

Filling the Gap: Opportunities to Maximize Efficacy of Waste Management Systems in Labuan Bajo, Indonesia

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Commissioned by Ocean Conservancy

Prepared by Marine Change

in Partnership with the Coordinating Ministry
of Maritime Affairs of the Republic of Indonesia



**Addressing
Marine Plastics**
A Systemic Approach



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1 INTRODUCTION

On behalf of the Indonesian Government's Coordinating Ministry for Maritime Affairs (CMMA), Ocean Conservancy commissioned Marine Change to:

- conduct a rapid assessment of the waste management systems currently in place in Labuan Bajo;
- provide cost estimates for improved waste management;
- propose an operational model for the PDU (*pusat daur ulang* – “recycling center”) newly constructed by CMMA
- propose a revenue collection framework for the local government to fund the costs of an improved waste management system

The waste management system we propose to be applied in Labuan Bajo leverages private sector engagement to operate the PDU and provides monetary incentives to producers of waste (i.e. Labuan Bajo residents, hotels, schools, hospitals, etc.) to sort their waste and facilitate recycling.

2 METHODOLOGY AND LIMITATIONS

The study followed an introductory meeting with CMMA in Jakarta (27 June 2018) and preparatory written conversations within a multi-stakeholder group via social media created by CMMA. This information was complemented by a site visit (30 July – 04 August 2018) as well as desk research of the existing World Wildlife Fund – Indonesia (WWF) waste management roadmap, documents and information provided by local and central governments (tourism, public works, and environment sections), and web-based research.

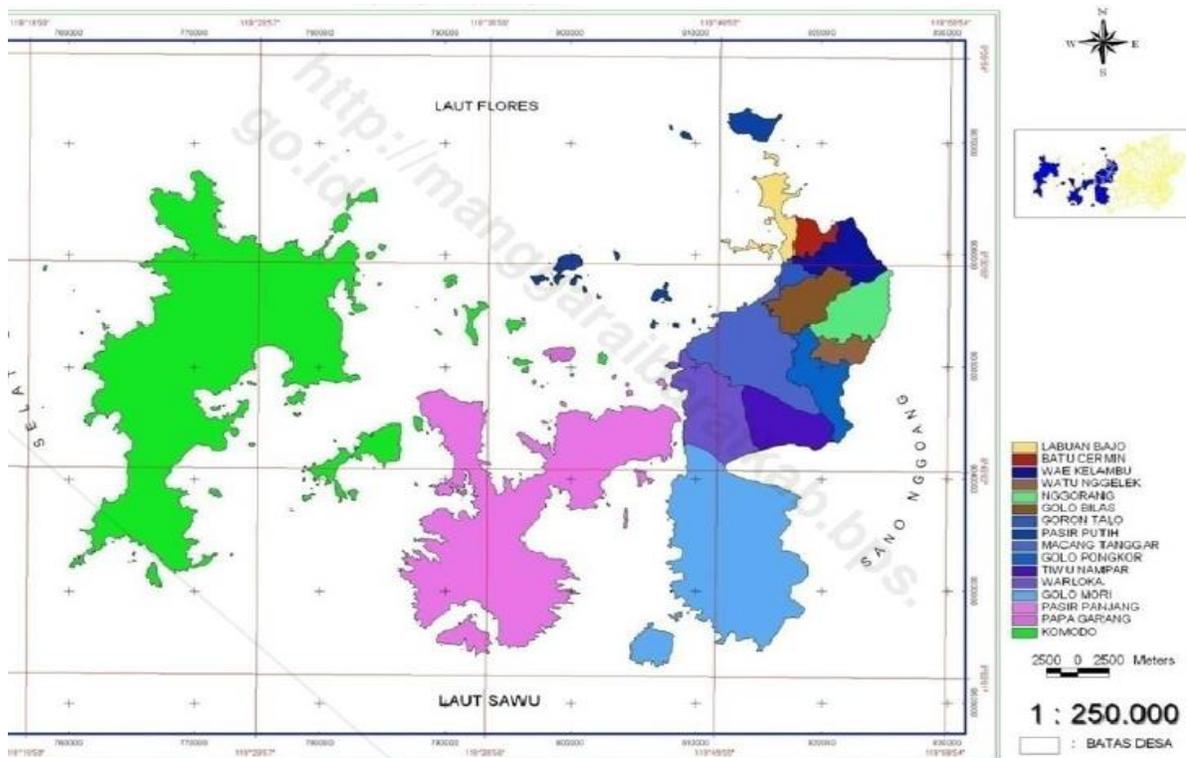
The intention initially was to rely on waste production and composition data presented in the WWF waste management roadmap. However, due to its small data set, the researchers sought alternative sources of robust data from elsewhere in Indonesia as the primary assumptions for the operational model included in the appendix.

3 CURRENT WASTE COLLECTION AND FACILITIES

As its reputation has grown among international travelers and its designation as one of the “10 new Balis” by the Government of Indonesia, Labuan Bajo has seen a significant increase in visitors over the last five years, with strong growth expected over the next several years. The local government is already struggling with collecting the additional waste associated with the influx of tourists. As visitor numbers continue to climb, this problem will only get worse without intervention, jeopardizing Komodo National Park's pristine reputation. The goal of this project is to assess the current waste management capacity and recommend ways to ensure the sustainability of the newly created waste management strategy.

Administrative Structure. The Komodo sub-district consists of administrative areas belonging to Komodo National Park (KNP) management¹ and the District Environmental Authority (DLH) for waste management services. DLH oversees areas which can be served with sea-based collection² and areas which need to be served with land-based collection (see figure below).³ This study provides cost modeling for the most densely populated areas of the latter, namely Labuan Bajo, Batu Cermin, Wae Kelambu, and Gorontalo. The model also includes the actual costs incurred by KNP to collect recyclable waste within their area of responsibility. The latest government data indicates a population of 25,798 within the DLH coverage area and 5,179 within the KNP coverage area.

Figure 1: Villages in Komodo Sub-district



¹ Komodo Island, Papa Garang, and Pasir Panjang

² Pasir Putih and some islands of Labuan Bajo as well as some islands of Golo Mori

³ Labuan Bajo, Batu Cermin, Wae Kelambu, Watu Ngelek, Nggorang, Golo Bilas, Goron Talo, Macang Tanggar, Golo Pongkor, Tiwu Nampar, Warloka, Golo Mori

Current collection. There are no reliable figures regarding the number of households and businesses currently served in Labuan Bajo, nor are there reliable figures regarding mass or volume currently collected. Estimates can be made based on data available from elsewhere in Indonesia, but this is a critical data point for accurate costing.

Material generated. As currently many households and businesses are without waste collection, waste often is burnt by open fire and/or gets dumped in the environment. Any damage to health and the environment arising from these practices is currently not accounted for (i.e. delayed effect on health cost). The costing exercise will account for a system where an increasing proportion of waste is collected and hence no burning or dumping will be necessary.

Available facilities for material flow management. In 2017, with support by WWF, a waste bank was established (KSU Sampah Komodo/KSK) aiming at trading recyclables from households and businesses to the recycling center in Surabaya. The center has not been successful. Reasons include lack of access to a reliable buyer and lack of paying clients. The center works on a donation-based model, where a donation is paid against pick up service of the recyclable waste. Feedback showed that a full waste stream solution would be preferred.

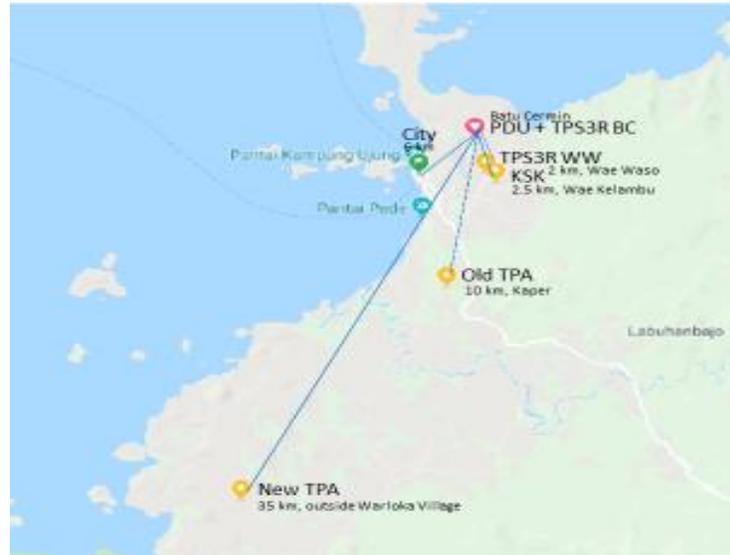
Facilities and distances in the material flow system to be costed. Labuan Bajo's future material flow management includes a sorting, storing and processing center (PDU) in Batu Cermin, the objective of which is to reduce the waste going to the landfill by extracting recyclable materials. The PDU is currently under construction and is scheduled begin operations in early 2019.

Figure 2: View from inside PDU under construction



Nearby, there is a storage room of an underutilized TPS3R (*tempat pengelolaan sampah reduce, reuse, dan recycle* – translated to English as “intermediate waste aggregation site with recycling capability”) in Batu Cermin (BC) which can be used as additional space of approximately 750 cubic meters. There is also a TPS3R in Wae Waso (WW) with storage capacity of about 1,000-1,500 cubic meters.

Figure 3: Facilities for material flow and waste management in Komodo Sub-district



Routing of current waste disposal. The old TPA (*tempat pembuangan akhir* – translated to English as “landfill”) is essentially an open dump site and is overcapacity, with open burning taking place to reduce volume.

Figure 4: Old TPA



Routing of new waste disposal. The new TPA is relatively far outside the city center, approximately 25-35 kilometers from the PDU depending on the construction of a new road. It has been designed to operate as a controlled landfill.

Figure 5: New TPA



4 PROPOSED WASTE MANAGEMENT DESIGN

Waste segregation and collection

Collection bins for segregated organic and non-organic waste already exist in Labuan Bajo city. The key is changing behavior so that burning is minimized and segregation at source actually takes place. While educational campaigns regarding sortation would be welcome, buying sorted waste (i.e. a waste bank model) would be direct incentive to change behavior.

Under the proposed model, the PDU will function like a standard manufacturing business: pay for raw materials, input labor and technology, and sell a value-added product for a profit. To secure raw material, the PDU would provide waste pick-up services for recyclable materials and accept drop offs, paying the waste producer in each instance for their segregated recyclables. The value-added products would in most cases be bales of sorted and/or compressed recyclables, such as plastic and paper. However, given the high cost of transport, it may be more economical to locally produce recycled goods – examples could include moorings for recreational vessels (which would reduce the need for anchors and protect shallow reefs) or cool boxes for local fishermen.

The local government would continue to be responsible for organic and residual waste, improving collection while using the same transport and disposal infrastructure currently in place. All waste collected by local government will go directly to the newly built TPA outside of Labuan Bajo. To further incentivize waste segregation, the local government could institute a “no

sorting, no pick-up” policy, in which only sorted waste is accepted – this policy has been implemented in Java and in multiple municipalities in the Philippines⁴ with apparent success.

We propose utilizing the local government unit of “RT” (translated to English as “neighborhood”) to provide additional social pressure and the infrastructure for proper waste disposal by Labuan Bajo residents. Each RT has a designated head already in place to manage local issues on behalf of government. Elsewhere in Indonesia, in Jakarta for example, waste management is organized at the RT level: residents pay a fee to the RT head who in turn pays the waste collector.

We propose placing a large waste bin/dumpster in each RT, acting as a mini-TPS (intermediate waste aggregation site). The area of each RT may be small enough that residents could take their waste to each bin and avoid the cost of collection by household. The bins for organic and residual waste would be provided as a free service by the government, while recyclables would be collected and paid for at each RT by the PDU operator. Each RT head would be paid a fee by government (in addition to their current compensation) to ensure that residents dispose of their waste in the bin rather than burning or littering. The RT heads could also assist the PDU operator when aggregating recyclable waste for purchase. Once the bins are full, the RT heads would also be responsible for notifying the relevant parties for pick up and disposal at landfill. The fee for the RT heads could be structured as payment for performance, with bonuses available for exemplary implementation.

To undergird the RT system, the local government should develop a penalty system for anyone caught illegally dumping or open burning. Signage should be displayed in key locations and each RT should have a general meeting to make goals and expectations clear going forward.

Assuming 40 households per RT and a cost of US\$1,200 per dumpster⁵, the total capital expenditure for this system would be approximately US\$400,000.

Government revenues

As Collection of recyclables by the private sector is expected to reduce the incidence of waste burning, as would more regular collection services by the government for organic and residual waste. Improved waste collection by the government is enabled by improved revenue collection. To that end, a simplified and practical system of retributions is proposed. The current retributions system is complicated, and it is unknown how much (if any) government revenue is generated.

We propose reducing the retribution categories from 45 to approximately 12 and focus on collecting revenues from businesses already accustomed to paying tax and that have a vested interest in proper waste management due to its impact on tourism: hotels, restaurants, dive shops, boat operators, and the airport operator (plus hospitals, as they produce large amounts of waste).

⁴ <https://www.npr.org/series/684530164/the-plastic-tide>

⁵ <http://www.sentraindustry.com/2015/01/container-sampah-lapis-fiber.html>

Figure 6: Current retribution system

Category	Price (IDR)	Price (~USD)	Unit
Housing	6,000	0.40	Per family per month
Kiosk	10,000	0.66	Per month
Food shop (Warung)	50,000	3.50	Per month
Shop	50,000	3.50	Per month
Small scale retail	50,000	3.50	Per month
Medium scale retail	100,000	7.00	Per month
Large scale retail	200,000	14.00	Per month
Homestay	40,000	3.00	Per month
Warehouse/factory	40,000	3.00	Per month
Small scale warehouse	50,000	3.50	Per month
Medium scale warehouse	100,000	7.00	Per month
Large scale warehouse	200,000	14.00	Per month
Industry/entertainment places	150,000	10.00	Per month
Restaurants:			
Small restaurant	60,000	4.00	Per month
Medium restaurant	100,000	7.00	Per month
Large restaurant	150,000	10.00	Per month
BUMN/BUMD (Public company)	150,000	10.00	Per month
Restaurant + lodge	80,000	6.00	Per month
"Melati" level hotel	70,000	5.00	Per month
Star hotels:			
1-star hotels	150,000	10.00	Per month
2-star hotels	250,000	17.00	Per month
3-star hotels	350,000	24.00	Per month
4-star hotels	500,000	35.00	Per month
5-star hotels	600,000	42.00	Per month
"Lopo-lopo" (translation unknown)	50,000	3.50	Per month
Shop-house	100,000	7.00	Per month
Informal seller	1,000	0.07	Per person per day
Harbormaster	300,000	21.00	Per month
ASDP port	150,000	10.00	Per month
Komodo airport	600,000	42.00	Per month
Air Nav	600,000	42.00	Per month
Dive operator	150,000	10.00	Per month
Vessel 1 - 7 GT	50,000	3.50	Per month
Commercial vessels:			
Cargo vessel	200,000	14.00	Per month
Cruise ship	400,000	28.00	Per month
Passenger ship:			

Ferry	150,000	10.00	Per month
KM Tilong kabila	400,000	28.00	Per month
KM Binaiya	250,000	17.00	Per month
KM Wilis	250,000	17.00	Per month
KM Sirimau	250,000	17.00	Per month
Reparation shop	75,000	5.00	Per month

Source: Coordinating Ministry for Maritime Affairs

The current retribution model mandates a levy for hotels based solely on star ratings. We propose a per-room retribution to account for both star rating (more expensive hotels tend to produce more waste per guest and likely have a greater ability to pay) and hotel size.

Figure 7: Proposed retribution system

Category	Price (IDR)	Unit	Current number
Budget hotel/hostel*	10,000	Per room per month	580 rooms
1-star hotel*	10,000	Per room per month	276 rooms
2-star hotel*	10,000	Per room per month	251 rooms
3-star hotel*	10,000	Per room per month	62 rooms
4-star hotel*	15,000	Per room per month	427 rooms
5-star hotel*	20,000	Per room per month	215 rooms
Airport	27,000	Per flight	365 flights/month
Hospital	200,000	Per month	4 hospitals
Restaurant	200,000	Per month	61 restaurants
Dive operator	200,000	Per month	32 shops
Boat operator	200,000	Per month	50 boats

*minimum IDR 200,000 per hotel

The proposed retributions paid by hotels, hospitals, restaurants, dive shops and boat operators are based on the IDR 200,000 paid by the establishments that participated in WWF's (mostly non-operational) waste bank. The proposed airport retribution per flight is based on a target of IDR 1 million per month. As the above categories all require business licenses, penalties could be applied for non-compliance.

These proposed retributions will be augmented with a proposed additional "environmental fee" of approximately IDR 10,000 (USD 0.65) per room per night. This fee will likely be charged as a percentage of spend, but for the purposes of the cost/revenue model we determined that an average fee near this level would be sufficient. In practice, hotels would be responsible for collecting this fee from guests.

Tourists and tourism-related businesses are targeted to bear the majority of the retributions/fees paid for waste management due to their ability and willingness to pay for a pollution-free holiday experience, and because per capita tourism waste is much higher than Labuan Bajo residential waste.

The proposed environmental fee is very low for foreign tourists, especially compared to the overall costs of a holiday in Labuan Bajo/Komodo National Park. However, proposing a higher fee that would cover all waste management costs is not recommended for two reasons. First, we believe it is important that local businesses become accustomed to paying for collection of their waste. Second, paying for waste collection gives businesses a clear signal to defray their retribution costs by selling their recyclables to the PDU operator. This is common practice for hotels in other parts of Indonesia.

A star rating system for waste management could be piloted for tourism-related businesses, giving eco-conscious visitors the opportunity to support responsible actors, and publicly identifying those that need to improve. If successful, this could be rolled out as a nationwide program.

Once revenues are collected, budget allocation will be equally important. Local regulations that ensure retribution and income is devoted to waste management must be introduced. Transparency and accountability will also be key considerations.

PDU operations

Once recyclables reach the PDU facility, they will be sorted (depending on the buyer) and processed. Based on our research, value addition at the PDU should likely entail no more than sortation, compression, and bailing of recyclables, and not include washing or shredding. There are two reasons for this. First, the PDU is not equipped to handle the contaminated waste water that would result from on-site washing (nor is the PDU equipped with a water connection, though according to the Coordinating Ministry this will be installed). Second, even if the required equipment were in place, some recyclers in Surabaya reportedly do not want washed and shredded raw material, preferring to process the materials in-house.

It is assumed that the PDU operator will be responsible for the purchase and maintenance of trucks and other equipment (such as ventilated bulk bags for weighing recyclables) required to transport recyclables to the facility. The operator would have access to the land, buildings, and machinery purchased or constructed by the government.

The price at which the PDU operator would purchase recyclable materials will depend on the sale price in Surabaya and the costs of operating the PDU. As Labuan Bajo is a relatively small city likely lacking the need for multiple PDUs, we expect a profit margin mutually agreed upon by the operator and government rather than set by a market mechanism. This is the business model of the Misool waste bank in West Papua province, which has operated successfully for five years.

While this report is agnostic regarding which entities are qualified to manage the PDU and its collections, the operator would benefit greatly from having a commercial background in waste management, sufficient available capital and connections with recyclers in Surabaya. Surabaya's recycling sector is informal and relationship-driven, with very opaque pricing schemes for the purchase of raw material. Thus, for example, it could be beneficial that the PDU operator be an extension of a recycling company. To attract private actors to manage the PDU, the local government could offer tax incentives.

TPA operations

Once organic and residual wastes reach the TPA, a key to extending the life of the landfill and ensuring it remains controlled is to compost the organic waste. There is no market for compost, especially contaminated compost, so this is simply a cost-saving exercise. Composting can reduce the volume of organic waste by 10 to 20 times, and the resulting material can then be used to cover the residual waste for a controlled or sanitary landfill.

Alternatively, composting could be done at the TPS3R/PDU level as this would reduce transportation costs to the new TPA – but would require identifying suitable areas. These options will continue to be discussed among the relevant stakeholders.

5 RECOMMENDATIONS, STATUS OF DISCUSSIONS, AND FUTURE FOCUS AREAS

This report is very timely, as the municipality of Labuan Bajo is looking at revising the retribution structure for 2019. Initial discussions with government and NGOs regarding the environmental fee have been very favorable, with discussion developing around a logo that businesses in the above suggested retribution categories could display on their premises to highlight participation in the scheme.

Recommendations

1. Now the model has been built and its potential can be seen, we suggest a detailed waste characterization for Labuan Bajo as data currently available is unreliable.
2. We suggest that the core stakeholder group of government ministries (local and national), civil society, and private sector meet regularly discussing the initial findings and contribute further to enriching and refining the approach, with different relevant stakeholders invited to each meeting as needed.
3. WWF has suggested that once the approach is approved to revise the waste masterplan incorporating the new directions. WWF has plans to develop similar waste masterplans for multiple cities and islands across Indonesia.
4. Indonesian Waste Platform (IWP) ran a successful school program around waste separation in 2016. Although the teachers and children were very excited, there was unfortunately no budget allocated for collection. Within the proposed approach we have intentionally removed any retribution for waste collection at schools in the hope that schools could generate revenue from recycling and not need to offset the retribution. We suggest that IWP conduct a refresher course.
5. The role of the fast-moving consumer goods (FMCG) producers will be to allocate sufficient marketing and communication budget to both support NGOs and communicate directly with communities on the importance of separation of recyclables – Unilever has been very successful with past marketing campaigns.

Status of discussions and future focus areas

The implementation of a new waste management system in Labuan Bajo will require consultation with numerous stakeholder groups, including multiple national and local government ministries, civil society, and private sector. To date, discussions have been very positive but there is a long road ahead. The design of the new waste management system is a work in progress, and the costing model will evolve in turn.

Going forward, discussions will focus on the following areas:

- As estimating the costs of waste management depends on the amount and composition of waste produced, improving waste characterization data will be key;
- The practical constraints of collecting household waste, e.g. are community-based bins sufficient, are the roads within communities large enough to accommodate trucks to collect the bins, is collection by pushcart or by some other means more feasible, what is the best way to promote segregation, etc.;
- Scenario analysis of the division of responsibilities between the public and private sectors – for example, will the operator of the PDU collect both recyclables and organics/residue from hotels, restaurants, and other businesses, and if so, will they also then collect the retribution as a revenue stream;
- Scenario analysis of organic waste handling i.e. will composting be done at the TPS level or on a larger scale at the TPA, and what are the costs implications of both; and
- Prioritization of the IDR 900 million earmarked for waste management will take place after the costing model is finalized and agreed by the stakeholder group.

Moving forward

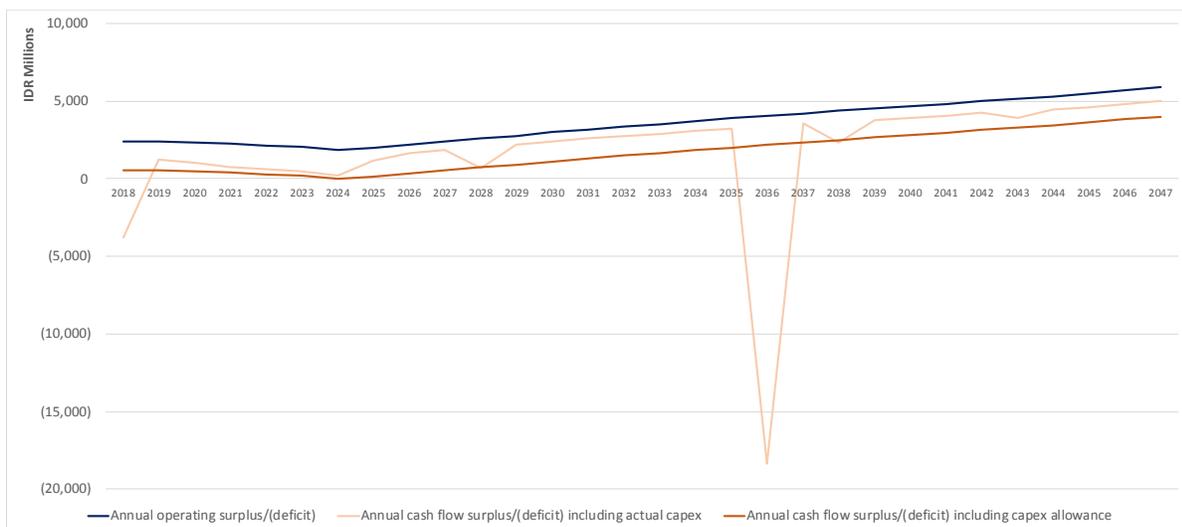
Now that the cost model has been developed and the relevant stakeholders have formed a focus group, discussions will continue regarding refining the assumptions and allow for the finalization of retribution and environmental fees. The focus group will also collaborate in the selection of a PDU operator and further refine the waste management plan as more information is received regarding the practical challenges of collection in Labuan Bajo. There has already been significant progress, and the work will continue.

ANNEX 1: RESULTS OF COST/REVENUE MODELING

Based on the waste management system outlined above, and assuming increased collections (and reduced burning) over time due to alignment of incentives and improved revenue collections by the government, we have attempted to keep the system revenue neutral for government and profitable for the PDU operator.

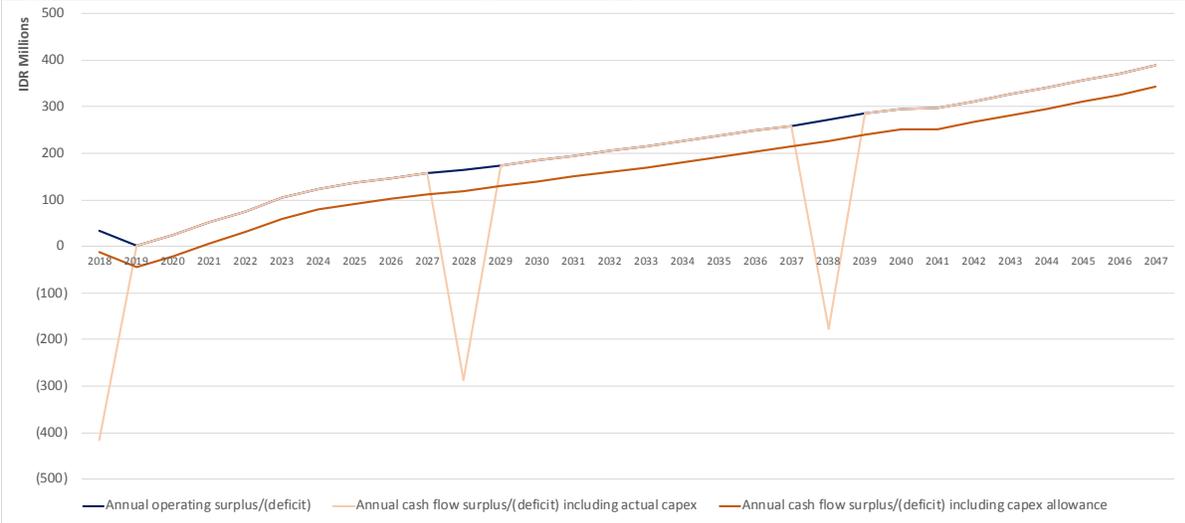
The following figure presents government cash flow for collection and disposal of organic and residual waste. The blue line represents operating cash flow without accounting for capital expenditures (e.g. trash bins, trucks, additional PDU, additional TPA). The light orange line represents operating cash flow less actual capital expenditures. (The steep drop in 2036 is due to the need for an additional TPA once the now-new TPA is estimated to be full.) The dark orange line represents operating cash flow less average capital expenditures. This allows government to see how much they should be putting aside to account for future capital expenses. The selected retribution and fee levels keep the cash flows less average capital expenditures above zero for the forecasted period.

Figure 8: Overall cash flows for waste management by government



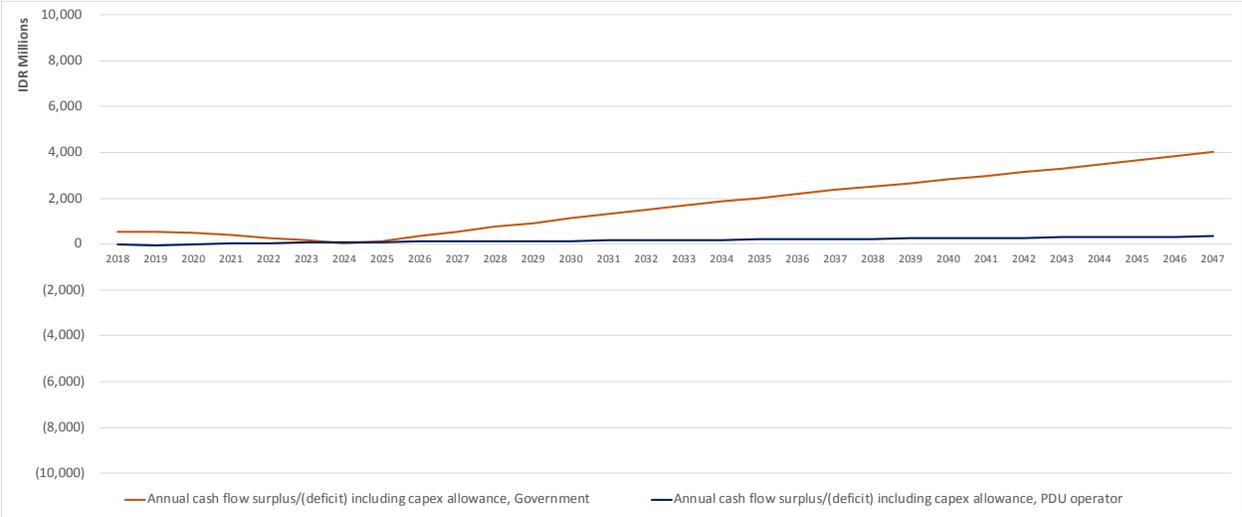
This second figure presents PDU operator cash flow for collection and sale of recyclables (plus disposal of residual wastes). The colored lines in this graph represent the same cash flows as the previous graph. The dips in 2018, 2028, and 2038 represent the purchase of trucks for collection. These cash flows assume a margin of approximately 10 percent on the sale of recyclables, resulting in an internal rate of return to the business of 19 percent.

Figure 9: Overall cash flows for PDU operated by private sector



Finally, this figure presents the cash flows to government and the private sector side by side, showing the benefits of public-private partnership.

Figure 10: Overall cash flows for government and private sector



ANNEX 2: INTERVIEW PARTICIPANTS

Figure 11: Interviewees, sites visited, and additional follow up

Interviewee	Position
Mr. Agustinus Rinus	Vice Head, District Environmental Agency
Ms. Sus Yanti Kamil and Mr. Kusnanto	Manager Waste Strategy, WWF
Mr. Thomas Aquino	Manager, KSU Sampah Komodo (KSK)
Ms. Maria Pangur	Manager, Komodo National Park
Ms. Shana Fatina Tinamitra	Indonesian tourism development expert
Ms. Annie Wahyudi	Danone sustainability expert
Current waste facilities	Current and new landfill, TPS3R, PDU
Several others	Selection of businesses (hospital, hotels, dive centers, restaurants, driver services)
Additional follow up	Position
Ms. Nani Anugrahadi	CMMA
Ms. Annie Wahyudi	Danone sustainability expert
Mr. Imam Mushtofa	WWF Director of Marine
Ms. Dini Trisyanti	Sustainable Waste Indonesia (SWI)