

Solid Waste Management in Sri Lanka: Plastic Recycling

CORDAID, 312/10085A



CORDAID Tsunami Reconstruction 6

Project Report

Authors: Valentin Post, Ivo Haenen

Editors: Valentin Post

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Cover photo: Hambantota plastic collection, Sri Lanka November 2007

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LIST OF ACRONYMS

CEA	Central Environmental Authority
HDPE	High-density polyethylene
HNPS	Hambanthota Nagara Pavithratha Sangamaya
ISWM	Integrated Sustainable Waste Management
Kg	kilogram
Km	Kilometer
LDPE	Low-density polyethylene
LKR	Sri Lankan Rupee
PET	Polyethylene terephthalate
PVC	Polyvinyl chloride
R&D	Research and Development
UN	United Nations
VNG	Vereniging van Nederlandse Gemeenten (Association of Netherlands Municipalities)

FOREWORD

The project started as a response to the disaster that struck Sri Lanka on the 26th of December 2004. Based on request on the Central Environment Authority (CEA) an assessment was made of the solid waste situation caused by the Tsunami in the coastal zones of Sri Lanka. The first assessment – partially supported by CORDAID – resulted amongst others in debris management guidelines issued by the Central Environment Authority end of January 2005.

In the course of 2005 it became clear that many organisations quite rightly at that time focused on immediate relief efforts, but much less attention was given to longer term reconstruction efforts. Waste management systems that were not very well functioning before the Tsunami had collapsed and in relief it was noticed as an important area so as to prevent outbreak of diseases and other human health related areas, but hardly ever as a reconstruction area. At the same time there was a widely voiced demand for show-how projects as there was very little practical experience as to how things could be improved.

This was the background to the current project. As much as possible show how projects and initiatives would be undertaken that would not only target local needs but also be essential building blocks of reconstruction efforts. As needs were so high, a relatively large number of projects were identified by local counterparts. Our aim was therefore to assist these counterparts with technically correct guidance that would make their interventions sustainable in all aspects, institutional, financial etc.

As the lack of knowledge and expertise about waste management was one of the striking factors, it was also deemed critical that efforts would be undertaken to share knowledge and disseminate whatever projects were implemented to a much wider audience. This is the background to this series of project reports.

The following areas were tackled and similar reports are available on each of these subjects: sanitation management; hospital liquid waste management; hospital solid waste management; solid waste management; wastewater management; faecal sludge management; debris management and composting.

By no means these are the last words that can be said about any of these subjects. In the case of health care waste management, final disposal remains a critical issue, in case of hospital waste water management, we believe we have made an appropriate design for a waste water treatment plant after a very elaborate consultative process with the client, but this still has to be built, in the case of debris management, the delay between project conception and the final approval proved too long, by then most of the debris in Kalmunai had disappeared and in Hambantota it was only those partially damaged buildings that were still standing that constituted debris, so it has become much more of a theoretical exercise than what we would have liked. Yet we do believe it is important to document what can be done with debris in case a next disaster strikes. Solid waste management is very diverse, from plastic recycling (two projects) to landfill improvement, solid waste management policy and strategy advocacy, setting up a national platform, feasibility studies for gasification of waste (and once it turned out to be not viable) stopping this initiative etc. Solutions for faecal sludge management are still a priority for organisations working with internally displaced persons in the Northern and Eastern Provinces of Sri Lanka (though from an environmental point of view we would suggest that it should be the entire country), we believe we have managed to significantly improve an existing design for a faecal sludge treatment system. Yet till today, the UN agency that wishes to implement this together with the municipal council of Kalmunai are still struggling to actually implement it. In case of Hambantota - as there is an existing site and additional VNG funds - the implementation of a different design is just beyond the current project period.

Valentin Post, December 2007

ACKNOWLEDGEMENTS

WASTE would like to acknowledge the support of Energy Forum (Asoka Abeygunawardene, Chinthaka Jayaratne, Messrs. Sisira and Sokanatan in particular) for facilitating and finally being instrumental in implementation of the plastic recycling.

For those not familiar with the conditions in Sri Lanka and the post-Tsunami conditions in particular, to get a piece of land for reconstruction activities is quite a lengthy process. If water connections and electricity has to be extended to the project sites as well one may easily have to wait one year. Due to heavy demand on the utility's services and the destruction caused to these, three phase electricity is perhaps the most difficult to get of all services.

Also I would like to put on record the well appreciated efforts made by the urban council and the district authorities in Hambantota to solve some of the practical issues.

A final word of thanks to our friends from CORDAID (Ilse du Pied, Christine Fenenga, Gemma Claessen, Bernadette Hermans, Astrid van den Berg and Hans Scheen). All have been actively involved at one stage or the other from preparatory assistance, to project design and / or have been a continuous source of support during the entire implementation.

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CHAPTER 1 INTRODUCTION TO CORDAID SRI LANKA PROJECT AND THIS DOCUMENT

1.1 Background of the Project

After the Tsunami struck Sri Lanka in December 2004, waste management systems virtually collapsed and waste was disposed of indiscriminately. The local authorities were faced with a post-tsunami situation which was beyond their resources. This led to unplanned coastal zone dumping practices, poor urban environment planning, substandard water management and sanitation practices and a general waste of resources.

The project “Rapid implementation of community based short and middle term measures to improve the functioning of solid waste management in Tsunami affected areas of Ampara and Hambantota districts” was approved by CORDAID on March 1st 2006.

As of such, the project team arranged interventions in the following thematic areas:

- ◆ Health care solid waste management (Report series 1);
- ◆ Faecal sludge management (Report series 2);
- ◆ Master Composting (Report series 3);
- ◆ Solid waste management: Policy and Strategy (Report series 4);
- ◆ Health care liquid waste management (Report series 5);
- ◆ Plastic recycling (Report series 6), and
- ◆ Debris management (Report series 7).

1.2 Objective of this document & intended audience

The project team felt a strong need to express and share the lessons learned from the project interventions. So the purpose of this document is provide thematic and practical knowledge on improving solid waste management and sanitation systems, in reconstruction efforts. However, we also see that this document has value in ‘ordinary’ development initiatives that aim on improving these environmental management aspects.

WASTE has prepared a similar document for each of the project interventions described in the first paragraph of this Chapter. The documents can be obtained electronically from the website www.waste.nl.

1.3 ISWM Methodology for Structure

In this document, the project team has opted to use the Integrated Sustainable Waste Management (ISWM) Methodology to provide a structure for presenting, and analysing information.¹ The ISWM Methodology is a tool that supports to describe and analyse any waste management system in a systematic way. The methodology describes three parts: waste system elements (generation, collection, transport, storage, treatment, disposal), waste system aspects (technical, institutional/political, legal, environmental/health, socio-cultural, and

¹ The ISWM Methodology has been developed by WASTE. The Manual ‘Putting ISWM into Practice’ can be obtained from the WASTE website at <http://www.waste.nl/content/download/561/4346/file/ISWM%20ass%20eng%20screen.pdf>

financial/economic). Additionally, the methodology identifies stakeholders that are relevant in the process.

1.4 Structure of this document

Chapter 2 provides a brief overview of the project objectives, expected results, and project activities related to plastic recycling in Sri Lanka. Chapter 3 gives a short introduction to plastic waste recycling in Sri Lanka, based on a case study of two plastic recyclers. Chapter 4 describes how the plastic recycling sector received support under the CORDAID project, and the issues encountered during implementation. Chapter 5 reflects with a set of conclusions and recommendations.

CHAPTER 2 PLASTIC RECYCLING IN SRI LANKA – PROJECT OBJECTIVES & OVERVIEW ACTIVITIES

2.1 Recycling in Post-Tsunami Reconstruction

Recycling is not a priority in post-disaster reconstruction, as there are more pressing demands, such as medical care, food, shelter, transport etc. However, in reconstructing an area that has been struck by a natural disaster, it is important to strive to use (and re-use) resources efficiently, and to stimulate livelihoods opportunities where possible.

In this project, recycling in the areas of Kalmunai and Hambantota is part of the overall strategy to improve solid waste management in both areas, and to integrate recycling with solid waste management practices.

2.1.1 SMART objectives and results

The Logical Framework of this specific intervention formulates the following overall objective, and specific result of the project related to plastic recycling. The complete Logical Framework is represented in Annex 1.

Table 1 Overall objective and specific result for plastic recycling

Overall Objective:	In target areas, safe and appropriate management of Tsunami related environmental waste.
Result for plastic recycling	Production of pellets in Hambantota from plastic waste generating sustainable local income (collection and conversion employing 20 people) whilst reducing the amount of indiscriminately disposed plastic waste by 50% preventing clogging of drainage channels and thus spread of waterborne diseases such as dengue. Plastic pellet production unit is constructed and operational by end 2006.

2.1.2 Overview of activities

Table 2 Overview of project activities in Sri Lanka

Time	Activity	Carried out by
March 2006	◆ Start of the project (Phase 2)	
November 2006	◆ Memorandum of Understanding (MoU) with informal sector entrepreneur	Energy Forum
March 2007	◆ Feasibility studies for Kalmunai and Hambantota	Energy Forum
April 2007	◆ Identification of entrepreneurs	Energy Forum
August 2007	◆ Purchase of equipment and other operational requirements	Energy Forum
September 2007	◆ Training of 8 plastic recyclers in Hambantota	Practitioner, Energy Forum
1 November	◆ Hambantota recycling facility operational (delay due to time needed for getting 3 phase electricity connection)	Energy Forum
15 November 2007	◆ Kalmunai recycling facility operational (delay due to time needed for getting 3 phase electricity connection)	Energy Forum
December 2007	◆ End of project	

CHAPTER 3 PLASTIC RECYCLING IN SRI LANKA

Although there is no specific information available on volumes, and number of businesses, it can be observed that the plastic recycling businesses is active in Sri Lanka to some extent. The majority of these businesses are located in or near the capital Colombo.

3.1 Characterization of two plastic recyclers in Sri Lanka

A brief study, done by students of the university of Moratuwa, illustrates how two comparative large companies, *Saru Recycling Centre* and *Viridis (Pvt.) Ltd.* operate in Sri Lanka. Table 3 presents an overview of some information on both plastic traders/recyclers. According to Viridis, the demand for recycled plastics in Sri Lanka is growing, especially for colour segregated plastics and especially white plastics.

Table 3 Two plastic traders/recyclers in Sri Lanka

	Saru Recycling Centre	Viridis Ltd
Location		Homagama
Output per day in tons (t)	1 – 1.5	2 – 3
Number of employees	80	50
Started businesses in	2005	2005
Capital investment in LKR	8,500,000	NA
Monthly salary range	1,000 – 15,000	NA
Buying price range kg of plastic in LKR	20 – 80	10 – 25, depending on point of collection, and type
Selling price range per kg in LKR	120 (1 kg of pellets PE)	50 – 120
Collection of plastics	Plastics are both delivered to Saru (mostly plastics from industry), as well as collection by Saru (individuals, collection centres, industry)	Viridis arranges collection from other plastic traders, urban councils and rural committees.
Identification of plastics	Manual segregation, based on visual observation	Manual segregation, based on visual observation (symbols) and by burning the plastic with a hot needle, then smell the smoke of the burning plastic.
Processing of plastics	Segregation, remove labels, washing, crushing	There are 2 processes: 1. Crushing, washing, drying, crushing 2. Washing, crushing, drying, crushing
Outputs	Pellets	Pellets



Photo 1 Plastic waste transport



Photo 2 Manual dismantling



Photo 3 Crushing



Photo 4 Drying of pellets



Photo 5 Machine drying of pellets

Source: Moratuwa University 2007

CHAPTER 4 STRENGTHENING PLASTIC RECYCLING IN HAMBANTOTA AND KALMUNAI

4.1 Geographical setting

4.1.1 *Hambantota*

The city Hambantota, and the district with the same name, are situated in the South of Sri Lanka, at the Indian Ocean. Hambantota Urban Council has 5,500 inhabitants.

4.1.2 *Kalmunai*

The Kalmunai municipality is situated at the east coast of Sri Lanka, in the Ampara district. In terms of casualties, the Ampara district is most heavily Tsunami-affected in Sri Lanka. Kalmunai town has around 135,000 inhabitants.

4.2 Identification of entrepreneurs

Before starting in its current set-up in Hambantota, project team made several attempts to start plastic recycling through an existing micro-entrepreneur. The entrepreneur, Mr. Maulana, had lost his possessions in the Tsunami and was now working as an informal sector waste collector. As he was already involved in the business and had some expertise, the project team decided to implement the plastic recycling with him.

Subsequently, in the course of several meetings the project team and Mr. Maulana prepared an action plan. As he and his family was occupying a piece of land without ownership rights, his first and immediate need was to get a piece of land. Energy Forum approached local authorities (district secretary) and a piece of land was duly allocated. Meantime a Memorandum of Understanding between Energy forum and Mr. Maulana had been drawn up and a lease deed was drafted for equipment (crusher) selected by Mr. Maulana.

Because of difference in opinion, Mr. Maulana and the Urban Council have not yet come to a final agreement on land allocation, and it is unlikely that this will take place in the future. Though the real reason will most likely never be known, fact is that Mr. Maulana quit the recycling business altogether and went into a completely different business line. Local authorities still recognise the need for plastic recycling in Hambantota, a different implementation modality is clearly required.

Fortunately in Kalmunai it was much easier to find a local entrepreneur.

4.3 Training of Recyclers

An informal plastic recycler from Colombo, identified by Energy Forum, and member of the ISWM National Policy Platform (also see document on Policy and Strategy) trained (potential) workers from the two plastic recycling units from Hambantota and Kalmunai. To increase efficiency, the training took place in Hambantota, and the participants from Kalmunai travelled to Hambantota. The training took place in September 2007.

The training focused on collection and segregation of plastic waste materials, as there are many different types of plastics. When plastic waste are segregated according to type, the price per kilo increases substantially. When the plastics are further segregated to colour, the price per kilo will increase even more.

4.4 Collection and transport

4.4.1 *Hambantota*

The plastic recycling plant operates in close cooperation with the integrated waste management facility in Hambantota. This facility is operated by the society Hambanthota Nagara Pavithratha Sangamaya (HNPS), that consists of members from the Urban Council, the private sector and NGOs, and its objective is to oversee the solid waste management process in Hambantota area.

The urban council workers collect waste from households and businesses, and transports it to the facility. It is anticipated that in future informal sector collectors will also bring plastics to the centre. Informal sector and urban council efforts are aided by the waste segregation efforts that are accompanying home composting (see Reconstruction Report 7).

4.4.2 *Kalmunai*

The plastic recycling facility in Kalmunai makes use of the existing informal sector structure for supply of plastic materials. The facility buys plastics from 17 informal collectors (all Tsunami victims), and in November 2007, they collected 7 tonne of plastic waste. Next to informal collectors bringing the waste directly to the recycling plant, there are four 'collection points' for plastic waste. The collection points are established on the premises of four informal sector collectors, and in November 2007, the collection points stocked from 130 – 600 kg of plastic waste. The recycler pays 8 Sri Lanka Rupees per kilo to the informal collectors when they deliver the plastic waste to the recycler. The recycler can also arrange collection himself, but then the price drops with 1 or 2 Sri Lanka Rupees per kilo.

In addition to the informal collection, the Ashroff Hospital in Kalmunai delivers decontaminated plastic waste to the recycler. The plastic health care waste consists mostly of plastic (saline) bottles that are used for IV and contain sodium chloride solution. Before establishment of the plastic recycler, the hospital would burn the plastic waste in an incinerator at low temperatures, causing health and environmental risks, but the project team convinced the management of the hospital to recycle it instead.

4.5 Segregation and processing

4.5.1 *Hambantota*

As part of the CORDAID reconstruction project, the former composting facility was rebuilt after the Tsunami swept away most of the infrastructure in December 2004. At the moment, Energy Forum is proposing to further extend the operations of the facility to include a range of waste treatment operations, such as hazardous waste storage, temporary storage of municipal waste, waste water treatment, and land-filling. In addition to the treatment options, Energy Forum proposes that the facility includes an office building and staff welfare

room, a rain water collection system, a garden and vegetation area, a plastic collection mechanism, and a Research and Development (R&D) & Training Centre, among others.



Photo 6 Shredding in Kalmunai



Photo 7 Manual segregation in Hambantota

At the facility, waste is segregated according to biodegradable wastes, plastics, paper, glass, metal, wood, non recyclables and hazardous waste. The plastics are further segregated into Low-density polyethylene (LDPE), High-density polyethylene (HDPE), Polyethylene terephthalate (PET), and Polyvinyl chloride (PVC) and ‘other plastics’.

In some (or most) cases, the plastic waste will contain a symbol for the type. Figure 1 reflects some of the symbols for plastic materials.



Figure 1 Different plastic types



Photo 8 Pellets Kalmunai

Often the segregated plastic materials are stained with food scraps, dust, and other adhesives. The plastics are then washed and labels are removed. In some cases the workers use detergents to remove labels if necessary. The wastewater is treated and reused by normal sedimentation and a (small) constructed wetland (that will be set-up early 2008).

The washed materials then go to a sun-drying bed, and when dry, the materials are stored temporarily before crushing, as sufficient volume is required to increase the efficiency of one crushing batch.

The facility uses a electric shredding machine. The shredded plastics are then packed in sacks, and sold to the informal plastic recycler who trained the recycling workers.

The facility has been operational since November 2007.

4.5.2 Kalmunai

In Kalmunai, a plastic recycling plant has been operational since 15 November 2007. The facility employs four fixed workers (2 men, 2 women), two foremen and one director. The workers wash the plastics, sun-dry the materials and then segregate the plastic waste based on type, and then on colour if this is possible.

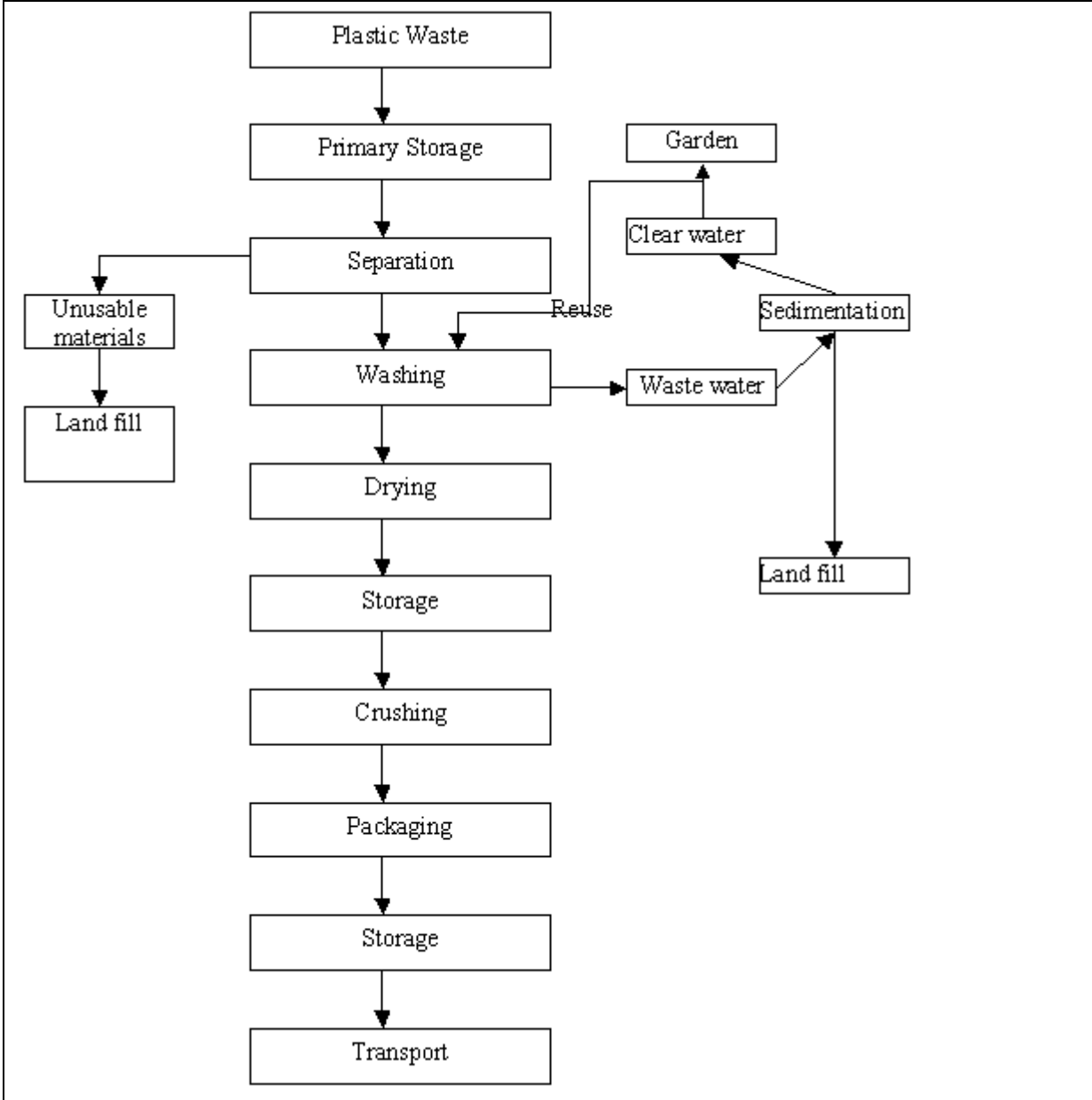


Figure 2 Process flow diagram of the integrated waste management facility in Hambantota

The electric shredder converts the material into pellets. As is the case in Hambantota, the pellets allow cost-effective transport, and meet the requirements of the recycling sector based

in Colombo. The facility sells the plastic materials to the informal sector trader (as in Hambantota) at a rate of 50 Sri Lanka Rupees per kilo (November 2007).

4.6 Recycling

The recycling of the collected and segregated plastics takes place in and around the Colombo region, where the major industries are located. Plastics are transported by truck (Hambantota – Colombo is 225 km, Kalmunai – Colombo is a bit more, but takes much longer in time because of military road-blocks). Because of the distance between Hambantota and Kalmunai, and Colombo, it is essential that the plastics are transported in the most cost-effective way. This means that size reduction techniques are essential.

4.7 Process issues

While the facilities in both Hambantota and Kalmunai are operational at the moment of writing this document, the project team encountered several issues during the process. This section reflects briefly on these issues.

4.7.1 *Hambantota*

There are several institutions (donors and national institutes) active in the Hambantota area that focus on improving waste management systems. It seems that there is little coordination as of yet between the different initiatives. Also, there does not appear to be much knowledge or capacity about solid waste and recycling at municipal level, and also not much evidence that things are being co-ordinated or will be resolved. Key stakeholders appear to be outside the processes, or when they are inside processes, there is mistrust between a private waste dealer and the municipality, as both are interested in generating income from waste.

4.7.2 *Kalmunai*

The participation of the municipality in the plastic recycling initiative seems very low. This was also observed during a composting training. Another major threat for the viability of the waste collection for recycling business is the security situation in the East of Sri Lanka, as the operations depend heavily on the quality of transport-lines to Sri Lanka's capital Colombo. During a mission that focused on home composting, the trainer observed that a truck full of light iron was also being searched, and the soldiers required that the truck be completely emptied, a process which took a lot of time at only that one checkpoint.

CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Although recycling is not a priority in post-disaster areas, recycling forms an important role in Integrated Sustainable Waste Management. Recycling supports livelihoods, and strengthening recycling initiatives can hence result in creating livelihood opportunities, also, and especially for the groups and individuals who usually find it difficult to find additional income.

Through recycling, less waste materials is being disposed on landfills, which means that the landfill has a longer life compared to when plastics are disposed indiscriminately.

5.1.1 *Hambantota*

In Hambantota, the municipality is very much interested in generating income from plastic and other waste materials. However, the private waste system that already exists in Hambantota is somewhat neglected, it seems. Also, the municipality has little understanding of how recycling systems operate in Sri Lanka. On the other hand, the presence of different stakeholders offers potential for cooperation.

5.1.2 *Kalmunai*

In the case of Kalmunai, the local recycler makes use of the local existing informal plastic collection system. On the other hand, the relation between the private sector and the municipal government seems weak.

In both Hambantota and Kalmunai, technical recycling infrastructures have been set up, but there are several weak points that need further attention. These include, among others:

- ◆ Open communication lines between different stakeholders;
- ◆ Increasing knowledge and understanding of how each stakeholder operates.

5.2 Recommendations

When aiming to improve recycling initiatives, it is always important to consider the existing recycling infrastructure, and in urban areas there is almost always some combination of formal and informal waste collection and segregation system that feeds recycling initiatives.

When several actors have interest in recovering the value of waste materials, a multi-stakeholder approach is often necessary in order to get trust and understanding between the different stakeholders.

ANNEX 1 LOGICAL FRAMEWORK RELATED TO PLASTIC RECYCLING

Intervention logic				Risks & Assumptions	
Objective 4	In target areas safe and appropriate management of Tsunami related environment projects.	At present many environmental related projects have been identified by local district partners, these have been prioritised in consultation with stakeholders. It is expected that participatory implementation of these demonstration projects will not only transfer skills and build local capacities, but it will result in replications in neighbouring areas too.		<p>Budget to implement this objective: The political situation does not deteriorate further, primarily hampering implementation of activities at Kalmunai For replication, VNG & Canadian counterparts (LOGO South Southern Province) continues its activities in Galle and Matara districts reinforcing Hambantota experiences. District Tsunami coordination committees Ampara remain active. Listed NGOs and CBOs remain active. Euro :</p>	
Result	4.1 Production of pellets in Hambantota from plastic waste generating sustainable local income (collection and conversion employing 20 people) whilst reducing the amount of indiscriminately disposed plastic waste by 50% preventing clogging of drainage channels and thus spread of waterborne diseases such as dengue.	4.2 Waste segregation at household level benefiting over 30,000 members WDF, about 10,000 members PP	4.3 Training of stakeholders (Scout Association of Sri Lanka, CARE, Solidarity etc.) in waste management, thereby benefiting reconstruction as previously unusable material will become available, and / or processed locally.	4.4 Training MSMEs waste collection and recycling with HDCC and ADCC, providing sustainable employment for 30 people	4.5 Demonstration of landfill improvement in Kalmunai with main stakeholders, local authorities and CBOs, infrastructure development through NGO GOAL. Landfill is overstretched putting about 2000 people at risk due to accumulation of Tsunami waste.
Objectively verifiable Indicators	Plastic pellet production unit is constructed and operational by end 2006.	Home composting practiced in Hambantota district by June 2007. Waste segregation at household level.	Posters translated and distributed. Reports on campaigns by organisations	Waste reuse by 3 MSMEs.	Photos before and after landfill improvement.
Means of Verification	Photos / reports Amount of plastic collected and recycled.	Photos / reports Assessment of reduction in amount of organic waste at landfill sites	Photos / reports Actual amount of waste recycled in tonne/day	Photos Actual amount of waste recycled in tonne/day Reports	Photos Actual amount of waste deposited tonne/day Reports

Activities	<p>4.1.1 Feasibility report for plastic conversion unit (capacity, siting etc.)</p> <p>4.1.2 Construction of plastic conversion unit</p> <p>4.1.3 Training of collectors (segregation) and operators</p>	<p>4.2.1 Waste segregation awareness training</p> <p>4.2.2 Waste reuse demonstration particularly household composting</p> <p>4.2.3 Training SSEs waste collection and recycling with HDCC and ADCC</p>	<p>4.3.1 Training of key local people with assistance of Solidarity (NGO) in waste management in IDP, Ampara.</p> <p>4.3.2 Training of key local people with assistance of CARE (NGO) in waste management in IDP, Hambantota.</p> <p>4.3.3 Awareness raising of population through training of selected staff of Sri Lanka Scout Association</p>	<p>4.4.1. Feasibility (technical, socio-economical, operational) of different options</p> <p>4.4.2. Training and operational assistance to 3 MSMEs</p>	<p>4.5.1 Feasibility of suggested option</p> <p>4.5.2 Training of LA and others in operation and maintenance landfill</p> <p>4.5.3. Construction of improvement by NGO</p>
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