



Zero Waste Index-Based Waste Management Planning for a Government Office: A Case Study of DLHK D.I. Yogyakarta

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Article Info	Abstract
Article history: Received 25 February 2024 Revised 21 April 2024 Accepted 30 May 2024 Published 12 June 2024	Background: Effective waste management at the source is essential to reduce waste generation and minimize waste disposal in landfills. The Zero Waste Index (ZWI) provides an approach for evaluating waste reduction and resource recovery. Aims: This study aimed to develop a waste management plan for the office area of the Department of Environment and Forestry of the Special Region of Yogyakarta (DLHK D.I. Yogyakarta) using the Zero Waste Index approach. Methods: Waste generation and composition were measured based on SNI 19-3964-1994. The waste generation rate, composition, Zero Waste Index, substituted energy, and area required for the temporary waste storage facility (TPS) were determined. A residual plastic waste substitution program using plastic-based paving blocks was also proposed and projected over two years. Result & Conclusion: The average waste generation was 22.52 kg/day, with garden organic waste as the dominant component (13.85 kg/day). Waste generation was 0.06 kg/person/day, with a volume of 1.1 L/person/day. The waste composition consisted of 61.4% organic waste, 24.4% mixed residual waste, 9.4% paper, 2.3% recyclable plastic, and 2.3% glass. The initial ZWI was 49%, with 39.28 MJ of substituted energy, while the required TPS area was 39 m ² . A two-year projection with the proposed plastic waste substitution program increased the ZWI to 66%, with substituted energy reaching 99.54 MJ. The results indicate that the proposed waste management plan can improve waste recovery and reduce waste disposal.
Keywords: Waste management planning, Waste generation, Zero Waste Index.	
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1. Introduction

Solid waste is a major environmental issue, particularly when it is not properly managed, as improper waste management can contribute to environmental degradation and increase pressure on public infrastructure and environmental services (Song *et al.*, 2015; Abdel-Shafy & Mansour, 2018). Municipal solid waste generally consists of organic and inorganic materials generated from domestic, commercial, and other human activities. Waste generation and composition data are important for determining the appropriate waste management system, including in office areas, where waste streams may consist of organic waste, paper and cardboard, plastic, glass, metal, and other residual materials (Karak *et al.*, 2012; Laura *et al.*, 2023). In Indonesia, SNI 19-3964-1994 provides guidelines for sampling and measuring municipal solid waste generation and composition as a basis for determining waste generation and composition in an area and

supporting waste management planning (Raharjo *et al.*, 2018; Rochimawati *et al.*, 2025; Sembiring *et al.*, 2026).

Waste management is also closely related to environmental conditions and human behavior. Appropriate waste handling is expected to support environmental quality, public health, and healthy living conditions (Setyowati & Mulasari, 2013). Office buildings are sources of commercial and institutional waste and generally generate municipal-type waste fractions, including paper, organic waste, plastics, packaging, and residual waste. Therefore, waste generated from office activities requires appropriate source-based management, particularly in government institutions with environmental management responsibilities (Ali *et al.*, 2018; Salsabila *et al.*, 2025).

The zero waste concept is an approach to waste management that emphasizes waste reduction at the source and minimizes the amount of waste disposed of in landfills (Song *et al.*, 2015; Sundana *et al.*, 2021). Implementing zero waste requires appropriate performance indicators to evaluate the effectiveness of waste reduction and resource recovery. One such approach is the Zero Waste Index (ZWI), which measures waste management performance based on the extent to which recovered waste can substitute the use of virgin materials and conserve energy and other resources (Zaman & Lehmann, 2013; Zaman, 2014). Therefore, the ZWI can provide a broader assessment of waste management performance beyond simply measuring the amount of waste diverted from landfills.

Effective waste management planning requires reliable data on waste generation, composition, and recovery potential, as these variables determine appropriate waste handling strategies and suitable recovery pathways (Gallardo *et al.*, 2016; Yulianto *et al.*, 2026). Detailed waste characterization supports decisions on source segregation, collection, processing, recycling, and final disposal by identifying the proportions of recoverable, recyclable, and residual waste fractions (Bisinella *et al.*, 2017). In Indonesia, SNI 3242:2008 provides a reference for waste management planning, including operational techniques, service arrangements, financing, and institutional management (Priyana *et al.*, 2024). Thus, integrating waste characterization with the Zero Waste Index provides a basis for developing waste management strategies that emphasize resource recovery and waste reduction.

The office area of the Department of Environment and Forestry of the Special Region of Yogyakarta (DLHK D.I. Yogyakarta) generates waste from various daily administrative and institutional activities. In the context of sustainable waste management in Yogyakarta, improving waste management requires consideration of waste generation, composition, recovery potential, and existing management practices (Fitriana *et al.*, 2025). However, site-specific information on these aspects is needed to develop an appropriate waste management strategy for the DLHK D.I. Yogyakarta office area. Therefore, a waste management plan based on actual waste characteristics and resource recovery potential is required to support waste reduction and minimize waste sent to final disposal facilities, while source-based waste management can also contribute to more efficient and sustainable waste management (Zhang *et al.*, 2024).

Based on these considerations, this study aimed to analyze waste generation and composition and develop a waste management plan for the DLHK D.I. Yogyakarta office area using the Zero Waste Index approach. The study also evaluated the potential for resource recovery and energy substitution as a basis for developing a waste management strategy and projecting improvements in zero waste performance.

2. Material and Method

2.1 Data Collection

Data were collected through direct observation and waste sampling in the office area of the Department of Environment and Forestry of the Special Region of Yogyakarta (DLHK D.I. Yogyakarta). Waste sampling was conducted for eight consecutive days following SNI 19-3964-1994 concerning the methods for sampling and measuring municipal solid waste generation and composition. The collected data included waste generation, waste composition, and information on existing waste management practices in the study area. The data were subsequently analyzed using the Zero Waste Index (ZWI) approach proposed by Zaman (2014), while waste management planning referred to SNI 3242:2008.

2.2 Waste Generation

Waste generation was measured for eight consecutive days to determine the quantity of waste generated in the DLHK D.I. Yogyakarta office area. Waste generation was expressed in terms of weight and volume per person per day. Waste generation by weight and volume was calculated using Equations (1) and (2), respectively.

$$\text{Waste generation by weight} = \frac{\text{Average total waste weight (Kg)}}{\text{Total number of employees}} \quad (1)$$

$$\text{Waste generation by volume} = \frac{\text{Average total waste volume (Liter)}}{\text{Total number of employees}} \quad (2)$$

The results were expressed as kg/person/day and L/person/day, respectively.

2.3 Waste Composition

Waste composition was determined based on SNI 19-3964-1994 and expressed as the percentage of wet weight. The collected waste was classified according to its material type, including organic waste, recyclable materials, and residual waste. The composition of each waste fraction was determined based on both weight and volume. Waste composition by weight and volume was calculated using Equations (3) and (4), respectively.

$$\text{Waste composition by weight (\%)} = \frac{\text{Average total waste weight}}{\text{Average total waste weight}} \times 100\% \quad (3)$$

$$\text{Waste composition by volume (\%)} = \frac{\text{Average total waste volume}}{\text{Average total waste volume}} \times 100\% \quad (4)$$

2.4 Waste Collection Planning

Waste collection planning was conducted based on the quantity and composition of waste generated in the DLHK D.I. Yogyakarta office area. The waste was classified into three main categories, namely recyclable waste, organic waste, and residual waste. The required collection frequency for each waste category was determined based on the amount of waste generated and the available storage capacity. The collection frequency for recyclable, organic, and residual waste was calculated using Equation (5)-(7). The collection frequency was expressed as times (×).

$$\text{Collection frequency of recyclable waste} = \frac{\text{Volume of recyclable waste (L)}}{\text{Volume of waste collection container (L)}} \quad (5)$$

$$\text{Collection frequency of organic waste} = \frac{\text{Volume of organic waste (L)}}{\text{Volume of waste collection container (L)}} \quad (6)$$

$$\text{Collection frequency of residual waste} = \frac{\text{Volume of residual waste (L)}}{\text{Volume of waste collection container (L)}} \quad (7)$$

2.5 Zero Waste Index

The performance of waste management in the DLHK D.I. Yogyakarta office area was evaluated using the Zero Waste Index (ZWI) approach proposed by Zaman (2014). The ZWI measures waste management performance based on the amount of waste managed through recovery processes and the extent to which recovered materials substitute virgin materials. The ZWI was calculated using the equation (8) as follows:

$$\text{Zero Waste Index} = \frac{\sum_{i=1}^n \text{WMS}_i \times \text{SF}_i}{\sum_{i=1}^n \text{GWS}} \quad (8)$$

where WMS_i is the amount of waste managed through recovery process i , SF_i is the substitution factor for recovery process i , and GWS is the total amount of waste generated. The substitution factors used in the ZWI calculation were adopted from Zaman (2014), as presented in Table 1.

Table 1. Resource Substitution Values by Waste Management System

Waste Management Systems	Waste Category	Virgin Material Substitutions Efficiency (tonnes)	Energy Substitutions Efficiency (GJ LHV/tonne)	GHG Emissions Reduction (Tonne/CO ₂ e)	Water Saving (kL/tonne)
Recycling	Paper	0.84–1.00	6.33–10.76	0.60–3.20	2.91
	Glass	0.90–1.00	6.07–6.85	0.18–0.62	2.30

	Metal	0.79–0.96	36.09–191.42	1.40–17.8	5.97–81.77
	Plastic	0.90–0.97	38.81–64.08	0.95–1.88	–11.37
	Mixed	0.25–0.45	5.00–15.00	1.15	2.0–10
Composting	Organic	0.60–0.65	0.18–0.47	0.25–0.75	0.44
Landfill	Mixed MW	0.00	0.00–0.84	(–)0.42–1.2	0

2.6. Waste Management Strategy Planning

Waste management strategy planning was developed based on the results of waste generation and composition analysis, waste recovery potential, and ZWI calculation. The planning was designed to support waste reduction at the source, increase resource recovery, and minimize the amount of waste transported to final disposal facilities.

Waste generated from office activities was temporarily collected at a temporary storage facility (TPS). Based on SNI 3242:2008 concerning waste management in settlements, TPS facilities are classified into three types, namely Type I, Type II, and Type III. Considering the characteristics and requirements of the study area, a Type I TPS was considered suitable for the proposed waste management system. The proposed facility consists of a sorting area, storage area, waste transfer area equipped with a container platform, and a land area of approximately 10–50 m².

The proposed waste management strategy was formulated based on the characteristics of the waste generated in the study area, with emphasis on source separation, recovery of recyclable materials, management of organic waste, and appropriate handling of residual waste. The strategy also considered the potential substitution of residual plastic waste through the production of plastic-based paving blocks as an alternative waste reduction measure.

3. Results and Discussion

3.1. Study Area and Existing Waste Management

The DLHK D.I. Yogyakarta office area accommodates 423 employees and covers approximately 5,328 m², consisting of eight permanent office buildings, six semi-permanent office buildings, and one permanent security post. Waste is generated mainly from office activities and three canteens. Office activities commonly generate paper, plastic bottles, packaging materials, and food-related waste with recovery potential ([Albanna, 2013](#); [Rodríguez-Guerreiro et al., 2024](#)).

Waste containers are provided outside the office buildings, as containers are not available inside the offices. Waste is collected from 07:00 until completion and transported to the janitor room for temporary handling and sorting. Recyclable materials with potential economic value are partially separated, while the remaining waste is transported to the waste depot in Bachiro, Yogyakarta City, recorded by the depot operator, and subsequently transported to the final disposal facility. This flow is consistent with waste management systems involving containment, collection, transfer, and sorting ([Zhang et al., 2022](#)).

The waste identified in the study area was classified into recyclable, landfill/residual, and compostable waste, with specific materials presented in Table 2. The recyclable fraction included plastic, paper, glass, and metal, while the residual fraction consisted mainly of mixed paper, food packaging, plastic packaging, duplex waste, tissue, styrofoam, and other non-recoverable materials ([Albanna, 2013](#); [Al-Shatnawi et al., 2022](#)). Organic waste consisted of plant and food waste.

Table 2. Waste Generated in the DLHK D.I. Yogyakarta Office Area

Waste Management Category	Waste Type	Waste Material
Recycle	Plastic	Plastic cups, plastic bottles
	Paper	Duplex, wrapping paper, cardboard
	Glass	Lamps, glass/bottles
	Metal	Iron, cans
Landfill	Mixed	Residual wrapping paper, residual food paper, residual plastic packaging, residual duplex, residual tissue, styrofoam
Compost	Organic	Plant waste, food waste

Although recyclable materials are partially recovered, sorting is not yet comprehensive. Improved source separation, routine collection, and downstream recovery such as composting and waste-bank utilization are therefore needed (Rodríguez-Guerreiro *et al.*, 2024). The remaining mixed waste is transported to an external depot before final disposal, indicating the need for improved residual-waste handling within an integrated waste management system.

3.2. Waste Generation and Composition

Waste generation by weight was measured for eight consecutive days following SNI 19-3964-1994. As shown in Figure 1, the daily waste generation ranged from 17.67 to 27.29 kg/day, with the highest generation recorded on the first sampling day and the lowest on the sixth day. Based on the total waste generated and the number of employees, the average waste generation was 0.06 kg/person/day.

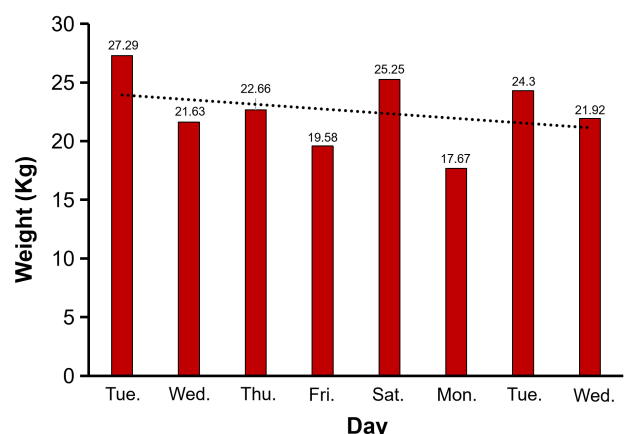


Figure 1. Daily waste generation by weight during the eight-day sampling period at the DLHK D.I. Yogyakarta office

Based on its recovery potential, the waste was subsequently classified into recyclable, compostable, and residual waste. As shown in Figure 2, compostable waste represented the largest fraction (62%), followed by residual waste (24%) and recyclable waste (14%). The high proportion of compostable waste indicates that organic waste is the dominant fraction and provides considerable potential for biological treatment (Fernández-González *et al.*, 2020). Similar dominance of organic waste has been reported in institutional and office-related waste streams (Speier *et al.*, 2019; Laura *et al.*, 2023).

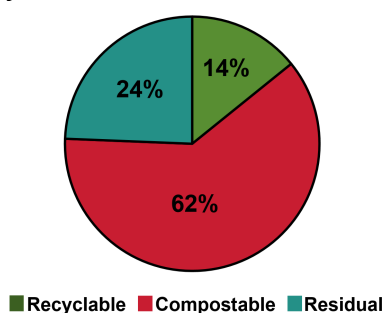


Figure 2. Waste composition based on recovery potential at the DLHK D.I. Yogyakarta office

The recyclable fraction, although smaller than the compostable fraction, represents an opportunity for material recovery (Aleisa & Al-Jarallah, 2024). Paper and plastic are commonly generated from office activities and can be recovered through source separation (Al-Khatib *et al.*, 2023). Meanwhile, the residual fraction of 24% indicates that a substantial proportion of waste still requires disposal, highlighting the importance of improving source separation and recovery practices (Wang *et al.*, 2021).

Waste generation by volume was measured for eight consecutive days following SNI 19-3964-1994 and expressed in liters per day. The measurement was conducted using a 20 cm × 20 cm × 100 cm measuring device equipped with a height scale. As shown in Figure 3, the daily waste volume ranged from 375.6 to 558.8 L/day, with the highest volume recorded on the first sampling day (558.8 L/day) and the lowest on the sixth sampling day (375.6 L/day). Based on the average total waste volume and the number of employees, the average waste generation was 1.1 L/person/day.

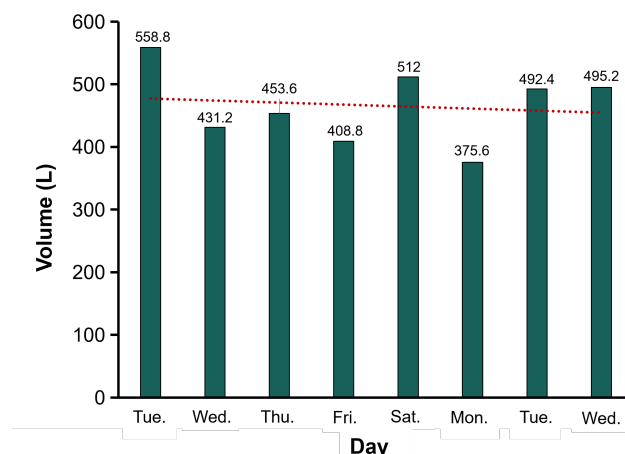


Figure 3. Daily waste generation by volume during the eight-day sampling period at the DLHK D.I. Yogyakarta office

During the eight-day sampling period, waste composition was classified into recyclable, waste for disposal, and compostable waste based on the Zero Waste Index categories (Zaman, 2014). The detailed composition by material type is presented in Figure 4.

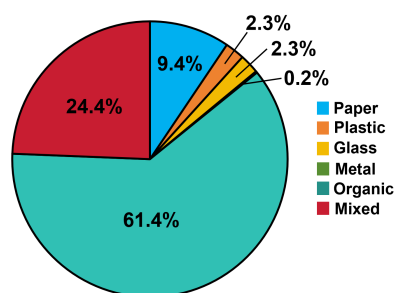


Figure 4. Waste composition during the eight-day sampling period at the DLHK D.I. Yogyakarta office

Organic waste was the dominant fraction, accounting for 61.4% of the total waste, followed by mixed waste (24.4%), paper (9.4%), plastic (2.3%), glass (2.3%), and metal (0.2%). Based on the Zero Waste Index classification, the waste comprised 61.4% compostable, 24.4% waste for disposal, and 14.2% recyclable waste. The dominance of organic waste indicates a considerable potential for composting, while the recyclable fraction provides an opportunity for material recovery. In contrast, the relatively high proportion of mixed waste indicates that a substantial portion of the generated waste still requires disposal, highlighting the need for improved source separation and recovery practices (Al-Khatib et al., 2023).

3.3 Zero Waste Index

The Zero Waste Index (ZWI) evaluates the extent to which generated waste can be recovered through recycling and composting, including the potential substitution of virgin materials, energy savings, greenhouse gas emission reduction, and water savings (Zaman & Lehmann, 2013; Zaman, 2014). In this study, waste was classified into recyclable, compostable, and waste for disposal according to the ZWI framework.

Based on the proposed waste management scenario, which projects improvements over the next two years through better source separation and diversion of food waste from the mixed fraction to composting, the calculated ZWI reached 66% (Table 3). This indicates that a substantial proportion of the generated waste could be recovered through the proposed management system, while the remaining fraction would still require disposal (Zaman & Lehmann, 2013).

Table 3. Zero Waste Index and resource substitution values

Location	Waste Management	Waste Composition	Total Waste Managed (kg)	Potential Virgin Material Substitution (kg)	Energy Substituted (MJ)	Total GHG Emission Reduction (CO ₂ /kg)	Total Water Saving (L/kg)	ZWI
Office of the Department of Environment and Forestry of the Special Region of Yogyakarta	Recycle	Paper	6.92	5.81	43.79	4.15	20.13	0.66
		Plastic	1.29	1.16	50.23	1.23	-14.72	
		Glass	0.38	0.34	2.29	0.07	0.87	
		Metal	0.03	0.02	1.09	0.04	0.18	
	Compost	Organic	11.90	7.14	2.14	2.97	5.24	
	Landfill	Mixed	1.28	0.00	0.00	-0.54	0.00	
	Total		21.80	14.48	99.54	7.93	11.70	

The projected waste management system resulted in a total energy substitution of 99.54 MJ. Plastic contributed the largest share of energy substitution (50.23 MJ), followed by paper (43.79 MJ), glass (2.29 MJ), organic waste (2.14 MJ), and metal (1.09 MJ). The results indicate that improving the recovery of recyclable materials, particularly plastic and paper, can substantially increase resource recovery and contribute to improved waste management performance (Lipp *et al.*, 2025).

3.4 Waste Management Strategy

Waste management planning was developed based on SNI 3242:2008, with emphasis on waste separation at the source, implementation of the 3R principles, and appropriate handling of residual waste (Zhang *et al.*, 2022). The proposed system includes waste containment and collection, an integrated temporary storage facility (TPS), organic waste processing, recyclable waste storage, and residual waste management.

Based on the average waste volume of 465.95 L/day and a container capacity of 50 L, the proposed system requires 9 sets of waste containers, consisting of separate containers for recyclable, organic, and residual waste (Zhang *et al.*, 2022; Rodríguez-Guerreiro *et al.*, 2024). The distribution of containers is presented in Table 4.

Table 4. Waste Containment Planning at the DLHK D.I. Yogyakarta Office

Waste type	Total waste volume (L/day)	Average total waste	Waste bin volume (L)	Number of permanent buildings	Proposed containers
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		volume (L/day)			
Recyclable	153.65				
Organic	250.70	465.95	50	8	9
Residual	61.60				

Waste transportation to the TPS was planned based on the daily waste volume and collection capacity. Waste collection and transportation are important components of municipal solid waste management and require appropriate planning to improve operational efficiency (Santos Neto *et al.*, 2024). Based on the average daily waste volume, the required number of carts with a capacity of 120 L was 4 units (Table 5).

Table 5. Waste Transportation Planning at the DLHK D.I. Yogyakarta Office

Waste type	Total waste volume (L/day)	Average total waste volume (L/day)	Cart volume (L)	Number of permanent buildings	Total requirement
Recyclable	153.65				
Organic	250.70	465.95	120	8	4
Residual	61.60				

An integrated TPS was then proposed based on SNI 3242:2008. Among the three TPS classifications (Types I, II, and III), Type I was considered appropriate for the study area. The proposed facility includes a sorting area, storage area, waste transfer area with a container platform, and additional areas for organic waste processing, waste size reduction, and residual waste management. A similar approach was reported by Fidela *et al.* (2020) in the design of the Cipapais TPS, which incorporated waste sorting, organic waste processing, and waste transfer facilities in accordance with SNI 3242:2008.

The waste receiving and sorting area was estimated at approximately 1 m², while the shredding area required approximately 2.92 m², rounded to 3 m². Organic waste was planned to be processed using open-windrow composting with bamboo aerators. Based on a projected composting volume of 7.52 m³/month, four bamboo aerators were required, resulting in a composting area of approximately 11 m². A planned space of 3 m × 3.7 m was considered sufficient for the composting activity and movement space.

Following sorting and processing, recyclable and compostable materials were planned to be temporarily stored before further utilization or sale. Based on the projected monthly waste volume and a compaction factor of 50%, the required storage areas were 1.80 m² for organic waste and 1.12 m² for inorganic waste, as presented in Table 6.

Table 6. Waste Storage Area Planning at the DLHK D.I. Yogyakarta Office

Source	Volume Period 1 Bulan (m³)	Compaction Factor	Compacted Residue	Dimensions of Storage Room (m)	Room Area (m²)
Organic	7.50	50%	3.76	1.5 × 1.1 × 1.1	1.80
Inorganic	1.85	50%	2.07	1.5 × 0.9 × 0.9	1.12

The supporting facilities include an office, equipment storage, and sanitation facilities. The existing 4 m × 3 m building can be utilized as an office for seven sanitation workers, while sanitation and equipment storage areas were planned at 2 m × 1.5 m and 2 m × 3 m, respectively. The total supporting area was approximately 39 m², and the proposed TPS layout is presented in Figure 5.

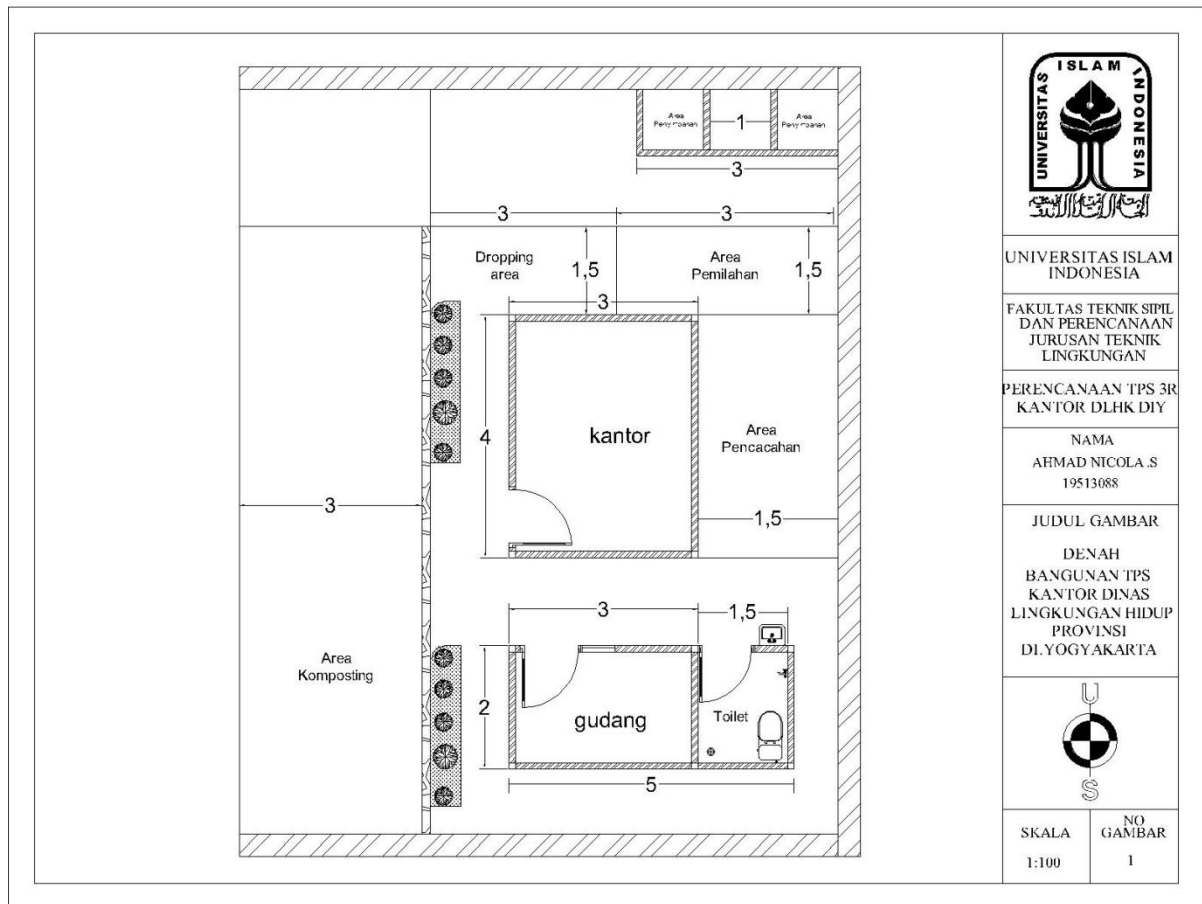


Figure 5. Proposed integrated TPS layout at the DLHK D.I. Yogyakarta office

Residual plastic waste was proposed to be utilized as a material for plastic-based paving blocks to reduce the amount of waste requiring disposal and increase residual waste recovery. Based on the overall planning, the estimated investment cost was IDR 65,333,500, covering waste containers, transportation equipment, shredding equipment, and facilities supporting organic waste processing. The proposed system was designed according to the projected waste recovery scenario corresponding to a ZWI of 66%.

4. Conclusion

The study found that the DLHK D.I. Yogyakarta office generated an average of 22.54 kg of waste per day, with organic waste being the dominant fraction (61.4%), followed by mixed waste (24.4%), paper (9.4%), plastic (2.3%), glass (2.3%), and metal (0.2%). Based on the proposed waste management scenario, the Zero Waste Index (ZWI) reached 0.66 (66%), with a total energy substitution of 99.54 MJ.

The results indicate that improved source separation and waste recovery are essential to reduce the residual waste fraction. The proposed waste management system, including recycling, composting, and residual waste processing, provides an opportunity to increase waste recovery and reduce the amount of waste requiring disposal.

5. References

- Abdel-Shafy, H. I., & Mansour, M. S. M. (2018). Solid waste issue: Sources, composition, disposal, recycling, and valorization. *Egyptian Journal of Petroleum*, 27, 1275-1290. <https://doi.org/10.1016/j.ejpe.2018.07.003>
- Albanna, M. (2013). Anaerobic digestion of the organic fraction of municipal solid waste. In A. Malik, E. Grohmann, & M. Alves (Eds.), *Management of Microbial Resources in the Environment*. Springer, Dordrecht. https://doi.org/10.1007/978-94-007-5931-2_12
- Aleisa, E., & Al-Jarallah, R. (2024). Characterization of municipal solid waste in Kuwait: Sector-specific composition analysis and implications. *Journal of the Air & Waste Management Association*, 74(9), 623–638. <https://doi.org/10.1080/10962247.2024.237810>
- Ali, M., Hadi, S. P., & Soemantri, M. (2018). Utilization of information technology for non domestic waste management in Semarang City. *E3S Web of Conferences*, 31, 09014. <https://doi.org/10.1051/e3sconf/20183109014>
- Al-Khatib, I. A., Guo, J., Kuchta, K., Draid, A. A., Abu Amara, S. Y., & Allassali, A. (2023). Municipal solid waste composition and generation with emphasis on plastics in Nablus City, Palestine. *Sustainability*, 15, 14640. <https://doi.org/10.3390/su151914640>
- Al-Shatnawi, Z., Alnusairat, S., & Kakani, A. (2020). Towards zero solid waste in Jordanian universities: The case of Al-Ahliyya Amman University. *Journal of Environmental Research, Engineering and Management*, 76(4), 46–59. <https://doi.org/10.5755/j01.erem.76.4.27369>
- Bisinella, V., Götze, R., Conradsen, K., Damgaard, A., Christensen, T. H., & Astrup, T. F. (2017). Importance of waste composition for life cycle assessment of waste management solutions. *Journal of Cleaner Production*, 164, 1180–1191. <https://doi.org/10.1016/j.jclepro.2017.07.013>
- Fernández-González, J. M., Díaz-López, C., Martín-Pascual, J., & Zamorano, M. (2020). Recycling organic fraction of municipal solid waste: Systematic literature review and bibliometric analysis of research trends. *Sustainability*, 12, 4798. <https://doi.org/10.3390/su12114798>
- Fidela, A., Putra, H., Chairunnisa, N., Raihani, F., Lubis, F. A. S., Kandyas, M. A., Larasaty, Risma Amelia, & Ganda, G. R. (2020). Perancangan TPS Cipapais sebagai sarana pengelolaan sampah di Kelurahan Kadumerak, Kecamatan Karang Tanjung, Kabupaten Pandeglang. *Jurnal Pusat Inovasi Masyarakat*, 2(4), 540–548.
- Fitriana, K. N., Suranto, Akalili, A., Wulansari, N. L. T., & Agustinova, D. E. (2025). Policy innovations for sustainable waste management in Yogyakarta City. *IOP Conference Series: Earth and Environmental Science*, 1556(1), 012083. <https://doi.org/10.1088/1755-1315/1556/1/012083>
- Gallardo, A., Edo-Alcón, N., Carlos, M., & Renau, M. (2016). The determination of waste generation and composition as an essential tool to improve the waste management plan of a university. *Waste Management*, 53, 3–11. <https://doi.org/10.1016/j.wasman.2016.04.013>
- Karak, T., Bhagat, R. M., & Bhattacharyya, P. (2012). Municipal solid waste generation, composition, and management: The world scenario. *Critical Reviews in Environmental Science and Technology*, 42(15), 1509-1630. <https://doi.org/10.1080/10643389.2011.569871>
- Laura, W., Galih, I., & Lovena, A. (2023). Potential of reduction solid waste from office building (Case study: Gedung Polda Jambi). *Berkala Sainstek*, 11(3), 145–152. <https://doi.org/10.19184/bst.v11i3.36679>
- Lipp, A.-M., Blasenbauer, D., Stipanovic, H., Koinig, G., Tischberger-Aldrian, A., & Lederer, J. (2025). Technical evaluation and recycling potential of polyolefin and paper separation in mixed waste material recovery facilities. *Recycling*, 10, 176. <https://doi.org/10.3390/recycling10050176>
- Prianata, D., Sudyana, I. N., & Sutrisno, H. (2024). Waste management in subsidized housing in Palangka Raya City based on SNI 3242:2008. *Science in the Tropics*, 1(1), 19–27. <https://doi.org/10.62090/r2zkz579>
- Raharjo, S., Ruslinda, Y., Bachtar, V. S., Regia, R. A., Fadhil, M., Rachman, I., & Matsumoto, T. (2018). Investigation on municipal solid waste characteristics from commercial sources and their

- recycling potential in Padang City, Indonesia. *IOP Conference Series: Materials Science and Engineering*, 288(1), 012134. <https://doi.org/10.1088/1757-899X/288/1/012134>
- Rochimawati, N. R., Yuwono, A. S., Jayanegara, A., & Sintawardani, N. (2025). Exploring waste generation and composition in Bogor Municipality, Indonesia. *IOP Conference Series: Earth and Environmental Science*, 1557, 012015. <https://doi.org/10.1088/1755-1315/1557/1/012015>
- Rodríguez-Guerreiro, M.-J., Torrijos, V., & Soto, M. (2024). A review of waste management in higher education institutions: The road to zero waste and sustainability. *Environments*, 11, 293. <https://doi.org/10.3390/environments11120293>
- Salsabila, T. H., Akbar, A. A., & Jati, D. R. (2025). Analisis potensi nilai ekonomi sampah dari aktivitas perkantoran di Kota Pontianak. *Jurnal Teknologi Lingkungan Lahan Basah*, 13(1), 180-188. <https://doi.org/10.26418/jtlb.v13i1.89856>
- Santos Neto, A. B. P., Simões, C. L., & Simoes, R. (2024). Optimization of municipal solid waste collection system: Systematic review with bibliometric literature analysis. *Journal of Material Cycles and Waste Management*, 26, 1906–1917. <https://doi.org/10.1007/s10163-024-01966-y>
- Sembiring, E., Ramadan, A. H., & Farid, M. (2026). Implications of shorter sampling durations on the analysis of municipal solid waste generation and composition. *Journal of Material Cycles and Waste Management*, 28, 133-140. <https://doi.org/10.1007/s10163-025-02401-6>
- Setyowati, R., & Mulasari, S. A. (2013). Pengetahuan dan perilaku ibu rumah tangga dalam pengelolaan sampah plastik. *Kesmas: Jurnal Kesehatan Masyarakat Nasional*, 7(12), 562. <https://doi.org/10.21109/kesmas.v7i12.331>
- Song, Q., Li, J., & Zeng, X. (2015). Minimizing the increasing solid waste through zero waste strategy. *Journal of Cleaner Production*, 104, 199-210. <https://doi.org/10.1016/j.jclepro.2014.08.027>
- Speier, C. J., Nair, R. R., Mondal, M. M., & Weichgrebe, D. (2019). Multi-sector evaluation of generation, composition and sustainable treatment systems for commercial waste streams in India. *Journal of Material Cycles and Waste Management*, 21, 1155–1166. <https://doi.org/10.1007/s10163-019-00869-7>
- Sundana, E. J., Sutadian, A. D., & Juwana, I. (2021). Conceptual framework for the development of West Java Zero Waste Management Index. *IOP Conference Series: Earth and Environmental Science*, 794, 012050. <https://doi.org/10.1088/1755-1315/794/1/012050>
- Wang, Y., Shi, Y., Zhou, J., Zhao, J., Maraseni, T., & Qian, G. (2021). Implementation effect of municipal solid waste mandatory sorting policy in Shanghai. *Journal of Environmental Management*, 298, 113512. <https://doi.org/10.1016/j.jenvman.2021.113512>
- Yulianto, K. A. N. (2026). The role of waste generation and composition data in advancing circular economy strategies in Indonesia. *International Journal of Educational Research & Social Sciences*, 7(1), 57–72. <https://doi.org/10.51601/ijersc.v7i1.1031>
- Zaman, A. U. (2014). Measuring waste management performance using the 'Zero Waste Index': The case of Adelaide, Australia. *Journal of Cleaner Production*, 66, 407–419. <https://doi.org/10.1016/j.jclepro.2013.10.032>
- Zaman, A. U., & Lehmann, S. (2013). The zero waste index: A performance measurement tool for waste management systems in a 'zero waste city'. *Journal of Cleaner Production*, 50, 123–132. <https://doi.org/10.1016/j.jclepro.2012.11.041>
- Zhang, L., Li, H., Hu, T., Du, X., Zhou, Y., Sun, G., & Liu, J. (2024). The reduction of the carbon footprint of municipal solid waste management via source classification and supporting strategies: An analysis for the megacity of Shenzhen. *Waste Management*, 187, 145–155. <https://doi.org/10.1016/j.wasman.2024.07.012>
- Zhang, X., Liu, C., Chen, Y., Zheng, G., & Chen, Y. (2022). Source separation, transportation, pretreatment, and valorization of municipal solid waste: A critical review. *Environment, Development and Sustainability*, 24, 11471–11513. <https://doi.org/10.1007/s10668-021-01932-w>