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Sandec Department of Sanitation, Water and Solid Waste for Development

Applying the Waste Flow Diagram Regionally

Introduction

The Waste Flow Diagram (WFD) is a practical tool designed to assess plastic leakage in solid waste management systems. While originally developed for city-level use, it can be adapted to regional scales — such as provinces, states, counties, or groups of municipalities. This guide suggests how to apply the WFD at a regional level to generate actionable insights that support planning, infrastructure investment, and targeted policy interventions.

Two primary approaches were tested for the regional application of the WFD: the sum method and the weighted method. While both methods offer useful perspectives, other approaches may also warrant consideration depending on the context. The sum method was found to be preferable in most situations, as it is more transparent and precise.

Data Requirements and Sources

WFD assessments always combine secondary data and field observations. For a regional application, inputs should be disaggregated by administrative subunit level whenever possible. Essential subunit level information includes:

- Number of inhabitants and waste generation per person
- Waste composition, especially plastics
- Waste collection coverage and disposal practices
- Informal and formal recyclables recovery rates
- Field-based observations of plastics in the environment (plastic fates) and in the stages of the waste management system (plastic leakage) by sub-unit

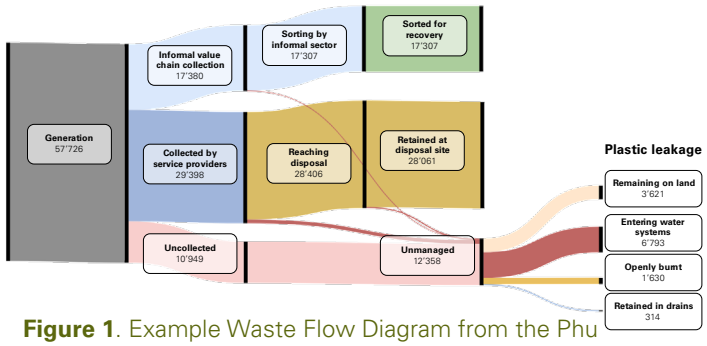

Figure 1. Example Waste Flow Diagram from the Phu Yen Province, Vietnam. Plastic flows in [ton/year]
9.4 kg/person/year are leaking to the aquatic environment

Key Takeaway: Our study found that the sum method is more precise than the weighted method for a regional WFD. This is because a WFD is created for each administrative subunit and the results aggregated into the regional overview.

Recommended

Option 1: Sum Method

When using the Sum Method, one WFD is applied separately to each administrative subunit (e.g. municipalities, counties or districts). Individual WFD results are then aggregated (summed) to provide a regional overview (see **Figure 1** for an example). This approach is suitable when subunit-level data is available or can be estimated with reasonable confidence. The advantage of using this approach is:

- The spatial granularity and level of detail in the set of data is maintained.
- Leakage hotspots in the area being assessed can be easily identified.

Option 2: Weighted Method

In the Weighted Method, a single WFD is done for the entire region. Each input to the WFD is calculated using weighted averages of waste generation, waste collection, and/or disposal volumes across subunits. The drawbacks of this approach include:

- This method requires data to be computed before input into the WFD, which increases the overall complexity.
- By "pre-processing" data, the single WFD obscures sub- regional differences and, thus, reduces level of detail in the results.

However, this method can be appropriate when:

- No administrative subunit data is available, AND
- Only a high-level indicative regional overview of plastic leakage is required.

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Practical Guidance

1. Planning the Field Observations

- Divide the region into administrative subunits (e.g. counties, municipalities, towns, etc.)
- Select at least 40 observation points per subunit; adjust the number of points per subunit based on the area size and its estimated heterogeneity
- Use stratified sampling across urban, peri-urban, and rural zones
- Ensure that critical infrastructure (e.g. disposal sites and drainage hotspots) will be assessed through observations
- Record the GPS coordinates of the observations based on the WFD leakage potentials and fates evaluation

2. What to Observe

Each observation point should assess:

- The presence of plastic waste in the streets, drains, and public areas, and the collection infrastructure (bins, frequency of service, etc.)
- Open dumping or evidence of burning
- Proximity to water bodies
- Visual signs of informal recycling or waste picking activities
- Waste accumulation near disposal sites or roadsides

While travelling to the specific observation points, ensure that you also gather a general impression of the subunit through observation. Additionally, keep track of the solid waste management infrastructure and vehicles that you see during travels to obtain a more accurate evaluation of the WFD leakage potential.

3. Conducting the System Assessment

After completing field visits and observations in a subunit:

- Assess the leakage potential of each stage: uncollected waste, collection, transport, sorting, and disposal
- Assign fate distributions to leaked waste: land retention, open burning, drain retention, or entry into aquatic systems
- Always use WFD's scoring definitions to maintain consistency

4. Data Processing

- Input results into the WFD tool for each subunit (sum method) or compute weighted averages (weighted method)
- Combine observation-based data with data on population, collection coverage, waste generation, composition, recovery, and disposal volumes
- Review all assumptions and adjust for known uncertainties where needed
- Compile all WFDs (sum method) into a unique regional WFD by summing the results, while accounting for the magnitude of each subunit's contribution.

References

Dorian Tosi Robinson, Thao Thanh Le, Huong Thi Thuy Ngo, Thu-Huong Thi Hoang, Christian Zurbrügg, Thi Hanh Tien Nguyen, 'Regional land-based plastic leakage into the aquatic environment – Waste Flow Diagram applied to the Phu Yen province, Vietnam', Marine Pollution Bulletin, 217 (2025), 118058, ISSN 0025-326X, Available at: https://www.dora.lib4ri.ch/eawag/islandora/object/eawag:34683

RWM Global, 'Waste Flow Diagram Platform', [web page] (2025) <https://wfd.rwm.global>, accessed 27 August 2025.

Quality Assurance

- Train all field teams on leakage potential and fate definitions as per WFD methodology
- Use example photos or trial runs to calibrate observer ratings
- Practice assessments with all field teams so that the results correspond with each other and to limit personal interpretation of given situations
- Document all estimation methods and deviations from standard protocols

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