

# Solid Waste Management Case Study

---

## Solid Waste Collection, Transfer and Disposal, Sohag City

### Governorate of Sohag

---

#### **Introduction**

A waste collection service was implemented in a number of low income, densely populated areas in Sohag City. Approximately 70,000 people, or about 40% of the population of Sohag City, now benefit from the new system.

Prior to implementation, a large number of the residents had expressed dissatisfaction with the waste management service. Waste collection was irregular, collection trucks were inadequate and unsuitable for working in narrow streets and the levels of littering had reached alarming levels.

A cost effective waste collection and transfer system was developed by the SEAM Project in collaboration with the Sohag East and West Districts and residents. A fleet of 1.5 ton Micro Trucks proved ideal for collection in the narrow streets. Support was also provided by SEAM to strengthen the local manufacture of a tractor-trailer-container pick up system which was then used for transferring waste from the collection area to the dumpsite.

Associated problems of waste disposal, vehicle maintenance and accumulated street waste were also addressed. Achieving community participation proved essential in ing sustainability.

The annualised capital and operating costs for the collection and transfer equipment were LE226,138 (excluding plastic bags). Cost per household is LE1.4 per month.

#### **Which Areas were Covered in Sohag City?**

The project was implemented in five areas as follows:

**Areas in Sohag City Covered by the New Waste Collection System**

		<b>Population</b>	<b>Comments</b>
<b>Sohag West</b>	El-Makhbaz El-Ally	25,000	Residential
	Kessareya	10,000	Commercial and residential
	Ghayeteya	10,000	Commercial and residential
<b>Sohag East</b>	Naga Abou Shagara	15,000	Residential
	El Arqam	10,000	Residential, many hospitals and clinics

The waste collection was introduced into El-Makhbaz El-Ally and Naga Abou Shagara and progressively extended to the other three areas. The phased approach allowed time to train staff and overcome any initial operational difficulties.

### How to Involve the Community?

It was recognised from the outset that the efficiency of the system would be dependent upon gaining the involvement and co-operation of the community.

An initial social survey of 945 households was undertaken to get views and on how and when waste should be collected. At the same time the survey was aimed at identifying indicators that could be monitored over time to determine the success of the project (e.g. satisfaction levels, dirtiness of streets) and to gauge perceived improved service. A follow up survey was undertaken 9 months after the service had been operating. A comparison of the key findings is given below:

#### Key Findings of Social Survey, Before and After Implementation

	BEFORE July 97	AFTER April 98
Satisfaction with waste service	32%	85%
Collection vehicles seen in the streets	40%	85%
Street sweepers pass in the street	40%	86%
Preferred collection in plastic bags	52%	73%
in bins	7%	NA
Preferred time for morning collection	8-10.00 (50%)	7-9.00 (97%)
Willingness to pay for improved service	70%	59%
Average monthly fee per household	LE1.40	LE1.03

and operation of the waste system. In addition views were sought from the waste operators on opportunities for improvement as well as preferences for vehicles that could be more easily maintained.

A range of other activities to involve the community and to raise their awareness had been developed as follows:

- ❖ 10 large resident meetings were held to raise awareness on solid waste issues and to discuss operator and community roles in introducing the new system.
- ❖ Workshops were held with other key stakeholders including the Directorates of Health, Social Affairs and Education, religious leaders and the media to encourage their active role in raising community awareness.
- ❖ Focused group discussions were also held with waste workers, residents and key stakeholders.
- ❖ Door to door household visits were undertaken by a local NGO to disseminate waste collection bags, information leaflets and posters that explained the new system.
- ❖ Resident committees were established in the East and West Districts. The committees, comprising around 30 people, meet monthly with District officials to mutually resolve any issues and to stimulate better waste practices among residents.
- ❖ Various competitions were held for the cleanest building, cleanest street, waste collection crew of the month and a song that is played by the collection crew to alert residents of the collection service.

### Developing Efficient Waste Collection and Transfer

Equipment selection and the development of the waste collection system was based on the following:

- ❖ Views expressed by the community in the initial social survey.
- ❖ Views expressed by the two respective Districts and their workers.
- ❖ Equipment that could be easily maneuvered in narrow, winding streets.
- ❖ Simple technology that can be locally maintained.
- ❖ System that is practical and affordable.

In light of the above, a cost effective collection and transfer system was designed and the equipment procured as indicated below.

#### Collection and Transfer Equipment

Collection Equipment			
Number	Equipment	Total Cost LE	Comments
7	1.5 ton Suzuki Micro Trucks	332,500	These small (1.6 m <sup>3</sup> ) high tipping trucks are cost effective for primary collection systems where there are short haul distances and narrow streets and where they can discharge directly into larger transfer containers. They are particularly effective with a bag collection system where bags of waste can be thrown into the body. The system is suitable for use with two workers.
21	Handcarts with bins	9,009	Work in tandem with the Suzuki trucks to sweep street waste and collect waste from very narrow passageways. Operated by 1 person and manufactured locally in the Akhmim workshop.
4	Jawa Motorcycles	17,676	For supervisors of the waste teams
110	Uniforms	4,590	Provided to the 50 District workers
2 tons	Plastic bags	23,320	Provided free to residents for the first 4 months so that they become accustomed to dispose their waste in plastic bags. Residents are now re-using plastic grocery bags.
<b>Sub Total</b>		<b>387,095</b>	

<b>Transfer Equipment</b>			
<b>Number</b>	<b>Equipment</b>	<b>Total Cost LE</b>	<b>Comments</b>
21	6 m <sup>3</sup> Containers	71,400	Waste is transferred to containers located in the collection areas, so that Suzuki round-trip transfer transfer to the dumpsite. Tractors are cost effective for transporting heavy loads over short haul distances. A tractor-trailer-container pick-up system was developed in association with Mabrouk Engineering of Tanta. The hydraulic trailer/container system is designed for use behind tractors of at least 60 hp and with waste densities of 400-600 kg/m <sup>3</sup> . One tractor was fitted with a front end loader to remove accumulated street waste. Approximately 25 × 6 m <sup>3</sup> loads are transferred daily to the dumpsite, 4 km away.
3	Tractors	116,000	
4	Trailers	52,000	
	<b>Sub Total</b>	<b>239,400</b>	
	<b>TOTAL</b>	<b>626,495</b>	

The new collection system operates on two shifts with the morning shift (7.00 a.m. - 3.00 p.m.) collecting waste in the residential areas. Each truck collects around five loads. A reduced afternoon shift operates with collection principally in the commercial areas (shops and main streets). Residential users of the system put waste in the plastic bags, which are placed on the street in front of their apartment blocks between 7.00 - 9.00 a.m. daily. This minimises the opportunity for waste to be scattered by scavengers and goat herders. Street sweepers also collect waste from narrow passageways and place the collected waste in bin lined handcarts. When full, the bags are tied and left on the street for collection by the Suzuki trucks. Waste collected in the Suzuki is transferred to the 6 m<sup>3</sup> containers, which are then hauled by tractor to the dumpsite, 4 km away.

The system is operated by the Sohag East and West Districts and employs over 50 people. Training of waste supervisors and collectors has been an integral part of the project. The Districts have paid all labour and operating costs. There are 11,000 households, which make up 85% of all premises covered by the new service, the remainder being commercial shops, offices, clinics and market stalls.

#### *Clinical waste segregation*

Often clinical waste is mixed in with municipal waste and poses health risks to those who may come in contact.

Within the El Arqam District there are four hospitals with the following bed capacity: 1) Chest - 128 beds; 2) Fever - 64 beds; 3) Endemic disease - 20 beds; and 4) Psychiatric - 20 beds. In addition there are two health care units. A system was put in place to segregate the clinical waste with separate containers being provided for sharps, clinical waste and other waste. Clinical waste and sharps are now collected twice a week and transported to a clinical waste

Hoval incinerator, which was recently installed and incinerates waste at 500 °C in primary combustion and 900 °C in secondary combustion.

Awareness raising workshops were held in each of the hospitals and health clinics to inform staff of the dangers and appropriate procedures for handling clinical waste. This

was undertaken in conjunction with the Directorate of Health.

### **Removing Accumulated Waste**

There were many areas, particularly in West Sohag but also in parts of East Sohag, where large heaps of wastes had accumulated on vacant land, between blocks of apartments and even in basements of buildings. These areas had become breeding grounds for insects and rodents and were creating health hazards to residents.

Clean-up campaigns were organised to remove the accumulated street waste, involving District workers and the community and using the tractors fitted with front-end loaders. Once cleaned the area was included in the regular collection service. In addition a major awareness-raising effort was carried out, incorporating home visits, the distribution of stickers and leaflets to all households and the

were cleaned were planted and turned into green areas.

### **Burning Dumpsite What Can be Done?**

The dumpsite for Sohag City lies beside Naga El Shamendy, a village of around 6,000 inhabitants situated about 4 km from Sohag City. The site is an old drainage canal that was designated a temporary dumpsite around five years ago.

The dumpsite posed serious health risks due to its deteriorated condition. As there was no real system of managing the waste at the site, garbage was dumped randomly and set on fire. Mounds of burning waste impeded access to the village and schools and the smoke caused many village residents to suffer respiratory problems. Hospital and clinical waste that had been dumped at the site also posed a health risk to children scavenging there.

A survey of village residents and dumpsite scavengers showed the following:

#### **Naga El-Shamendy Village (151 interviewed)**

- ❖ 92.1% felt the adjoining dumpsite affected their health.
- ❖ 89.0% indicated they suffered respiratory disease.
- ❖ 57% preferred the dumpsite to be transformed into a public park; 49% would like a building for literacy classes.
- ❖ 95% were willing to look after the area after remediation.

**Scavengers (27 interviewed)**

- ❖ Average age was 11 years.
- ❖ Average income from the dumpsite was LE1.90 per day.
- ❖ 68% Suffered health problems.
- ❖ 67% Suffered skin infections; and 56% gastro-enteritis.

Remedial action was taken to:

- ❖ Extinguish the fires and introduce controlled tipping.
- ❖ Remove the piles of accumulated waste.
- ❖ Level and top dress the area with 4,000 m<sup>3</sup> of soils dredged from the irrigation canals.
- ❖ Transform the area into a public park and football field.

The above actions were done in conjunction with the Governorate, Sohag East and West Districts, and after consulting with residents, teachers and children of the nearby village and schools. 99% of residents surveyed expressed satisfaction with the remediation. 81% indicated that the positive effects were less smoke and odour.

Equipment was provided by the Districts at the dumpsite to maintain the better tipping practices. In addition a gardener has been appointed full time to look after the public garden.

**Upgrading of Maintenance Workshops**

The maintenance facilities in the East and West districts of Sohag City were not able to provide the most basic vehicle servicing requirements in an adequate manner. Improving the maintenance facilities was essential to avoid:

- ❖ Poor vehicle utilisation due to excessive downtime.
- ❖ Reduced life expectancy of vehicles and equipment.

An overall plan was developed to upgrade the workshop facilities. Construction undertaken by SEAM included renovations for maintenance rooms, improved facilities for servicing vehicles and the provision of a lube bay.

A stock of spare parts for the Suzukis and sets of workshop tools were provided to both workshops. Preventive maintenance programmes are now in place and vehicle logbooks are kept not only for the Suzukis but also for the other District vehicles.

This work has resulted in:

- ❖ Improved service areas for maintaining vehicles.
- ❖ Construction of workshops and lube bays.
- ❖ Supply of workshop tools and vehicle spare parts.
- ❖ Workshop training and the introduction of preventative maintenance schedules.

Further work is planned by both District workshops including improving tools and spare part storage and paving workshop areas.

**What Does the New Collection System Cost?**

Capital costs expended on the waste collection and transfer equipment are summarised below.

**Capital Costs for Waste Collection and Transfer Equipment.**

Item	LE
Suzuki trucks	332,500
Handcarts and bins	9,009
Supervisor motorcycles	17,676
Uniforms	4,590
6 m <sup>3</sup> containers	71,400
Tractors	74,000
Tractor with front end loader	42,000
Trailers	52,000
Miscellaneous tools	4,500
Bins for segregating clinical waste	5,990
<b>Total</b>	<b>613,665</b>

The above costs were met through the SEAM Project. SEAM and the Sohag East and West Districts incurred additional costs on community participatory activities, workshop upgrading, dumpsite remediation and conversion to a public garden and clinical waste segregation.

The Sohag East and West Districts have met all labour, fuel, maintenance and other operating costs, which have been r understanding of the costs for replicating the scheme a financial analysis was undertaken with capital investments being annualised at 10% real discount rate over 7 years.

The total annualised capital and operating costs are LE226,138. This reduces to LE192,217 for the 11,000 households, which comprise 85% of all premises covered by the service. Cost per household is LE1.4 per month (excluding the cost of plastic bags).

A summary of the financial analysis is as follows:

**Replicable Costs for the Solid Waste Collection and Transfer System**

Cost Element	LE
Capital costs	613,665
Annual Operating Costs	
Labour (on the basis of 2 shifts)	60,000
Fuel and Lubricants (based on diesel at LE0.40 per litre)	9,408
Maintenance (5% of capital costs)	30,683
Plastic bags (cost is LE4.25 per kg)	69,960
TOTAL Annual Operating Costs, including bags	170,051
TOTAL Annual Operating Costs, excluding bags	100,091
Total Annualised Capital costs (discounted at 10% over 7 years)	126,047
Total annualised capital and operating costs, including bags	296,098
Total annualised capital and operating costs, excluding bags	226,138
85% of annualised capital and operating costs attributable to households (with plastic bags)	251,683
85% of annualised capital and operating costs attributable to households (without plastic bags)	192,217
No of households covered by the service	11,000
Total costs per household per month, including bags	1.9
Total costs per household per month, excluding bags	1.4

The introduction of a user fee to cover the costs of operation is presently under consideration by the Governorate. There is also considerable interest in extending the service to other parts of the city as well as replicating the system in other urban centres.

### **Is the New Waste System Sustainable?**

The waste system implemented was designed to be sustainable in the following ways:

- ❖ Providing suitable equipment appropriate for use in narrow, densely populated areas.
- ❖ Strengthening local technology and local fabrication that is better able to support current operations and future replication.
- ❖ Selecting equipment that can more readily be serviced by the local mechanics.
- ❖ Training and improving the capacity of the workers and supervisors.
- ❖ Involving the community throughout all phases of implementation.
- ❖ Delivering a service that satisfies residents as evidenced by the dramatic increase in satisfaction levels, from 32% before to 85% after.
- ❖ In comparison with the costs of running the old system the new system is about 35% cheaper per cubic metre of waste collected.
- ❖ Upgrading maintenance capabilities and introducing preventive maintenance servicing.
- ❖ Sohag East and West Districts have met all operating costs since inception, and have used existing labour.
- ❖ 70% of residents had initially indicated a willingness to pay. Consideration is presently being given to introducing a user fee.
- ❖ Encouraging better law enforcement.

### **CONTACTS**

More information on this project and the SEAM Project, are available from:

- ❖ **Egyptian Environmental Affairs Agency (EEAA)**  
Technical Co-operation Office for the Environment (TCOE)  
30 Misr Helwan Agricultural Road  
5th floor, Maadi, Cairo, Egypt  
Tel.: (20) 2 525 6452 Fax: (20) 2 525 6457  
email: EEAA2@idsc.gov.eg
- ❖ **SEAM/Entec UK Ltd.**  
30 Misr Helwan Agricultural Road  
4th floor, Maadi, Cairo, Egypt  
Tel.: (20) 2 525 6452 Fax: (20) 2 524 6162  
email: entecegy@eis.com.eg
- ❖ **Governorate of Sohag**  
Sohag City  
Tel.: (20) 93 604491 - 604492 Fax: (20) 93 605222

**March 1999**

# Solid Waste Management Case Study

---

## Solid Waste Collection, El-Kawther Industrial Zone

Governorate of Sohag

---

### **Introduction**

The El-Kawther District Council is responsible for waste collection in the recently established El-Kawther Urban and Industrial Development Zone. Waste generation for the District was estimated in 1997 to be 18.5m<sup>3</sup> per day and is forecasted to increase to around 103m<sup>3</sup> per day given the expected rapid development over the next 5 years.

Most wastes, except high density rejects from the tile and marble factories, had been collected by the District using a 3 ton truck. Collection methods were inefficient and unhygienic, in part due to the high loading height of 1.9m. A total crew of 6 loaders, one driver and one supervisor collect around 16 m<sup>3</sup> or roughly 4.5 tons of waste per day, an average labour productivity of only 750 kg/man/day. This compares with a typical European rate, hand loading from bins, of 3,000 kg/man/day. In addition the one truck would not cope with the projected expansion of the area.

After consultation with the factories, the SEAM Project together with the El-Kawther District Council developed a waste collection system, using a combination of vehicles and different size storage bins. Although the initial focus had been on the Industrial Zone there was sufficient capacity to cater for the rest of the District, as well as allowing for the projected increase in waste generation forecasted over the next few years. Segregation of waste at the factory, recovery and recycling of paper and plastics, and awareness raising had been integral parts of the projects implementation

Capital expended by SEAM on equipment was LE245,465. Operating costs are born by the El-Kawther District who also levy an annual waste management fee of 0.014% of the capital costs of the infrastructure and buildings for each factory.

### **El-Kawther Urban and Industrial Development Zone**

The El-Kawther Urban and Industrial Development Zone was established in 1993 to help diversify the economic base of Sohag Governorate. It covers 3,000 feddans including 600 feddans for an Industrial Zone. The remaining 2,400 feddans are in the process of being developed for educational and training institutes, retail and commercial businesses, agricultural research, recreational and residential areas.

The Industrial Zone is being developed in three phases as indicated below. Phase I is largely complete with most infrastructure in place. Infrastructure and buildings are under development for Phase 2 and Phase 3 is about to start.

#### Phases of Development of the El-Kawther Industrial Zone

	Phase 1	Phase 2	Phase 3
Area (feddans)	75	130	395
No. of Factories Approved	63	66	In planning
% Operational (March 99)	68	25	
Industrial Sectors	Textiles, chemicals, metals, engineering, timber, building materials, food processing and animal feed		

The El Kawther District Council is responsible for solid waste collection throughout the Urban and Industrial Development Zone and had been using the same truck to service all areas.

#### How Much and What Types of Wastes are Generated?

A survey of 38 factories undertaken in November 1997 indicated that:

- ❖ 71% (27 factories) produced negligible solid waste.
- ❖ 16% (6 factories) produced less than 1m<sup>3</sup> solid waste per week.
- ❖ 13% (5 factories) produced between 1-10m<sup>3</sup> solid waste per week.

The number of employees in the factories surveyed ranged from 5 to 40 and averaged 16.

Based on this survey and on discussions with the El-Kawther District Council, total waste generation was estimated to be 18.5m<sup>3</sup> per day as indicated below.

#### El-Kawther - Volume of Waste Generated Daily (November 1997)

Sources	Main Waste Type	Estimate Daily Volume (m <sup>3</sup> )
<b>Industrial Zone</b>		
Small waste producers	Paper, food wastes, cans, bottles, some steel shaving	4.0
Larger waste producers		
Tomato paste	Organic tomato residues	2.0
Footwear	Rubber offcuts	2.0
Tile and marble factories	High density rejects and offcuts	2.5
<b>Residential and commercial</b>		
	Food waste and paper	8.0
	TOTAL	18.5

With the forecasted expansion of the Urban and Industrial Development Zone, waste generation is expected to increase over the next five years by 6 times for industrial waste and 5 times for non-industrial waste. On this basis, typical daily waste collection by the year 2002 is expected to be:

- ❖ 68m<sup>3</sup> of mixed waste for hauling to the dumpsite.
- ❖ 20m<sup>3</sup> of waste paper and plastics baled down to around 2 m<sup>3</sup> for resale.
- ❖ 15m<sup>3</sup> of high density for hauling to the dumpsite.

#### Designing the Waste Collection System

Based on consultations with the factories and the El-Kawther District Council the new waste management service was designed to:

- ❖ Establish a cost-effective system for the collection of all wastes presently generated.
- ❖ Provide sufficient capacity to allow for an increase in the waste to be collected from 18.5m<sup>3</sup> to 103m<sup>3</sup> per day, as the El Kawther District expands rapidly.
- ❖ Segregate waste at source in the factories.
- ❖ Recover and recycle paper and plastics.
- ❖ Improve working conditions for waste collectors.

In designing a reliable waste collection system it was recognised that:

- ❖ The system should not be dependent on a single collection vehicle, as downtime of 20% should be allowed for servicing and breakdowns. Downtime will be small in the first year but will escalate as equipment ages.
- ❖ The existing 3 ton truck will eventually be phased out because of efficiency and hygiene problems but could be used as a back up.
- ❖ A tractor-trailer-container system could be readily maintained and could be further supported by the spare capacity within the Districts existing three 65hp tractors.

#### What Equipment is Required?

Equipment was provided for the storage, segregation, collection, and transfer of waste and for the recovery and recycling of paper and plastics. A combination of truck, tractor, trailer and container system was developed as indicated below.

#### Storage of Waste

- ❖ 100L bins for putrescibles and 170L bins for paper and plastics were manufactured locally in the Akhmim workshop and provided to each factory for waste segregation. Maximum bin weight when full is 40kg, which is within the capacity of 2 men to lift. Putrescibles are collected daily and paper bins are collected when full. The collection frequency has been adjusted for each factory to suit the amount of waste generated.
- ❖ 6m<sup>3</sup> containers are provided to factories and institutions that produce larger quantities of medium density waste.

- ❖ 3m<sup>3</sup> containers are provided to the producers of high density waste (e.g. tile and marble factories).

#### *Collection and Transfer of Waste*

- ❖ An 8 ton Isuzu waste collection truck with a capacity of 7m<sup>3</sup> was provided for use in the industrial, commercial and residential areas. Refuse is hand loaded at the front and pushed back with a hydraulic press plate. A 65 hp tractor and trailer is used to collect and transfer the 3m<sup>3</sup> and 6m<sup>3</sup> containers. Tractors are cost effective for short haul distances, the dumpsite being only 3km away.
- ❖ A low loading trailer with a capacity of 4.5m<sup>3</sup> and a low loading height and pulled by a tractor can be used in conjunction with the Isuzu truck for hand loaded collection.

#### *Recycling of Paper and Plastic*

- ❖ A waste paper trailer, with fully enclosed mesh sides, is used to collect and transfer paper and plastics.
- ❖ A paper press was provided with 15 ton press power that produces compacted bales of 50x70x80cm. An area in the District workshop has been prepared for paper baling operations.

In addition a Jawa motorcycle has been provided to facilitate supervision of the waste collection.

#### **How Will the System Operate?**

Wastes are segregated by the factories in the two bins provided. Paper and plastics are collected when the bins are full and transferred to the paper press for baling. Putrescibles are collected daily. For the larger producers of medium density waste 6m<sup>3</sup> containers are provided and collected when full. For the high density waste producers, 3m<sup>3</sup> containers are provided and collected every 1-3 days. Waste is collected daily from the rest of the El-Kawther District.

The District collects waste in one shift, employing 6-8 people. All wastes are dumped at a site in the desert, approximately 3km away.

At present there is surplus equipment capacity. However, rapid future development is likely to result in more than a 5-fold increase in the volume of waste by the year 2002. Planning for this increase will result in the following collection system.

#### *Collection of the Expected 68m<sup>3</sup> per day of Mixed Waste*

Of the 68m<sup>3</sup> it is expected that 40m<sup>3</sup> will be collected by hand loading and the remaining 28m<sup>3</sup> will be collected in large containers using the container pick up system. The Isuzu truck should be capable of collecting the 40m<sup>3</sup> in 6 loads with one shift of 3-4 employees. If necessary, the low loading trailer will provide back up.

The tractor-trailer-container system requires 2-4 workers and would be capable of moving the 28 m<sup>3</sup> of container waste in around 6 loads. This should be managed in one shift.

Overall, it is estimated that the Isuzu truck and the tractor with a low loading trailer will together have a single shift daily capacity of around 60-70m<sup>3</sup> of wastes, or up to 130m<sup>3</sup> of waste on a double shift.

#### *Collection of the Expected 15m<sup>3</sup> of High Density Wastes*

High density waste will be stored in 3m<sup>3</sup> containers and collected using the tractor-trailer system. Approximately 5 loads per day

will be transferred and ultimately a second shift will be required to handle these wastes.

#### *Collection of the Expected 20m<sup>3</sup> of Paper and Plastics*

It is estimated that by the year 2002 there will be the potential to recycle 20 m<sup>3</sup> or 2 tons of paper, cardboard and plastic materials per day. There is also likely to be further potential to recycle steel cans and other lightweight steel scrap. Paper wastes are presently collected and transported to the District workshop where a paper press has been installed. Paper is then baled and sold for recycling.

#### **How were the Factories Involved?**

Prior to implementation, visits were made to most factories that were in operation at the time. Their views were incorporated into the design of the system and their cooperation was sought in the segregation of waste.

Information leaflets were prepared and disseminated. An awareness workshop was also held for all main stakeholders in the El-Kawther District to discuss the new system and their respective roles.

#### **What was the Capital Cost?**

The capital cost of the equipment was funded by SEAM and cost LE245,465. A breakdown of costs is given below.

**Capital Costs for Waste Collection and Transfer Equipment**

Item	Number	Unit Price (LE)	Total Cost (LE)
100L steel bins	50	120	6000
170L steel bins	44	146.5	6446
6m <sup>3</sup> containers - uncovered	4	3,400	13,600
6m <sup>3</sup> containers covered	2	4,000	8,000
3m <sup>3</sup> containers	3	2,500	7,500
8 ton Isuzu waste collection truck	1	110,000	110,000
65hp tractor	1	45,000	45,000
Low loading trailer	1	14,750	14,750
Container haulage trailer	1	9,000	9,000
Waste paper trailer	1	3,000	3,000
Paper press	1	17,750	17,750
Jawa motorcycle	1	4,419	4,419
<b>TOTAL</b>			<b>245,465</b>

Additional costs were also incurred for preparation of the baling area, uniforms and community awareness campaign.

All labour, fuel, maintenance and other operating costs were born by the El-Kawther District Council. The Council also raises an annual waste management fee equivalent to 0.014% of the capital costs of the infrastructure and buildings for each factory. Charges are in the range LE200-400 per year per factory.

**CONTACTS**

More information on this project and the SEAM Project, are available from:

- ❖ **Egyptian Environmental Affairs Agency (EEAA)**  
 Technical Co-operation Office for the Environment (TCOE)  
 30 Misr Helwan Agricultural Road  
 5th floor, Maadi, Cairo, Egypt  
 Tel.: (20) 2 525 6452 Fax: (20) 2 525 6457  
 email: EEAA2@idsc.gov.eg
- ❖ **SEAM/Entec UK Ltd.**  
 30 Misr Helwan Agricultural Road  
 4th floor, Maadi, Cairo, Egypt  
 Tel.: (20) 2 525 6452 Fax: (20) 2 524 6162  
 email: entecegy@eis.com.eg
- ❖ **Governorate of Sohag**  
 Sohag City  
 Tel.: (20) 93 604491 - 604492 Fax: (20) 93 605222

**March 1999**

# Solid Waste Management Case Study

---

## 150 tpd Compost Plant, Mansoura

Governorate of Dakahleya

---

### Introduction

A 150 ton per day municipal solid waste composting plant has been constructed at Mansoura to treat waste from the City and surrounding environs. The SEAM Project and the Governorate of Dakahleya jointly financed the plant, designed by SEAM. Total cost for plant, equipment and construction was LE2.4 million, significantly cheaper than similar size plants built elsewhere in Egypt. Construction time was 7 months. The quality of the compost is good and is presently sold as a conditioner for land reclamation schemes. Dry recyclables are also recovered and sold. The plant is now operated by a private contractor, under a management contract with the Dakahleya Governorate.

### Why Compost?

Waste generation in the urban areas of Mansoura and adjoining Talkha is estimated to be 305 tons per day. A further 105 tons is generated in the rural districts of both areas. Typically, the organic content of urban waste is 60-70% and for rural waste, 50%. Recyclable material (paper, cardboard, plastic, glass, metal, rags) is 3-7% of urban waste and less than 2% of rural waste. All wastes had been previously disposed at the municipal dumpsite.

As much of Dakahleya is prime agricultural land, the availability of sites suitable for landfilling is severely limited. This problem can be partially addressed through composting, which will reduce the amount of material to be landfilled by 40%. In addition the demand for compost in Egypt has been rising. Within Dakahleya around 55,000 feddans of arid land in the northern part of the Governorate are being reclaimed for which compost can be used as a soil conditioner. Other desert reclamation schemes in Egypt will place further demands on available compost.

Composting is not new in Egypt, the first plant having been established more than 15 years ago. Currently there are 15 plants operating and a further 40 plants have been proposed. The purpose of constructing this plant was not only to take advantage of the economic benefits but also to demonstrate:

- ❖ Low cost technology, the capital cost being at least 40% cheaper than most other plants that had been commissioned.
- ❖ The applicability of a shredder to reduce particle size instead of the more commonly used rotary homogenising drum.
- ❖ Commercial viability through the introduction of a Gate Fee of LE5 per ton, which may in turn encourage the private sector to enter the market.

**What is the Capacity of the Mansoura Plant?**

The plant was designed with a daily capacity of 150 tons, equivalent to 45,000 tons per annum on the basis of 300 operating days per year. The recovered organic content of the waste was estimated to average 50% of the incoming waste stream and compost yield was estimated at 70% of the organic component. Recoverable recyclables (plastics, paper, metal, glass, rags and bones) were estimated to be 5% of the waste stream. A summary of the design capacity follows.

**Design Capacity of the Mansoura Compost Plant**

	%	Tons/Day	Tons/Year
Waste intake	100	150.0	45,000
Recovered dry recyclables	5	7.5	2,250
Organic matter	50	75.0	22,500
Rejects to landfill	45	67.5	20,250
Compost produced	35	52.5	15,750

**Construction and Commissioning**

Detailed design and bills of quantities were prepared for all plant and equipment as well as civil, mechanical and electrical engineering requirements. Tenders were called, the successful bidder being Dakahleya Construction Cooperative, a Mansoura based construction company. All metal fabrication was done locally with only the shredder mill being imported from Germany.

Construction took 7 months commencing April 1998. Commissioning took a further 3 months during which time engineering defects were identified and rectified, staff training was provided, an operations manual prepared and waste characterisation tests undertaken.

The contractor formally handed over the plant to the Governorate in February 1999. Management of the plant was tendered in January 1999 and awarded to a private contractor in March 1999. As at April 1999 the plant was operating at around 55-60% of design capacity and is expected to be close to full production by late 1999.

The plant operates on two 7 hour shifts, 300 days a year. There are 50 employees, including 20 staff on the picking belt, 10 drivers and 10 general labourers.

**What is the Operating Process?**

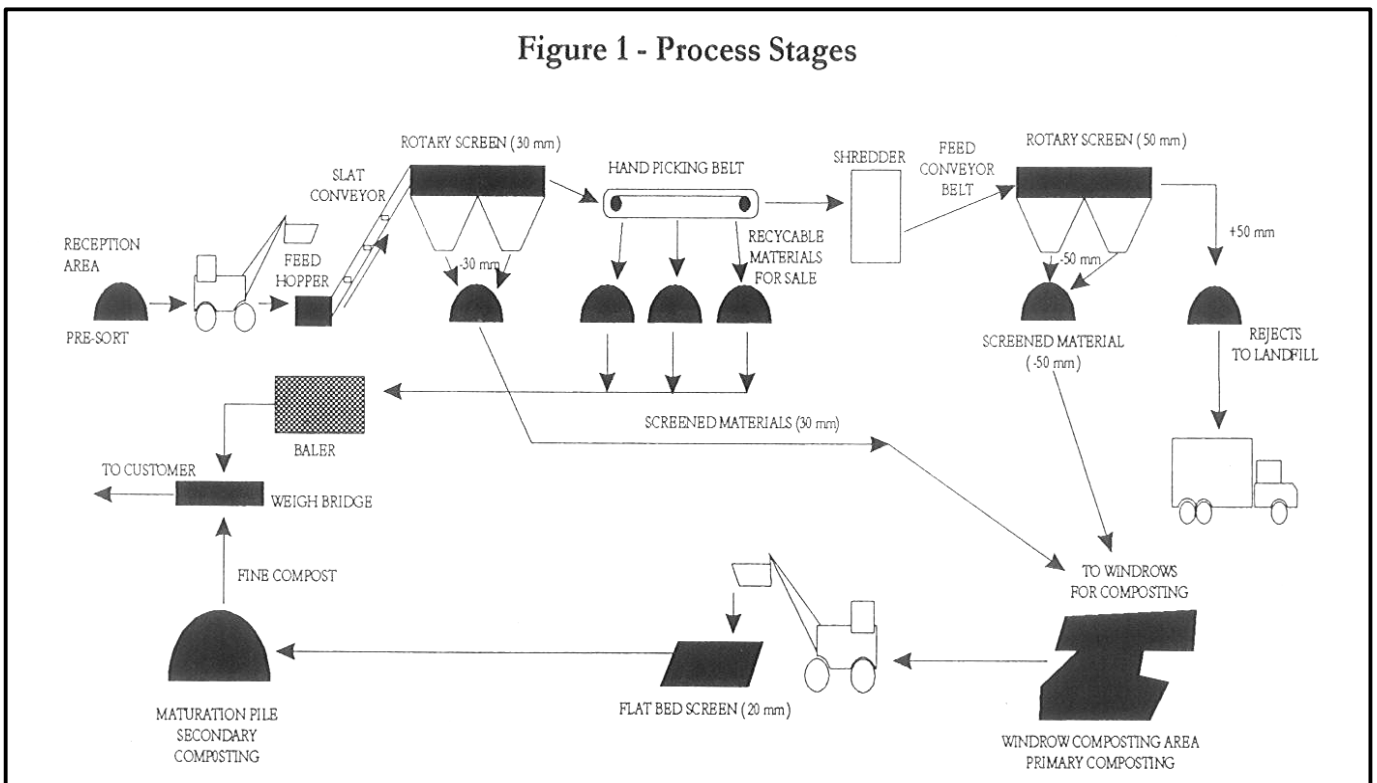
Figure 1 illustrates the process in graphical form. The process may be summarised as follows:

*1. Rough Sorting*

Material entering the site is first weighed at the weighbridge and then delivered to the reception area. Here large objects (e.g. lumps of concrete, tree stumps) are removed by hand and transferred to the dumpsite. Rejects in the first few months of operation averaged 7%.

*2. Pre-screening (30 mm rotary screen)*

Waste material is loaded into a hopper at a rate of 10.7 tons per hour using a front-end loader. The hopper feeds a 30 mm rotary screen via a chain link slat conveyor. The screen incorporates fixed blades within the drum, which facilitates the break-up of waste material. The minus 30 mm component (fines) comprising mostly dust and smaller particles of organic material are collected and transported to the windrows. Fines averaged 33% of the treated waste in pre-testing.



### 3. Picking Belt for Removing Dry Recyclables

The picking belt is 24 m long and 1.3 m wide and travels at 15 m per minute at waist height. There are five picking stations on either side with chutes leading to collection bays below. Pickers are assigned to recover paper, cardboard, plastics, metals, rags, glass and bones. The separated materials are dropped down the chutes and subsequently pressed into bales, except the glass and bones. The percentage of recyclables in the first few months of operation averaged less than 2%.

### 4. Shredder Mill

The material from the picking line passes through a magnetic separator to collect any remaining ferrous metals and then into a shredder mill. The shredded material falls by gravity onto a conveyor belt. The shredder mill breaks down the organic material to the optimal size for composting. Any plastic bags passing through the mill tend not to be shredded and are removed by subsequent sieving.

### 5. Rotary Screen (50 mm)

The shredded material is fed into a high level rotary screen by means of a belt conveyor. The material passing through the screen is collected and transported to the windrows. This has been averaging around 30%. The plus 50 mm fraction, approximately 35% of throughput, is sent to the landfill.

### 6. Aerobic Composting

The minus 50 mm and minus 30 mm fractions are laid out together in windrows, which are approximately 3 m at the base, 2 m high and 50 m long. Water is added to the screened material to raise the moisture content to approximately 50-55%. Windrows need to be turned approximately once a week to avoid material drying and to facilitate aerobic breakdown.

Material is held in windrows for 4-6 weeks during which time degradation of the composting process results in a loss in mass of around 30-45%. During this process the temperature will range from 50°C to 70°C.

### 7. Final Screening and Maturation

When primary composting is complete (4-6 weeks), the material is fed onto a 20 mm flat bed screen using a front end loader. The oversize material is recycled into new windrows. The minus 20 mm material is moved to a maturation pile where it remains for a further 6-8 weeks during which secondary composting takes place. At the end of this period the compost is suitable for sale and the moisture content is in the range 15-30%.

## What Equipment and Infrastructure is Required?

The total area for the compost plant is about 20,000 m<sup>2</sup> of which about 8,500 m<sup>2</sup> are for windrows, and 1,000 m<sup>2</sup> for waste reception.

Main items of equipment and infrastructure are summarised below.

### 1. Plant and equipment Main Items

- ❖ Hopper and swan neck feeder and slat conveyor 1.5m x 17.7 m 5 kW motor.
- ❖ Rotary screen (30 mm) 1.8 m diameter x 5.5 m long 10 kW motor.
- ❖ Hand picking conveyor - 1.3 m x 24 m 6.9 kW motor.
- ❖ Magnetic separator - producing 600 gauss.
- ❖ Heavy duty shredding mill with vibrating feeder 75 kW motor.
- ❖ Inclined belt conveyor 1.3 m x 15 m 5.5 kW motor.
- ❖ Rotary screen (50 mm) 1.8 m diameter x 5.5 m long 10 kW motor.
- ❖ Baling press for paper, cardboard, plastics and textiles.
- ❖ Baling press for metals.

### 2. Infrastructure Main Items

- ❖ Incoming power supplies 120 KVA.
- ❖ Incoming water supplies 100 mm UPVC pipe.
- ❖ Reinforced concrete area for waste reception, buildings and fixed plant.
- ❖ Concrete area for windrow composting and maturation pile.
- ❖ Administration and maintenance buildings.
- ❖ Drainage.
- ❖ Perimeter fence.

The total costs for plant, equipment and infrastructure construction costs was LE2.4 million.

## Waste Characterisation

Six samples varying in size from 11.3 tons to 26.8 tons (average 20.9 tons) were tested during commissioning to determine size fractions and amount of dry recyclables that could be recovered. The averaged results show:

Fines (minus 30 mm)	:	33%
Dry recyclables	:	1.6%
Coarse fragment (minus 50 mm)	:	30%
Rejects (plus 50 mm)	:	35.4%

## What is the Compost Quality?

The quality of the compost produced is considered good. Analysis of compost taken from the final maturation pile gave the following results:

Type of Analysis	Sample 1	Sample 2	Sample 3	Average
Weight per cubic meter, kg/m <sup>3</sup>	610	460	525	532
Humidity, %	35.9	23.4	40.0	33.1
Acidity, pH	8.6	8.5	7.4	8.2
Conductivity, milliohms/cm	5.4	4.6	5.5	5.2
Total Nitrogen, %	1.12	1.03	1.20	1.1
Ammonium Nitrogen, mg/kg	2188	735	2359	1761
Nitrogen nitrate, mg/kg	35	21	259	105.0
Organic matter, %	31.8	36.8	32.1	33.6
Organic carbon, %	18.4	21.3	18.6	19.4
Ash, %	68.2	63.2	68.0	66.5
Carbon : Nitrogen ratio	16.3	20.7	15.4	17.5
Total intestinal bacteria cell/gm x10 <sup>3</sup>	5.0	3.0	15.4	7.8

### Recovery of Recyclables and Compost

Recovery of materials for recycling and the production of compost have been assessed over a three month operational period, from February to April 1999. Recoverable fractions are expressed as a percentage of total waste throughput and are compared to those used in the design stage.

#### Recovered Materials as a % of Waste Throughput

	ESTIMATED Design Stage		ACTUAL Feb. - April 99	
	%	Selling Price Per Ton	%	Selling Price Per Ton
Compost Produced	35	LE18-21	38	LE25
Dry Recyclables	5.0		1.6	
Cardboard and paper	1.6	60	0.4	70
Plastics	0.7	400	0.2	415
Glass	0.7	40	0.4	50
Rags	1.0	30	0.3	15
Metals	0.7	150	0.3	60
Bones	0.3	100	negligible	300
<b>TOTAL</b>	<b>40.0</b>		<b>39.6</b>	

The lower than expected recovery of dry recyclables would seem to indicate that these materials are being scavenged before the waste is delivered to the site.

### Are Capital Costs High?

Capital costs for plant, equipment and construction were at least 40% less than other similar size composting plants that had been commissioned. A summary of costs is:

Component	Costs in LE
Mechanical works	1,585,000
Electrical works	222,000
Civil works	145,000
Sanitation	39,000
Roads	409,000
<b>TOTAL</b>	<b>2,400,000</b>

In addition to the above items the Dakahleya Governorate provided the land as well as vehicles for windrow turning, waste and compost handling.

## What are the Revenue and Operating Costs?

As part of the feasibility study it was estimated that the plant would hit full capacity in its third year. Capacity in Year 1 is reduced due to commissioning and inevitable problems associated with plant start up. As a result it was estimated that revenue from the sale of compost and dry recyclables would rise from LE177,000 in Year 1 to LE578,250 in Year 3 onwards. A breakdown of revenues follows.

### Estimated Annual Revenue from the Composting Plant

Item	Year 1	Year 2	Year 3 on
Waste Treated (tpa)	15,000 <sup>1</sup>	37,500	45,000
Compost Yield (tpa)	5,250	13,125	15,750
Dry Recyclables (tpa)	750	1,875	2,250
Selling Price Per ton			
Compost	18 <sup>2</sup>	18/21	21
Dry Recyclables (weighted)	110 <sup>3</sup>	110 <sup>3</sup>	110 <sup>3</sup>
Revenue (LE per year)			
Compost	94,500	260,000	330,750
Dry Recyclables	82,500	206,250	247,500
<b>Total</b>	<b>177,000</b>	<b>466,250</b>	<b>578,250</b>

#### Notes:

- (1) Reduced capacity due to commissioning and plant start-up
- (2) Reduced price during first year to help establish market
- (3) Average price for recovered recyclables

To achieve full cost recovery a gate fee of LE5 per ton (roughly equivalent to LE0.50 per household per month) is to be imposed on waste treated at the plant. This would generate additional revenue of LE75,075 in Year 1 rising to LE224,950 in Year 3 onwards. The total projected revenue and operating costs for the plant are summarised below.

### Projected Revenue and Operating Costs of the Composting Plant (LE)

Revenue	Year 1	Year 2	Year 3 on
Sales of Compost	94,600	259,875	330,825
Sales of Recovered Recyclables	82,500	206,250	247,500
Gate Fee	75,075	187,550	224,950
<b>Total Revenue</b>	<b>252,175</b>	<b>653,675</b>	<b>803,275</b>

Operating Costs & Expenses	Year 1	Year 2	Year 3 on
Labour	85,387	170,775	170,775
Repairs and Maintenance	66,687	100,045	133,375
Utilities and Fuel	121,687	141,906	162,250
Contingency	27,376	41,272	46,640
<b>Total Costs</b>	<b>301,137</b>	<b>453,998</b>	<b>513,040</b>

Income (Without Capital Depreciation)	(48,962)	199,677	290,235

All operating costs are born by the Governorate and plant operator.

## Is the Compost Plant Sustainable?

The compost plant has been designed to be sustainable through the following actions:

- ❖ Capital costs were shared between the SEAM Project and the Governorate of Dakahleya thus increasing local ownership.

- ❖ All operating costs have been paid by the Dakahleya Governorate and the plant management company.
- ❖ Demonstrable economic benefits in reducing costly land requirements for final waste disposal.
- ❖ Good demand for the type of compost produced both within and outside the Governorate.
- ❖ Recovery and sale of dry recyclables.
- ❖ Imposition of a gate fee of LE5 per ton which enhances financial viability.
- ❖ Technology deployed is straightforward and can be easily maintained.
- ❖ The local manufacture of all equipment, with the exception of the shredder, will facilitate ongoing maintenance and support.
- ❖ Local recruitment and training of the workforce.

## CONTACTS

More information on this project and the SEAM Project, are available from:

- ❖ **Egyptian Environmental Affairs Agency (EEAA)**

**Technical Co-operation Office for the Environment (TCOE)**

30 Misr Helwan Agricultural Road

5th floor, Maadi, Cairo, Egypt

Tel.: (20) 2 525 6452 Fax: (20) 2 525 6457

email: [EEAA2@idsc.gov.eg](mailto:EEAA2@idsc.gov.eg)

- ❖ **SEAM/Entec UK Ltd.**

30 Misr Helwan Agricultural Road

4th floor, Maadi, Cairo, Egypt

Tel.: (20) 2 525 6452 Fax: (20) 2 349 9795

email: [entecegy@eis.com.eg](mailto:entecegy@eis.com.eg)

- ❖ **Dakahleya Governorate**

Mansoura

Tel.: (20) 50 312 535 Fax: (20) 50 317 600

June 1999

# Solid Waste Management Case Study

---

## Remediation of Burning Dumpsite, Mansoura

Governorate of Dakahleya

---

---

### **Introduction**

The main municipal dumpsite for Mansoura City, adjoining Talkha and the surrounding environs was located on the outskirts of the city, adjacent to the sewage treatment works. Approximately 100-150 loads or 400 tons of waste were delivered daily to the site. There were no tipping controls and waste was dumped randomly and set on fire.

Nearby residents had complained of smoke, odour and litter nuisance and people were reluctant to occupy apartment blocks recently built in the area. Responding to a request from the Governorate, the SEAM Project implemented a programme of remediation. Introducing better tipping practices, extinguishing smouldering fires and stabilising large mounds of burnt waste were key implementation priorities. In addition training was provided to the dumpsite workers and the role of scavengers was addressed.

Remediation was undertaken from July to September 1995 and tipping continued on other designated parts of the site till it was eventually closed in November 1996. There are plans by the Governorate to convert the remediated area to a public park.

Remediation cost LE105,120. A bulldozer and water pump were hired for the remediation and subsequently the Governorate purchased a bulldozer to maintain the new tipping practices.

### **Diverting Incoming Waste**

The first stage of the programme was to divert incoming waste to a new tipping area on the same site. This would avoid incoming refuse being ignited by the existing mounds of smouldering waste. An area of disused sludge drying beds, immediately adjacent to the burnt waste was selected.

Groundwater impacts were assessed and considered insignificant in the light of past practices. It was reported that the old dumpsite had not adversely affected the quality of the groundwater. In view of this and the remaining limited life of the site the use of a waste liner at this late stage was considered not feasible.

### Introducing New Tipping Practices

Incoming waste was dumped and spread out by a shovel loader to allow scavengers access to recover any recyclable materials. By controlling the area where scavengers could work this reduced the safety risk as previously they roamed the site often getting in the way of incoming vehicles.

The bulldozer was then used to tip, level and compact the waste in layers, or cells, between 10-20m wide and to a height of 2m. The waste cells were covered at the end of each day with a thin layer (150mm) of soil excavated at the site or by using suitable incoming construction waste. Daily cover minimises the risk of spontaneous combustion and reduces odour, flies and the amount of wind blown litter.

Cells were planned over the available areas and were prepared several days ahead by recovering and storing available cover material. Banks, 2m high, were also prepared around the proposed cell. Tipping in successive layers on the top of existing cells was practised up to a maximum height of 10m.

Training for the supervisors and onsite workers was provided on the new tipping procedures.

### How were Dumpsite Fires Extinguished?

Waste that had been recently dumped and set on fire would burn out within a few days. Diverting incoming waste to a different part of the site prevented adding further fuel to the existing fires.

However there was a huge volume of burnt waste that continued to smoulder in places. These areas were doused in water by pumping treated effluent from the discharge canals of the adjoining sewage treatment works. Despite this there were still hot spots which continued to smoulder at depth. These were excavated with a back-end loader and doused.

### Did Waste Disposal Continue?

In the period July to September 1995 an area of about 100m by 100m had been tipped to an average depth of approximately 3m, representing a total input of 30,000m<sup>3</sup>. The average volume tipped weekly was therefore around 2,500m<sup>3</sup> after compaction on site. The total remaining area for tipping as at September 1995 was identified at 137,500m<sup>3</sup> as indicated below.

### Available Disposal Space, Mansoura Dumpsite (September 1995)

Location on Site	Area (m <sup>2</sup> )	Available Depth (m)	Volume (m <sup>3</sup> )
Disused sewage sludge drying beds	10,000	3	30,000
Low areas caused by burned out waste	10,000	2	20,000
Borrow pits from excavated cover material	10,000	3.5	35,000
Other disused areas of the sewage works	10,000	3.5	35,000
Site of disused waste incinerators	5,000	3.5	17,500
<b>TOTAL</b>	<b>45,000</b>		<b>137,700</b>

At the rate of delivery of waste to the site, the tipping space identified as available gave a life span of 55 weeks. The dumpsite was subsequently closed in November 1996.

### Converting the Dumpsite to a Public Park

The burnt out waste remained in unstable mounds up to 12m in height. These areas were then graded to form a gentle slope and covered with soil excavated at the site. The covering served to:

- ❖ Reduce the likelihood of wind blown ash.
- ❖ Reduce the oxygen supply to underlying areas thereby minimising the risk of further combustion.
- ❖ Improve the visual impacts.

With grading and top dressing the area had been beneficially upgraded and was left in a suitable condition to be transformed into a public garden as planned by the Governorate.

### How were the Scavengers Affected?

An average of 64 scavengers worked on the old dumpsite, their ages ranging from 7 to 60. Before remediation the scavengers lacked even the most basic facilities. They had no access to clean water for drinking or washing, nowhere to eat or rest, no shelter and no proper toilet facilities. They and their children washed in the sewage works effluent and were exposed to considerable hazards from dangerous materials on the dumpsite (particularly clinical waste).

The scavengers arrive at the tip around 8.00 a.m. in the morning and remain while there is still sufficient daylight to sort waste. This is around 8.00 p.m. in summer and 6.00 p.m. in winter. The average quantities of recyclable materials that scavengers can pick per day is estimated as: 2 tons of paper; 100kg of glass; 50-100kg of plastics; and 150-700kg of metals. The average productivity of the scavengers per day is about 40-45kg of assorted dry materials. Earnings can amount to LE7-12 per person per day equivalent to LE175-300 per month. A social development study was commissioned to assess how to best deal with the scavengers. A number of options were considered including banning them completely although this would have detrimental consequences in loss of income to the individual. The favoured option allowed scavenging to continue but under controlled and improved conditions, which included:

- ❖ Designated area for scavenging incoming waste with time allowed to pick the waste before it was moved to the tip and compacted. This reduced the dangers of scavengers being accidentally hit by incoming vehicles.
- ❖ Preventing waste burning, which reduced their exposure to smoke inhalation.
- ❖ Provision of protecting clothing.
- ❖ Educating scavengers on health and safety issues.

- ❖ Provision of a shaded rest area.
- ❖ Provision of a first aid kit.

Due to the limited life of the dumpsite a clean water supply for drinking and washing could not be provided but was recommended for any new dumpsite.

### What are the Benefits of Remediation?

The introduction of the new tipping practices and the remedial works undertaken resulted in the following benefits:

- ❖ Elimination of fire and smoke and the minimisation of odour nuisance to nearby residents and people working at the site.
- ❖ Reduced problems associated with wind-blown litter and flies.
- ❖ Greater operational safety.
- ❖ Better control on scavenging and improved working conditions for scavengers.
- ❖ More income for scavengers due to easier access for recovering recyclables.
- ❖ Improved visual appearance of the site by cleaning, levelling and covering the old dump areas.
- ❖ Proposed Governorate redevelopment of the remediated site to a public park.
- ❖ Capacity building of supervisors and workers to maintain and replicate the new tipping practices.

Nearby residents were very pleased with the results of the remedial actions. It was also noted that residential building activity in the nearby areas had also accelerated since the site had been remediated.

### What are the Costs for Better Tipping Practices?

Equipment costs for implementation are outlined below.

#### Implementation Expenditure for Remedial Works and Improved Tipping

Item	Cost (LE)
D6 Bulldozer hire for 3 months	58,700
Extraction and transportation of daily cover material	31,600
Water pump rental and hose pipe	3,820
On site workers	4,600
Equipment for scavengers	2,800
Miscellaneous (spare parts, fuel etc.)	3,600
<b>TOTAL</b>	<b>105,120</b>

An approximation of the increased weekly operating costs as a result of the improved tipping practices are outlined below.

#### Approximate Weekly Increases in Operating Costs

Item	BEFORE LE	AFTER LE
Staff	320	320
Bulldozer (based on LE100 per hour rental)	500	4,000
Water pump (based on LE30 per day rental)	NA	180
2 x Tractor-trailers (based on LE 80 per day rental)	NA	960
<b>TOTAL</b>	<b>820</b>	<b>5,460</b>
Cost LE/m <sup>3</sup> (based on 2,500m <sup>3</sup> per week)	0.33	2.18
Costs spread per household per month	0.05	0.30

### CONTACTS

More information on this project and the SEAM Project, are available from:

- ❖ **Egyptian Environmental Affairs Agency (EEAA)**  
 Technical Co-operation Office for the Environment (TCOE)  
 30 Misr Helwan Agricultural Road  
 5th floor, Maadi, Cairo, Egypt  
 Tel.: (20) 2 525 6452 Fax: (20) 2 525 6457  
 email: EEAA2@idsc.gov.eg
- ❖ **SEAM/Entec UK Ltd.**  
 30 Misr Helwan Agricultural Road  
 4th floor, Maadi, Cairo, Egypt  
 Tel.: (20) 2 525 6452 Fax: (20) 2 349 9795  
 email: entecegy@eis.com.eg
- ❖ **Dakahleya Governorate**  
 Mansoura  
 Tel.: (20) 50 312 535 Fax: (20) 50 317 600

**February 1997**

# Community Environmental Projects

## Case Study

---

### Solid Waste Collection, Bardees Village

Governorate of Sohag

---

---

#### **INTRODUCTION**

Bardees is a rural village located in El Balliana Markaz in the southern part of Sohag Governorate. Population is around 40,000 with a high proportion of low income families. Bardees had been trying to deal with a growing waste problem with old equipment in poor condition.

As part of the Sohag Governorate Environmental Action Plan solid waste issues had been ranked by the community as the number one priority requiring attention. In response to a request to assist the community of Bardees, support was provided through SEAM to improve the waste collection system. Community participation has been an integral part of the project.

#### **ISSUES**

Previously, waste collection was undertaken using two old Belarus tractors with box trailers having a high loading height and limited capacity of 2.5 m<sup>3</sup>. Most of the wastes for collection are in loose heaps which are loaded into baskets and then lifted into the trailer. Waste is transported to a small disposal site about 4 km away.

Concerns and issues that arose were:

- ❖ Inadequate equipment in poor condition.
- ❖ Existing trailers have limited capacity with a high loading height of 1.9 m. Workers are required to load the trailer above their heads resulting in unhygienic waste spillage.
- ❖ Insufficient coverage - only 11% of residents in the smaller streets claimed they received a service. Service in main streets was much better.
- ❖ Community satisfaction of waste collection service is low, with only a 15% approval rating among households and 45% approval rating among non-households.
- ❖ 36% of residents regarded their streets as dirty.
- ❖ Lack of community awareness and involvement.

#### **IMPLEMENTATION**

##### **Waste characteristics and community views**

At the outset, an assessment was made of the waste characteristics and community views were sought on how to improve the waste collection system.

The waste for collection was found to be 60-70% ash and dirt. Residents tend to use organics for animal feed and recycle any materials of value. Common disposal practices, by residents, of the remaining waste are:

- 61% burn wastes in oven
- 30% put waste in collection vehicle
- 25% dump in nearby empty area
- 8% throw in canal
- 7% collected by door to door cleansing workers

Presumably in view of the way in which waste is disposed, only 9% of households were interested in segregating their waste prior to disposal.

On the preferred mechanism of waste collection, 72% favoured collection in bins and 28% in plastic bags. Over 66% of households and 89% of shops preferred to have their waste collected between 8:00-10:00 a.m.

### Waste collection equipment

In view of the nature of the waste a fore and aft trailer was designed with a capacity of 7 m<sup>3</sup> and a loading height of 1.2 m. Its application is appropriate for high density waste and with a fully enclosed body it is more hygienic during loading and transportation. The hydraulics allow for two way movement of the container. A large, low full width hopper at the rear is loaded with wastes and the body then tips forwards to allow the wastes to fall into the front of the body. For discharge the body tips backwards. Handcarts were provided to facilitate collection in very narrow streets and additional bins were provided along main streets.

The existing box trailers were upgraded by cutting doors into one side of each trailer while increasing the sides from 0.4 m. to 1.0 m. This had the effect of reducing the loading height from 1.9 to 1.5 m. and increasing the capacity from 2.5 to 7.0 m<sup>3</sup>.

The fore and aft trailer is capable of serving 6,870 households with a workforce comprising 2 supervisors, 17 sweepers and 1 driver. The modified trailers are used as back up and for collecting waste from outlying satellite villages.

Tree planting was undertaken along main streets and workers were provided with uniforms.

### COMMUNITY PARTICIPATION

Community participation, focus group discussions and awareness raising was an integral part of the project. Community views were sought from the beginning which helped in the design of the system and enabled perceived problems to be addressed.

Consultation with the waste collection workers helped to identify environmentally unsound practices of residents like dumping of household waste, ash from ovens and construction waste in the streets and in the central canal. On the other hand, women expressed their opinion about the behaviour of street sweepers, the inadequate coverage of the service, and the low standard of cleansing.

The head of the local council was very supportive throughout the project. The council organised a number of meetings and promotional campaigns.

Three Community Development Associations (CDAs) were involved in awareness-raising: the Association for Quran Memorisation and Family Care, the Muslim Youth Organisation

and the Soldiers of Jesus Association. The first CDA reached out to women through its literacy classes, sewing centre and day-care centre. Members of the second CDA, all young people from Bardees, distributed leaflets to shop owners to urge them to put their waste in garbage bins and to take care of trees. Posters were hung in their library, social club and cultural centre and meetings were organised to raise the awareness of youth. The third CDA organised awareness-raising in its own building and in two churches.

Additional awareness raising activities included door to door discussions and group meetings organised by the local council and the community.

Some of the key stakeholders involved included:

<b>Key Stakeholder Groups and their Roles</b>
<b>Community residents</b>
<ul style="list-style-type: none"> <li>❖ expressing views on improvements to waste collection</li> <li>❖ involved in women focus group discussions</li> <li>❖ participated in awareness-raising</li> <li>❖ willing to pay for improved service</li> </ul>
<b>Local council</b>
<ul style="list-style-type: none"> <li>❖ planning and co-ordination</li> <li>❖ operation of waste collection service</li> <li>❖ involved in awareness raising</li> </ul>
<b>Governorate</b>
<ul style="list-style-type: none"> <li>❖ planning and implementation</li> </ul>
<b>CDAs and NGOs</b>
<ul style="list-style-type: none"> <li>❖ involved in design and implementation of awareness-raising</li> <li>❖ to be involved in operation and user fee collection</li> </ul>
<b>Waste collection workers</b>
<ul style="list-style-type: none"> <li>❖ involved in focus group discussions</li> <li>❖ provide feedback on improvements to the system</li> <li>❖ help prepare environmental messages</li> </ul>
<b>Religious leaders</b>
<ul style="list-style-type: none"> <li>❖ involved in awareness-raising</li> </ul>
<b>Institute of Social Work, Sohag</b>
<ul style="list-style-type: none"> <li>❖ conducted social survey</li> <li>❖ facilitated focus group discussions</li> </ul>

## CAPITAL AND OPERATING COSTS

A cost breakdown of main capital items and operating expenses, excluding any overheads from the Bardees local council, are summarised below.

Capital cost	LE
Tractor - Universal 600	42,000
Fore & Aft trailer - 7 m <sup>3</sup>	20,000
Handcarts	2,700
Worker uniforms	1,160
<b>Total</b>	<b>65,860</b>

Operating costs per month	LE
Fuel	420
Labour	2,290
Maintenance	254
Capital depreciation - over 7 years	784
<b>Total</b>	<b>3,748</b>
Cost per house per month	0.55
<b>Plastic bags</b>	
10 per house per month	4,492
Cost per house per month	0.65
<b>Total cost per house per month</b>	<b>1.20</b>

In addition to the above, additional costs were incurred for tree planting, awareness raising programmes for local residents, alterations to existing trailers and spare parts.

## SUSTAINABILITY

Throughout the project the Bardees local government unit has met all operating costs and the service is now being provided on a more cost effective basis.

Cost recovery was assessed in the social survey. This showed that 68% of the community are willing to pay for an improved waste collection service. Results showed the following:

Willingness to Pay for Waste Collection	
Fee per month	% of Respondents
LE0.50	23%
LE1.00	27%
LE1.50-2.00	22%
LE2.50-3.00	15%
LE3.50-4.00	4%
LE5.00 or more	9%
Average Fee Per Month (LE)	
Households	1.60
Shops	2.70
Clinics	7.70

It should be noted that:

- ❖ The operating cost per household of LE1.20 per month is less than the average fee of LE1.60 per month that residents were willing to pay.
- ❖ Some residents are already paying between LE1.5-2.0 per month to have their waste removed by a local person with a donkey cart.

- ❖ In focus group meetings women expressed the view that fees should be adjusted to income levels.

The introduction of a user fee had been agreed and this is likely to be implemented through a local NGO on the following basis:

- ❖ Service to be operated by the NGO.
- ❖ Fees to be collected by the NGO based on a differential between houses, shops and clinics. Household fees should not disadvantage the very poor.
- ❖ Income to be split 50:50 between the NGO and the Council.
- ❖ 50% income split to the Council to cover fuel, labour incentives and maintenance.
- ❖ 50% split to NGO to cover plastic bags, fee collection and management costs.

In summary, the project was designed to be sustainable in the following ways:

- ❖ Gaining the involvement of the local council and community in design and implementation.
- ❖ All operating costs have been borne by the local council.
- ❖ A user fee for cost recovery has been agreed and the will be implemented through a local NGO. There has been a 68% willingness to pay among residents surveyed.
- ❖ Training of waste collection workers and their supervisors.
- ❖ Increased awareness of residents on the need to maintain a good waste collection service.

## BENEFITS AND ACHIEVEMENTS

- ❖ A better waste collection service for residents which has been adapted to their needs.
- ❖ Improved environmental conditions with positive effects for public health.
- ❖ Increased environmental awareness among the residents.
- ❖ Enhanced visual impacts through less street waste and additional tree planting.
- ❖ Enhanced co-operation between the local council and NGOs/CDAs in tackling a community priority.

## **CONTACTS**

More information on this project and the SEAM Project, are available from:

❖ **Egyptian Environmental Affairs Agency (EEAA)**

Technical Co-operation Office for the Environment (TCOE)  
30 Misr Helwan Agricultural Road  
5th floor, Maadi, Cairo, Egypt  
Tel.: 20 2 525 6452  
Fax: 20 2 525 6457  
email: EEAA2@idsc.gov.eg

❖ **SEAM/Entec UK Ltd**

30 Misr Helwan Agricultural Road  
4th floor, Maadi, Cairo, Egypt  
Tel.: 20 2 525 6452  
Fax: 20 2 349 9795  
email: entecegy@eis.com.eg

❖ **Governorate of Sohag**

Sohag City  
Tel.: 093 604491 - 604492  
Fax: 093 605222

***February 1999***

# Community Environmental Projects Case Study

---

## A Community Based Solid Waste Collection Service, Village of Gedelah, East Mansoura

Governorate of Dakahleya

---

### **INTRODUCTION**

As part of the Dakahleya Governorate Environmental Action Plan, extensive consultation showed that the community ranked solid waste management as the highest environmental priority requiring attention. In addition, mobilising community resources and encouraging community-based actions is considered to be an integral part of the Action Plan for improving environmental conditions.

A community based action to address a local solid waste problem was proposed by the Society for the Development of the Community of Gedelah. This Society is an active Community Development Association (CDA) that indicated the community's willingness to contribute to the costs of sustaining an improved solid waste service.

Gedelah is a village of around 50,000 people in the East District of Mansoura. Support was provided by SEAM to establish a community based solid waste collection service in a lower income area, initially covering around 1,600 households.

### **PROBLEMS WITH PREVIOUS WASTE COLLECTION SYSTEM**

A social survey undertaken in the area indicated that 78% of residents were dissatisfied with the previous waste collection service and 59% considered their streets dirty. Problems cited were waste accumulation in the streets, infrequent collection service and lack of street sweeping.

The high loading height of the box trailers required workers to lift waste above their heads into the container. As a result they struggled with heavy loads and in addition, waste frequently spilled back over the workers, which posed a health risk. These issues were addressed in designing new equipment.

### **INTRODUCING A COMMUNITY BASED WASTE COLLECTION SERVICE**

From the outset community views were solicited on how to improve the waste collection system. A social survey was undertaken of 349 randomly selected establishments, of which 291 were households and 58 were non-households (shops, workshops, street vendors and clinics). Twelve volunteers from the CDA, who were given some training on interview techniques prior to commencement, undertook the survey.

Of the respondents, 30% were male and 70% female. Monthly household incomes were generally less than LE500 with 35% below LE250. Average household size was 5.

Some key findings were:

- ❖ 6% previously received a door-to-door collection service.
- ❖ 36% preferred waste to be collected in plastic bags.
- ❖ 23% preferred waste collection between 8.00-10.00am; 31% favoured 4.00-6.00pm.
- ❖ 88% were willing to pay for an improved service.
- ❖ 70% preferred a monthly charge of less than LE2.50; average for all was LE2.25.
- ❖ 21% dumped waste on vacant land.

Although only a third preferred collection in plastic bags, the CDA opted to introduce an initial trial period by distributing free bags. This proved effective and has continued.

To overcome the high loading problems of the box trailer a low-loading trailer was designed. The new design had the advantages of reducing the loading height to 1.45m and increasing carrying capacity by 30% to 4.0 m<sup>3</sup>. The trailer (2m wide by 3m long) is pulled by a tractor and can be easily manoeuvred in narrow streets. A tractor driven hydraulic system allows rear end tipping for discharging waste. The wheels specified are suitable for maximum axle loads of up to 3.75 tons or, allowing for weight transfer and body weight, typical pay loads of around 4 tons. This will allow for waste densities of up to 900 kg/m<sup>3</sup> although normal waste densities are less than 500 kg/m<sup>3</sup>. The prototype was made in Cairo and a second trailer was fabricated in a local Dakahleya engineering workshop for LE6,500. The new trailer proved successful and the design is being replicated by the Governorate in other villages.

Overall, a tractor with front loading bucket for scooping up accumulated waste and two low loading trailers were provided to the CDA.

In introducing the service, the CDA initially contracted a private company to operate the equipment, collect fees and pay rent to the CDA. The rent was used to purchase plastic bags and trees for planting. However, management and administrative issues, coupled with the initial poor collection service, necessitated the CDA to run the service themselves.

### **HOW DOES THE SYSTEM OPERATE?**

The service is operated by the CDA. Workers were recruited and trained to use the equipment. The new service includes street sweeping and door-to-door waste collection from subscribers. There are 15 staff including 7 waste collectors, 3 street sweepers, one foreman for the workers, one tractor driver, a fee collector, a plastic bag distributor and a general supervisor. Working hours are 8.00-3.00pm, with daily waste collection in the main streets and every second day elsewhere. Trailer loading time has been around 3 hours and 2 loads are collected per shift.

A monthly fee of LE2 per household and LE3 per shop was introduced for the waste collection service. Fees are collected door-to-door by the CDA fee collector who places a sticker on the door of those houses that have paid. For the first 6 months, households and shops were provided plastic bags free of charge, and thereafter an additional LE0.5 monthly fee was charged. Labour, fuel and maintenance costs are borne by the CDA.

At present 80% of households and shops are paying the monthly fee.

### **COMMUNITY PARTICIPATION**

Raising the community's awareness of the service and the need to improve waste management was an essential component of the project. This process started with the distribution of leaflets during the first social survey. Subsequently leaflets were distributed door-to-door, in the streets and after the Friday prayers at the mosques. A number of community awareness meetings were held at the CDA.

The CDA established an Environmental Committee and street representatives were appointed to monitor the waste collection service. The committee meets weekly with representatives from all streets after Friday prayers.

A clean-up was also organised by the CDA in co-operation with the residents to remove accumulated waste.

Beautification efforts started three months into the project with a tree planting programme. Each household wishing to have a tree was asked to pay 40% of the cost (LE3 out of the LE7 total).

To date, 49% of residents have participated in the tree planting organised by the CDA. Of the remaining 51%, the main reasons for not participating were:

- ❖ 26% lacked adequate space.
- ❖ 18% were unaware of the scheme.
- ❖ 12% felt children playing in the street would damage the trees.
- ❖ 14% did not have the money.

Community views on the effectiveness of the service were sought 6 months after the system was operational. The survey covered 300 establishments (15% of total), comprising 276 households and 24 non-households. A comparison of results before and after is summarised as follows:

	Before	After
Residents satisfied with waste collection service	22%	56%
Residents who consider streets are clean	27%	53%
Number of residents subscribing	NA	80%

Although there has been a significant increase in the satisfaction levels, there is clearly scope for further improvement. Residents in medium sized streets were most satisfied and those in narrow streets least satisfied. Of those who were not satisfied the main reasons cited were irregular service and insufficient street sweeping. Overall, residents were supportive of a community-based organisation taking responsibility for improving the waste collection.

The 80% of the residents who are paying compares well with the 88% of residents that indicated a willingness to pay in the initial survey.

Of the 20% of residents who do not subscribe to the service, reasons for not paying were mainly:

- ❖ 44% felt they already paid the 2% Governorate cleaning fee.
- ❖ 15% did not like the service.
- ❖ 11% were considered too poor to pay.

The new design of the trailer design was favoured by the workers who found it easier and safer to load.

### FINANCIAL ISSUES

A breakdown of the capital and operating costs, together with an estimate of fee income, is given below.

Capital Costs (LE)		
Main items	1 x Universal 650 Tractor with loader 2 x Low loading trailers	37,000 19,500
	<b>TOTAL</b>	<b>56,500</b>

Operating Costs (LE per month)		
Labour	1 x supervisor @ 200 per month	200
	1 x fee collector @ 200 per month.	200
	1 x foreman @ 150 per month	150
	12 x workers @ 150 per month	1,800
	<b>Sub-total</b>	<b>2,350</b>
Fuel	300 lt. p.m. @ 0.40 per litre.	120
Plastic bags	Total cost 700 per month	700
Maintenance	5% of capital cost (LE56,500) per year	235
Dumpsite fees	LE2 per load for 60 loads	120
Depreciation	Capital cost depreciated over 7 years	667
	<b>TOTAL</b>	<b>4,192</b>
Average cost per establishment (based on 1,600 subscribers)		2.62

Fee Income (LE per month)		
Current Fee Income (approximate)	1,440 households @ LE 2.5 p.m.	3,600
	160 shops @ LE 3.5 p.m.	560
	<b>TOTAL</b>	<b>4,160</b>

The above costs indicate that operating costs are almost entirely covered by the current level of fees paid by the community.

Expenditure was also incurred by SEAM for the purchase of plastic bags, trees and the environmental awareness programme.

### SUSTAINABILITY AND REPLICABILITY ISSUES

A community-based service has been initiated with about 80% of the residents participating in the scheme. The service presently operates at close to break even after allowing for depreciation of the equipment provided by SEAM. There is excess capacity within the system and as additional households are

attracted into the scheme then the extra income will help consolidate the financial position. It will be important to strengthen management of the collection and ensure that workers provide a level of service that will satisfy the residents who are paying for it.

The system has been well received by the Governorate who report that similar schemes have since been established in five other areas using the normal box trailers. At least nine other CDAs visited the Gedelah waste collection project in the first half of 1998 and residents from the surrounding areas have requested a similar service.

The Governorate is also replicating the basic design of the low loading trailer. Indications are that another 50 will be purchased for use in other villages.

### ACHIEVEMENT HIGHLIGHTS

- ❖ Implementation of a community based waste collection service, adapted to the needs of residents.
- ❖ 80% participation of the community in paying the monthly fee.
- ❖ Improved environmental conditions with positive effects on public health.
- ❖ Increased environmental awareness among residents.
- ❖ Employment opportunities developed, with 15 jobs created.
- ❖ Capacity-building of the Gedelah CDA.

## **CONTACTS**

More information on this project and the SEAM Project, are available from:

- ❖ **Egyptian Environmental Affairs Agency (EEAA)**  
Technical Co-operation Office for the Environment (TCOE)  
30 Misr Helwan Agricultural Road  
5th floor, Maadi, Cairo, Egypt  
Tel.: (20) 2 525 6452 Fax: (20) 2 525 6457  
email: EEAA2@idsc.gov.eg
- ❖ **SEAM/Entec UK Ltd**  
30 Misr Helwan Agricultural Road  
4th floor, Maadi, Cairo, Egypt  
Tel.: (20) 2 525 6452 Fax: (20) 2 349 9795  
email: entecegy@eis.com.eg
- ❖ **Dakahleya Governorate**  
Mansoura City  
Tel.: (20) 50 312 535 Fax: (20) 50 317 600

***March 1999***

# Community Environmental Projects Case Study

---

## Developing a District-Community Partnership for Solid Waste Collection in Kolongeel Village

Governorate of Dakahleya

---

### **INTRODUCTION**

Problems related to solid waste issues were ranked as the top priority by stakeholders consulted during the preparation of the Dakahleya Governorate Environmental Action Plan (GEAP). In addition, mobilising community resources and encouraging community-based actions is one of the main objectives of the Action Plan in order to improve the environment.

As Mansoura city is expanding, many of the rural areas around the city have been urbanised in the last ten years or so. The communities from four villages around Mansoura including Kolongeel, Ezbet El-Shal, El-Bahr El-Sagheer and Kafr Badamas, requested assistance from SEAM to tackle their solid waste problem. The clean-ups that were undertaken in the four areas and the subsequent establishment of a permanent waste collection system in Kolongeel demonstrated a unique partnership between the Community Development Association (CDA) of Kolongeel and the district of East Mansoura.

### **PROBLEMS WITH THE PREVIOUS WASTE COLLECTION SYSTEM**

The village of Kolongeel is a typical example of a low income neighbourhood, with population of around 7,500 people, living together in extended families. A social survey undertaken in the village indicated that 92% of residents were not satisfied with the waste collection service provided before the project. Residents and shop owners were suffering from piles of garbage especially in the middle and narrow streets, due to the irregular collection services. The other three areas also suffered from similar problems.

A low-loading trailer, based on the design developed for another Community Project, was provided. It has more capacity and lower loading heights than the box trailers that are traditionally used.

### **CLEAN-UP IN FOUR DAKAHLEYA VILLAGES**

The project was championed by Mrs. Zeinab Ibrahim Ahmed who is an active member of Kolongeel CDA and the Women Representatives Association of Egypt's National Democratic Party. Mrs. Zeinab has previously mobilised a local group of women and school students to undertake effective community based actions to solve local environmental problems.

At the outset Mrs. Zeinab and 50 women volunteers from the CDA and Womens Association initiated community awareness raising on solid waste issues. Mrs. Zeinab along with her volunteers organised home visits to inform residents about the new project and to gain their support. Another objective of these visits was to identify a group of promoters or so-called street leaders who would distribute leaflets and flyers, and participate in awareness raising. Cloth signboards with texts on the importance of hygiene practices and public health were also hung in the villages to raise awareness. Seminars in social clubs were organised, along with meetings of children in their schools.

Before starting the clean-up campaigns, senior governmental officials, SEAM project staff, and the media were invited along with the residents to a large ceremony organised by the CDA to obtain support from all partners. After the ceremony, major waste clean-up campaigns were undertaken with a joint effort of the local communities, 100 students from five schools and labourers from East Mansoura District. The SEAM tractor/trailer and waste collection equipment from the District were used to remove piles of garbage that had accumulated in the areas over the years.

#### **INTRODUCING A COMMUNITY BASED SERVICE**

After the clean-ups in the four areas a permanent waste collection system was established in Kolongeel with the tractor and low loading trailer provided by SEAM. The East Mansoura District took responsibility for maintaining the other three cleaned areas and to improve the waste collection service there.

Consultation meetings were held with the different stakeholders at Kolongeel before implementing the waste collection service. A social survey was conducted to consult the local residents about their expectations from the project. The waste workers were involved as well to design a system that would enable them to undertake their work effectively and efficiently.

The nature of the waste in Kolongeel resembles the waste in other urban neighbourhoods and has the following characteristics: 50% organic waste, 25% dirt and ash, 22% non-organic waste (stones, sand, gravel, etc.), 1.3% paper, 0.4% iron, 0.3% old cloth, 0.2% plastic, 0.7% glass, and 0.1% bones. It is interesting to note that waste collectors in Kolongeel, as in other areas in Mansoura, tend to segregate plastic items during their rounds which they then sell for LE0.20/kg.

#### **HOW DOES THE SYSTEM OPERATE?**

The waste collection service that was established after the clean-ups in Kolongeel, is operated by Kolongeel CDA in collaboration with East Mansoura District.

The District provides a driver and two garbage collectors on a permanent basis. Their salaries are topped up by LE30-50 per month by the CDA. One additional worker was recruited by Kolongeel CDA as well as a part time fee collector, who comes from the same village. The new service includes street sweeping in main streets while in the narrow streets residents take responsibility for sweeping in front of their houses.

Collecting waste from households and commercial premises is done in an innovative way. When the tractor-trailer passes by, one of the workers blows a whistle to alert the residents to bring their waste down to be collected. Working women usually leave their waste on the main street, early in the morning before going to work. 32% of residents use plastic bags to dispose their waste, 43% use a tin container, and 25% use a plastic bin or bucket. This service is provided daily and minimises scavenging and scattering waste by animals.

According to a survey, which took place a few months after launching the project, most of the residents (94%) in Kolongeel were satisfied with the collection system. The main reason given for their satisfaction was the reliability of the service. Residents and shop owners also believe it is easier than before, because they don't have to walk a long distance to dispose of their waste.

Another indication of satisfaction is that 80% of households and shop owners paid a fee of LE1 per month to cover the operation costs of the service. A member of the Kolongeel CDA collects the monthly fee on a door-to-door basis. Although some of the poorer households are not able to pay regularly, Kolongeel CDA is still committed to collecting the waste from every household.

A special management committee of nine members, including residents, CDA members and officials from East Mansoura district was formed to monitor the project. This committee meets monthly to discuss issues related to the project and to provide guidance to the working team.

The East Mansoura District is committed to working with the Kolongeel CDA and to providing the necessary work force every day.

Once the waste had been removed trees were planted to help beautify the area. Planting was organised by the CDA with the assistance of the village children. They gave the trees their own names and were keen to protect them against wind and animals.

## FINANCIAL ISSUES

Capital Cost (LE)		
<b>Main Equipment</b>	1 x Universal 650 Tractor with loader	37,000
	1 x Low loading trailer	13,000
	<b>TOTAL</b>	<b>50,000</b>

Operating Cost (LE per month)		
<b>Labour</b>	1 x District driver @ LE 50 per month salary top up	50
	2 x District collectors @ LE 50 per month salary top up	100
	1 x waste collector from Kolongeel CDA @ LE 100 pm	100
	1 x fee collector from Kolongeel CDA @ LE 100	100
	<b>Sub-Total Labour Costs</b>	<b>350</b>
<b>Fuel and oil</b>		243
<b>Maintenance</b>		95
	<b>TOTAL</b>	<b>688</b>

Fee Income (LE per month)		
<b>Fees collected</b>	750 households and shops @ LE 1/month	750
<b>Profit</b>	Before Depreciation	62
<b>Depreciation</b>	Capital Costs depreciated over 7 years	595
<b>Loss</b>	After Depreciation	533

Before depreciation the service runs at a slight profit although the actual labour costs born by the District have not been taken into account. If depreciation of the equipment, that was provided by SEAM, was taken into consideration then the service would lose money. To be able to provide for replacement equipment then a higher monthly fee income will need to be introduced. A survey of residents indicates their willingness to pay more.

## SUSTAINABILITY AND REPLICABILITY ISSUES

The project was designed to be sustainable in the following ways:

- ❖ Raised awareness among the community on handling solid waste.
- ❖ Commitment by the East Mansoura District to maintaining the cleaned areas.

## CONTACTS

More information on this project and the SEAM Project, are available from:

- ❖ **Egyptian Environmental Affairs Agency (EEAA)**  
 Technical Co-operation Office for the Environment (TCOE)  
 30 Misr Helwan Agricultural Road  
 5th floor, Maadi, Cairo, Egypt  
 Tel.: (20) 2 525 6452 Fax: (20) 2 525 6457  
 email: EEAA2@idsc.gov.eg
- ❖ **SEAM/Entec UK Ltd**  
 30 Misr Helwan Agricultural Road  
 4th floor, Maadi, Cairo, Egypt  
 Tel.: (20) 2 525 6452 Fax: (20) 2 349 9795  
 email: entecegy@eis.com.eg

The collection of user fees in Kolongeel for the waste collection service by the CDA will help sustain the scheme.

- ❖ A high satisfaction level of 94% among residents will ensure there is a strong demand for the new service.
- ❖ The commitment of East Mansoura District to support the Kolongeel CDA with the provision of most of the waste workers.
- ❖ It is expected that raising of environmental awareness of Kolongeel CDA will lead to implementation of other environmental initiatives.

## ACHIEVEMENT HIGHLIGHTS

- ❖ Mobilisation of local communities for awareness raising and undertaking waste clean ups.
- ❖ Capacity of the Womens Association to undertake similar project elsewhere has been strengthened.
- ❖ Partnership developed between the East Mansoura District and the communities to improve waste management.
- ❖ Increased satisfaction levels in the Kolongeel community with approval ratings increasing from 8% to 94%, after implementation.
- ❖ 80% of the community are paying a monthly fee, to sustain the waste collection service.
- ❖ Improved environmental conditions with positive effects for public health.
- ❖ Capacity building of Kolongeel CDA.

### ❖ Dakahleya Governorate

Mansoura  
 Environmental Management Unit  
 Tel.: (20) 50 312 535 Fax: (20) 50 317 600

### ❖ Community Development Association of Kolongeel

Attention Mrs. Zeinab Ibrahim Ahmed  
 Tel: (20) 50 317 434

**February 1999**