establishment of an effective waste management system for Leonsberg Jetty aligns with Suriname's municipal waste management strategies.

Support for Circular Economy Initiatives
Improved collection of recyclables from Leonsberg Jetty supports PROMAR's objective of fostering circular economy practices by diverting plastics and other materials from landfills.

Capacity Development and Public Awareness
Awareness campaigns tied to tourism development could position waste management as a central component of urban development, encouraging responsible behavior among residents and visitors.

Contribution to Regional and International Goals
By strengthening waste monitoring and management at the demonstration sites, Suriname can provide valuable data and case studies for regional cooperation under the Cartagena Convention

and global frameworks such as the UN Sustainable Development Goal 14 (Life Below Water). These activities directly contribute to PROMAR's regional objectives of reducing plastic leakage into the Caribbean Sea and advancing Extended Producer Responsibility (EPR) models.

Reference list

ABS. 2020. *9th Environment Statistics Publication*. No. 9. Environment Statistics Publication, no. 9. General Bureau of Statistics (ABS).

adelphi. 2025. "Beach Data Sampling | Promar.Org." PROMAR. https://promar.org/en/beach-data-sampling.

Alkalay, Ronen, Galia Pasternak, and Alon Zask. 2007. "Clean-Coast Index—A New Approach for Beach Cleanliness Assessment." *Ocean & Coastal Management* 50 (5–6): 5–6. https://doi.org/10.1016/j.ocecoaman.2006.10.002.

Beaumont, Nicola J., Margrethe Aanesen, Melanie C. Austen, et al. 2019. "Global Ecological, Social and Economic Impacts of Marine Plastic." *Marine Pollution Bulletin* 142 (May): 189–95. https://doi.org/10.1016/j.marpolbul.2019.03.022.

G7 Leaders. 2015. "G7 Leaders' Declaration G7 Summit 7-8 June 2015." June. https://sustainabledevelopment.un.org/content/documents/7320LEADERS%20STATEMENT_FINAL_CLEAN.pdf.

Hartley, Bonny L., Sabine Pahl, Joana Veiga, et al. 2018. "Exploring Public Views on Marine Litter in Europe: Perceived Causes, Consequences and Pathways to Change." *Marine Pollution Bulletin* 133 (August): 945–55. https://doi.org/10.1016/j.marpolbul.2018.05.061.

IADB. 2018. *Urban Investments for the Resilience of Paramaribo: Building Adaptive Capacity of Paramaribo Communities to Climate Change Related Floods and Sea Level Rise through Strategic Urban Planning and Sustainable Infrastructure Investments*. AFB/PPRC 23/13. Suriname. https://www.adaptation-fund.org/wp-content/uploads/2018/10/AFB.PPRC_.23.13-Proposal-for-Suriname.pdf?utm_source=chatgpt.com.

ILACO. 2022. *Preparation of an Integrated Waste Management Plan (IWMP) for Suriname*. Suriname.

Jambeck, Jenna R., Roland Geyer, Chris Wilcox, et al. 2015. "Plastic Waste Inputs from Land into the Ocean." *Science* 347 (6223): 6223. https://doi.org/10.1126/science.1260352.

Ministry of Public Works. 2025. "Sustainable Infrastructure Development Plan Suriname 2050." April. https://gov.sr/wp-content/uploads/2025/05/@-Magazine-Vision-MIN-OW-SIDPS-2025-2050.pdf.

OECD. 2022. *Global Plastics Outlook: Economic Drivers, Environmental Impacts and Policy Options*. OECD. https://doi.org/10.1787/de747aef-en.

Sandu, Cristina, Emoke Takacs, Giuseppe Suaria, et al. 2020. "Society Role in the Reduction of Plastic Pollution." In *Plastics in the Aquatic Environment - Part II*, edited by Friederike Stock, Georg Reifferscheid, Nicole Brennholt, and Evgeniia Kostianaia, vol. 112. The

Handbook of Environmental Chemistry. Springer International Publishing. https://doi.org/10.1007/698_2020_483.

Tekman, Mine B., Bruno A. Walther, Corina Peter, Lars Gutow, and Melanie Bergmann. 2022. *Impacts of Plastic Pollution in the Oceans on Marine Species, Biodiversity and Ecosystems*. Zenodo. https://doi.org/10.5281/ZENODO.5898684.

UN Environment. 2017. *Marine Litter Socio Economic Study*. United Nations Environment Programme. https://wedocs.unep.org/20.500.11822/26014.

UNIDO. 2019. *Addressing the Challenge of Marine Plastic Litter Using Circular Economy Methods*. Working paper. Practices (KAP) on marine littering. https://www.unido.org/sites/default/files/files/2019-06/UNIDO_Addressing_the_challenge_of_Marine_Plastic_Litter_Using_Circular_Economy.pdf.

Veiga, Joana M., Thomais Vlachogianni, Sabine Pahl, et al. 2016. “Enhancing Public Awareness and Promoting Co-Responsibility for Marine Litter in Europe: The Challenge of MARLISCO.” *Marine Pollution Bulletin* 102 (2): 2. https://doi.org/10.1016/j.marpolbul.2016.01.031.