

# THE WASTE NETWORK



**CONCEPT**

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# THE WASTE NETWORK

Introduction

## **TRASH IS TRASH**

**Spatial impact of waste in different areas of the city**

- Central business district
- Parklands
- Kibera
- Dandora Dumpsite

**The Dandora dumpsite**

**History of Dandora**

**Dandora photographic survey**

## **TRASH IS CASH**

**The waste network**

**Actors**

- Collection
- Dumping
- Recycling

**Case Study: Brown Paperbag**

## **TRASH VS. CASH - CONCLUSIONS**

**Responsibilities**

**Background**

- Landfilling and Incineration in developing countries
- Waste management practices across the world

**Possible Approaches**

- Dumpsite upgrading
- Governmental initiative
- Private sector initiative



# THE WASTE NETWORK

When arriving in Nairobi's city center and walking around, waste management at first doesn't appear to be a problematic issue. Litter bins on every corner prevent people from dumping, street cleaners are sweeping the streets. Waste management in the city seems to be well-working and well-organized.

This impression changes drastically when moving around a bit more. The gap between the different areas is huge; in poorer neighbourhoods the streets are flooded with garbage. Waste collection seems to be non-existent, garbage piles up to small mountains on every other street corner and setting it on fire seems to be the only means to reduce the amount of litter lying around. It becomes evident that the city in fact faces serious problems in dealing with waste and that the current state has a negative impact on public health and the environment.

The first chapter of this book approaches the issue from this side; 'Trash Is Trash' is focusing on the negative effects waste has on Nairobi, starting with a comparison of different areas of the city and then focusing on Dandora, the city's only dumpsite and the nucleus of the waste system.

The second chapter, entitled 'Trash is Cash', is contrasting the first one with a different, less obvious approach and is looking at the profitable aspect of the issue. The lack of organization and control offers opportunities for many people to open a business and earn money by providing the services that otherwise would be missing. Private collection companies are serving residential areas for a monthly fee, poor people have a chance to earn their livelihood by collecting reusable waste and selling it to waste dealers and recycling companies. The result of this is a complex network, with individuals and groups, formal and informal actors involved and depending on each other. 'Trash is Cash' is trying to illustrate and personalize this network.

'Trash vs. Cash', the conclusion, is putting the two different aspects together. Analysis of the situation in Nairobi and comparisons with other cities or countries indicate possibilities on how to deal with the situation.



# TRASH IS TRASH







# TRASH IS TRASH

**SPATIAL IMPACT OF WASTE IN DIFFERENT AREAS OF THE CITY**

CENTRAL BUSINESS DISTRICT

PARKLANDS

KIBERA

DANDORA



FOURWAY  
TOWERS

ONE-WORLD COURIER  
1ST FLOOR

ANK

CITY BANK

MOKTAR BACHA ST

KSM



CENTRAL BUSINESS DISTRICT

PARKLANDS

KIBERA

DANDORA

## Central Business District

Waste management in the central business district and in the parks within the city center is organized and working very well. **Litter bins on literally every street corner make sure that garbage is getting dumped where it is supposed to and the Nairobi City Council employs people to sweep and clean up the streets.** Collected waste gets brought to different collection points within the CBD where trucks operated by NCC collect the waste several times a day to bring it to the Dandora dumpsite. Offices and store and restaurant owners pay a monthly fee to private companies to have them collecting and disposing their waste.

Location



Two of the countless litter bins to be found in the CBD of Nairobi. Bins get emptied regularly.



No-dumping-signs in parks make sure people remember where to put their garbage.



Cart of an NCC-employed street cleaner.



# TRASH IS TRASH - SPATIAL IMPACT OF WASTE IN DIFFERENT AREAS OF THE CITY

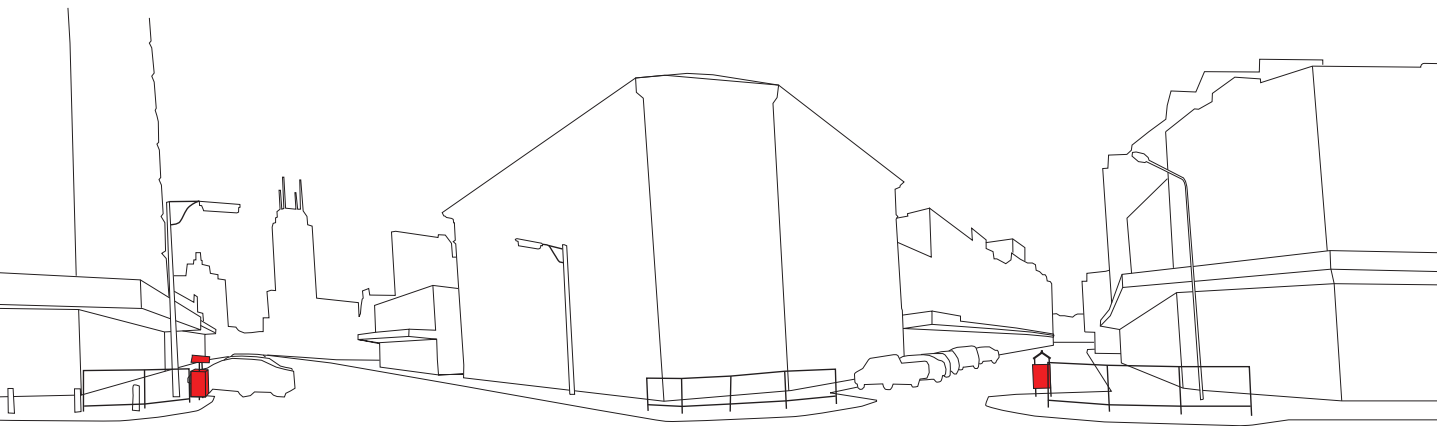
Waste of an office waiting for collection.



Street cleaners bring the waste to collection points. Often waste pickers are waiting there, searching through the garbage for valuables.



Truck of a private collection company.







CENTRAL BUSINESS DISTRICT

PARKLANDS

KIBERA

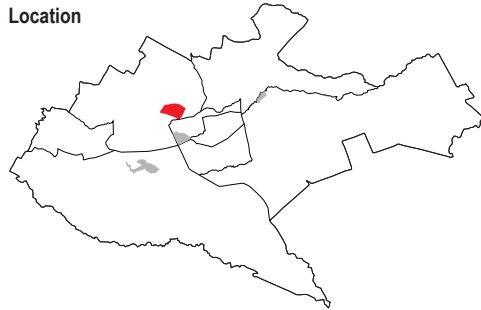
DANDORA

## Middle-income residential area: Parklands

The situation in middle- and high-income residential areas is comparable to the situation in the CBD: **In general waste gets disposed regularly and the streets are rather clean.**

Households collect their waste in garbage bags. Compounds usually have a designated space to keep full bags until collection day. Privately contracted garbage collection firms collect garbage twice a week from the households.

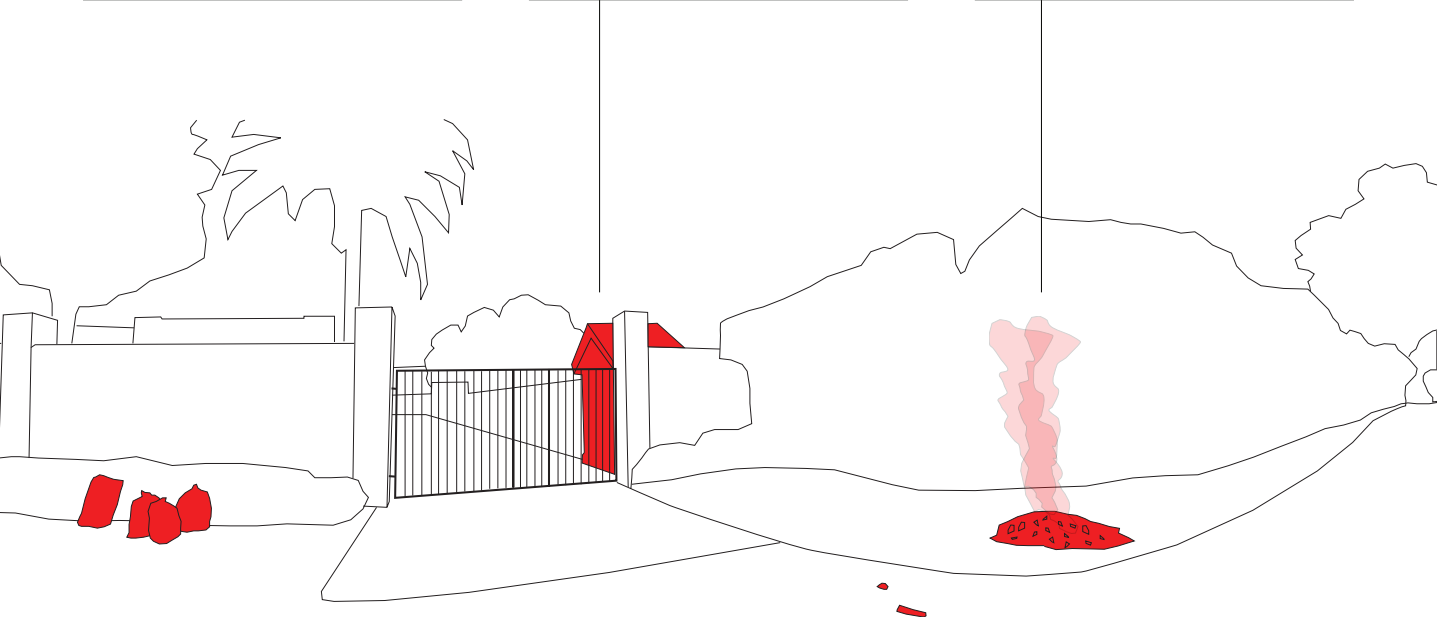
Location



Garbage bags are kept in a designated space on the own plot, for example in small huts, where garbage is stored until collection day.



Organic waste often gets burned on site.



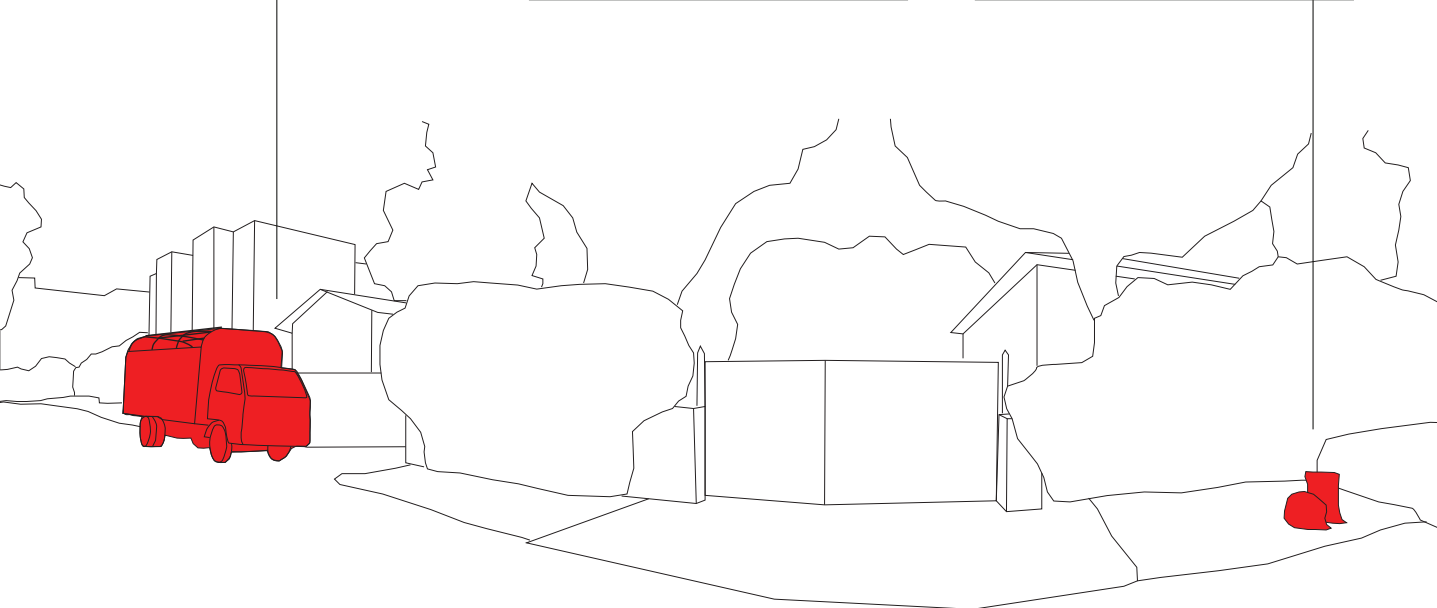


# TRASH IS TRASH - SPATIAL IMPACT OF WASTE IN DIFFERENT AREAS OF THE CITY

Truck of a private company collection waste.  
Garbage gets collected on Tuesday and Friday.  
Residents pay a monthly fee for the service.



On collection days garbage bags are put on the street, where the collection company can pick them up.





TRASH IS TRASH - SPATIAL IMPACT OF WASTE IN DIFFERENT AREAS OF THE CITY



CENTRAL BUSINESS DISTRICT

PARKLANDS

KIBERA

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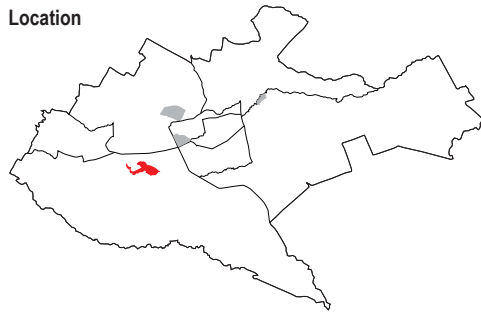
## Slum settlement: Kibera

Things change significantly in low-income residential areas and even more in informal settlements and slums.

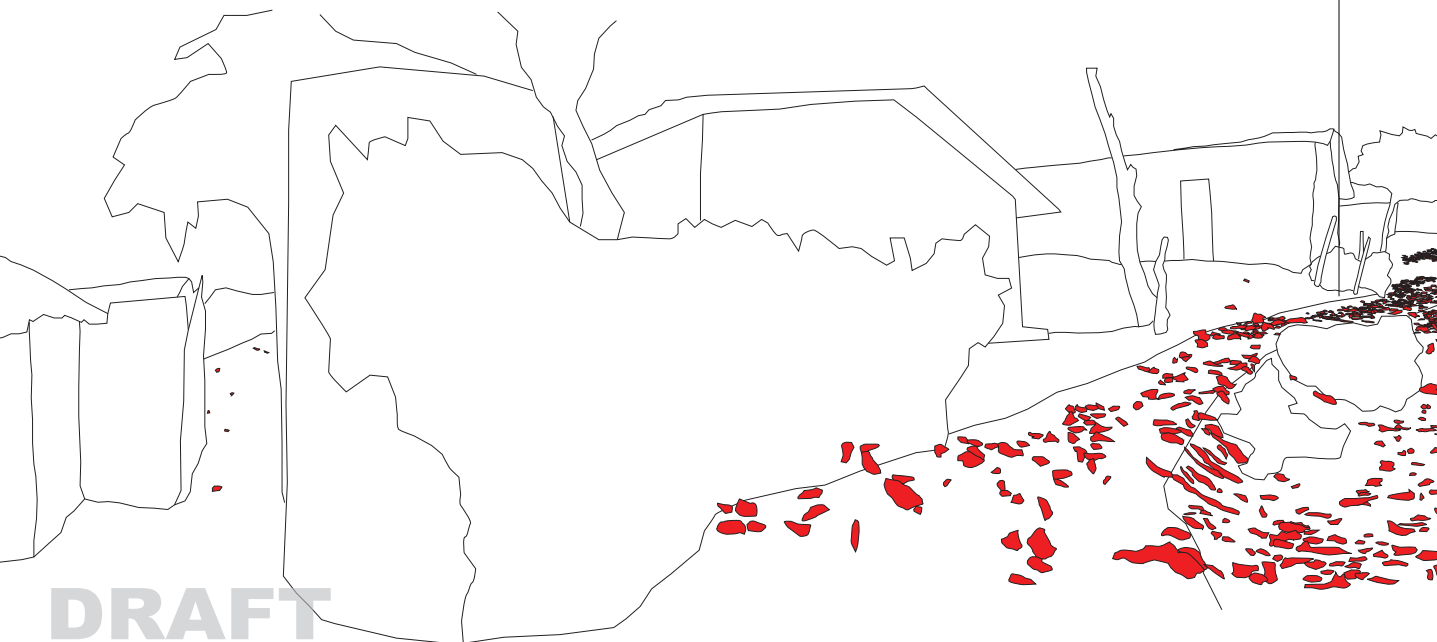
People living in such areas can't afford to pay for waste collection services. **As a result, garbage collects everywhere.**

Clean-up days, organized by Community Based Organizations or Youth groups, are not more than a drop in the ocean.

Location



Garbage piles up everywhere: In the sewers...



# TRASH IS TRASH - SPATIAL IMPACT OF WASTE IN DIFFERENT AREAS OF THE CITY

... on the streets...



... between the houses...



... and on open fields adjacent to the settlement.





TRASH IS TRASH - SPATIAL IMPACT OF WASTE IN DIFFERENT AREAS OF THE CITY



CENTRAL BUSINESS DISTRICT

PARKLANDS

KIBERA

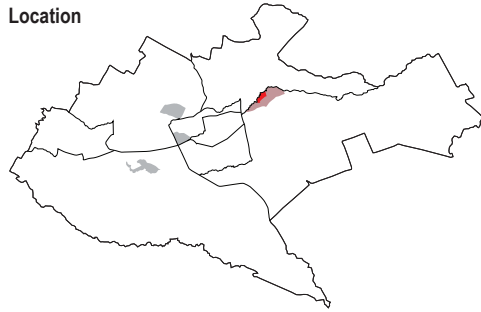
DANDORA

## Official Dumpsite: Dandora

The situation changes even more on Dandora, the only official dumpsite in the city of Nairobi. Of course this is a dumpsite, but in many ways it can be compared to the other parts of the city and seen as the inversion of the situation in those areas.

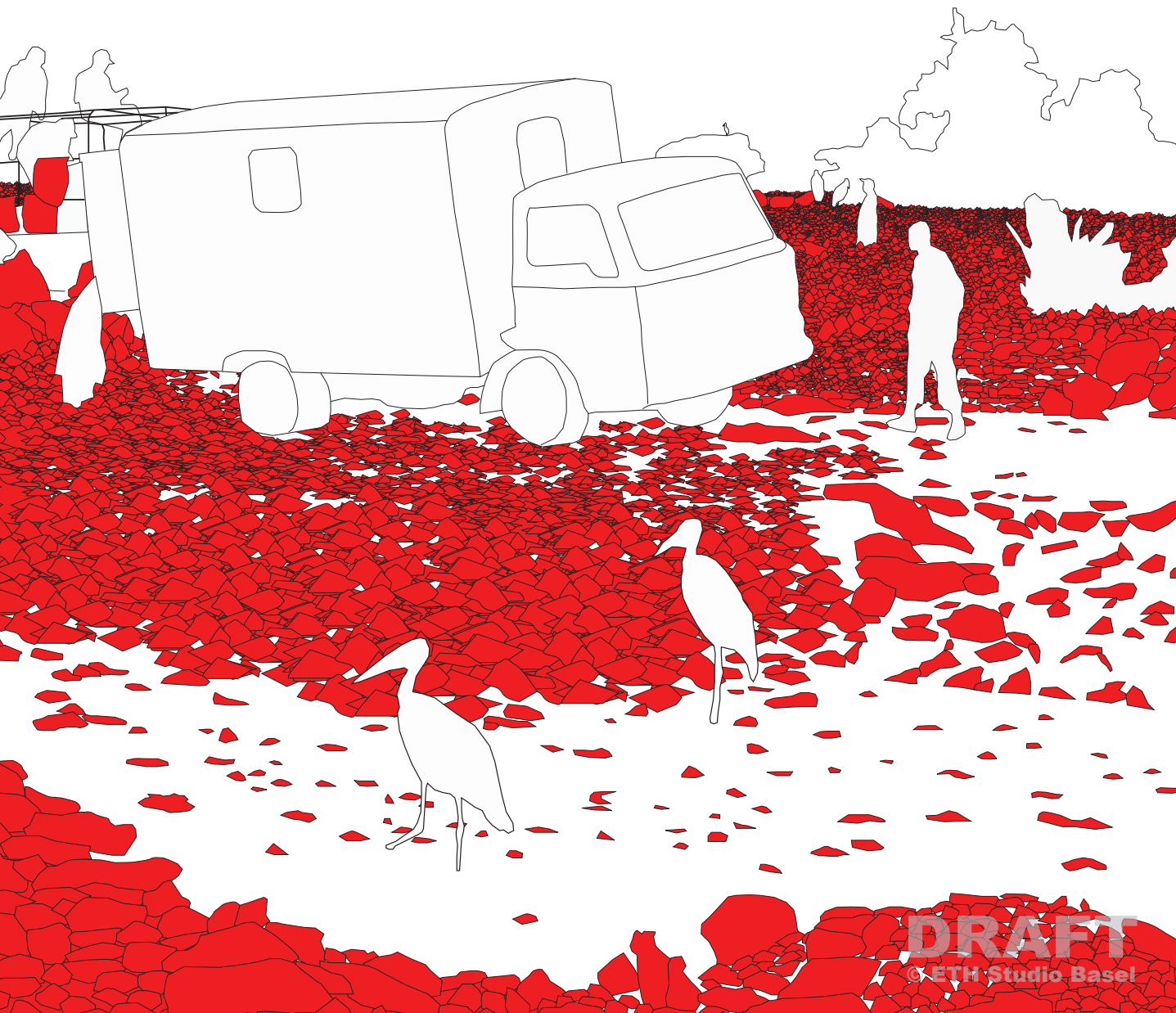
Many people work and live on the dumpsite itself, wading through mountains of garbage, looking for stuff they can collect and sell to waste-dealers for recycling.

Location





TRASH IS TRASH - SPATIAL IMPACT OF WASTE IN DIFFERENT AREAS OF THE CITY





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# TRASH IS TRASH



DANDORA DUMPSITE

## The Dandora dumpsite

The Dandora dumpsite is located in the eastern part of Nairobi, in the middle of the Dandora residential area.

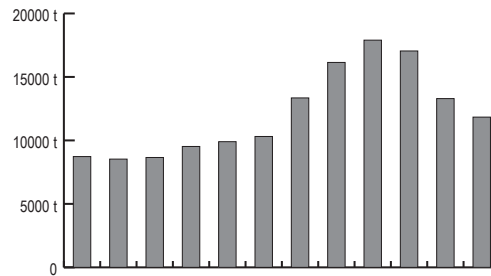
Two main problems led to the emergence of the dumpsite on this site: Lack of control led to a much higher population density in the Dandora residential area. Furthermore, the city neglected to plan a waste disposal solution when setting up the plans for the area. The resulting waste problems were tried to be solved by taking advantage of two empty quarries in the area; one located next to Dandora Phase I, the second one across the river in Korogocho. They were to be filled with waste to rehabilitate the land. As similar problems occurred in other parts of the city, the area was eventually designated the official dumpsite of the city.

Lack of control and mismanagement however let the situation get out of hand soon. Uncontrolled settlement encroached on the area beyond the initial boundaries. At the same time, instead of carting the waste into the quarries, it was left to sprawl. Both were reasons the quarries became inaccessible, leaving them unfilled and unrehabilitated. **The dumpsite spread out and began to occupy the area of Dandora Phase VI, which was already equipped with a water and sewerage system.** Phase VI was left to be developed later when Dandora Phase I-V were built, and most of the land was still the property of the Nairobi City Council.

**The dumpsite today occupies an area of about 26 hectares and is tightly enclosed and surrounded by both formal and informal housing units and public buildings such as schools.** About 2000 families (JICA 1998) are estimated to live within the dumpsite itself, about 3000 people earn their livelihood by collecting reusable waste from the dumpsite and selling it to waste-dealers for recycling. It is also a harbour and getaway route for criminals as it is physically difficult for the police to pursue them through the dumpsite. Although the NCC keeps a post at the dumpsite and has 18 officers stationed here, it has in fact little control over the whole dumpsite.

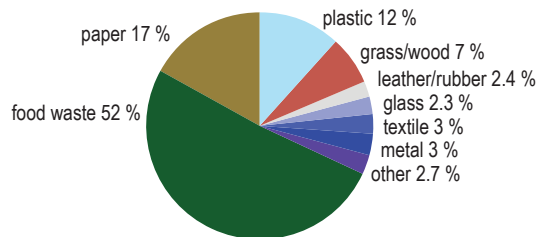
### Amount of waste disposed in Dandora in 2006

Total: 145'202 tons



Source: after Nairobi City Council, Cleansing Superintendent Record

### Composition of waste



Source: Anne Karanja, Solid Waste Management in Nairobi, 2005



**Amount of waste collected and taken away daily from Dandora for recycling: 25 t**



**Amount of waste disposed daily at Dandora dumpsite: 400 t**



**Amount of waste generated daily in Nairobi: 1530 t**

Sources: Anne Karanja, Solid Waste Management in Nairobi, 2005 // Eunice and Grace Muchane, Solid Waste Management in Nairobi, 2006

**Blacksmith Institute - The Dirty Thirty**

The Blacksmith Institute is a New York-based organization which develops and implements solutions for pollution-related problems in the developing world. According to a study published by the institute in 2007, Dandora is one of the world's thirty worst polluted places. From the list, it is the only place where urban waste is the reason for the pollution. For other sites on the list, reasons for pollution include mining, nuclear materials or air pollution, metals and chemicals from various industries.

The report summarizes that "living in a town with serious pollution is like living under a death sentence. If the damage does not come from immediate poisoning, then cancers, lung infections and mental retardations are likely outcomes. Often insidious and unseen, and usually in places with deficient and exhausted health systems, pollution is an unacknowledged burden on the poor and marginalized in the developing world." But the report also states that the situation is not hopeless, since there are decades of experience in industrial nations in cleaning up toxic sites.

How is it possible to measure and compare the level of pollution?

As a base for the list, the institute uses a database of nearly 400 sites nominated for Blacksmith consideration. An advisory board of experts then reviews the sites to sort out the serious contenders. For the final list a scoring system is used which measures the impact of the site. Criteria include the severity of toxins on the site, the amount of pollutant source, evidence of health impact and human exposure pathway, the level of exposure, the number of children at risk and the number of people in general potentially affected.

For the Dandora dumping ground, the number of potentially affected people is 100'000 according to the report. It lists heavy metals, chemical waste, PCBs and POPs as types of pollutants and municipal and industrial waste as the source of the pollution. The report states that the effects of constant exposure to the dump's stench and fumes on the residents remains unknown, but it states that only 10-15% of children living in the region could be described as healthy.



Sources: The Blacksmith Institute, The World's Worst Polluted Places, 2007

## The Dandora dumpsite - Impact on the society and the environment

The mismanagement at the dumpsite has had a negative impact on the environment and the society as well as on possible solutions for waste management in the city:

**The lack of control over the dumpsite empowers illegal parties to hijack the activities.** In Dandora, the Mungiki, an illegal, ethnically exclusionist group of the Kikuyu people, have virtually taken over the dumpsite. Vehicles have to pay a 'security fee' of 100 Ksh for every deposit of waste, in addition to the 140 Ksh (small vehicle) or 280 Ksh (large trucks) that have to be paid to NCC. Security problems and additional fees prevent many small companies from dumping in Dandora. The consequence is the disposal of waste all over the city, in open spaces or on illegal, privately owned dumpsites.

Mungiki also have control over separation of waste usable for recycling, by organizing the distribution of arriving truckloads, with women and children usually ending up as the most disadvantaged.

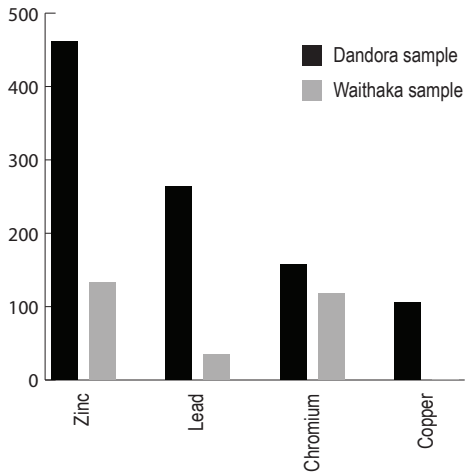
The state of the dumpsite creates a dangerous and hostile working environment for the wastepickers. Many mothers raise their children in the unsanitary conditions. Spontaneously inflamed emissions of methane, or fires light up by scavengers to cook are a constant hazard. **The smell around the dumpsite is pungent and the air is filled with toxic gases.** Industrial or hospital waste illegally dumped at the dumpsite are have a negative impact on the health of the waste pickers and on the environment.

Due to lack of facilities for waste separation both at source and at the landfill, large volumes of recyclable products are lost in the chaos of the dump. The present insecurity also keeps many individuals and CBO's or NGO's from recycling garbage. The quality of materials recovered from Dandora is low, which keeps the profit to be possibly made low as well. In addition, scavengers working on the dumpsite are exploited by the long chain of middlemen, waste-dealers and recycling companies, as there are few well organized possibilities to sell product. The reputation of the city as being incapable of managing the dumpsite is also increasing the opposition against plans of a relocated dumpsite, as people fear the same scenario to happen in their area.

**Resistance on the dumpsite itself is present as well: For many people, picking waste at Dandora is their only possibility to earn their livelihood, hence they are very protective of their jobs.** The existence of influential people profiting from the current chaos is another force that is resistant to either the closure of the current facility or the establishment of a sanitary landfill. It is commonly understood that powerful cartels, such as the Mungiki, are sustained by political actors who in turn get a cut from their profits.

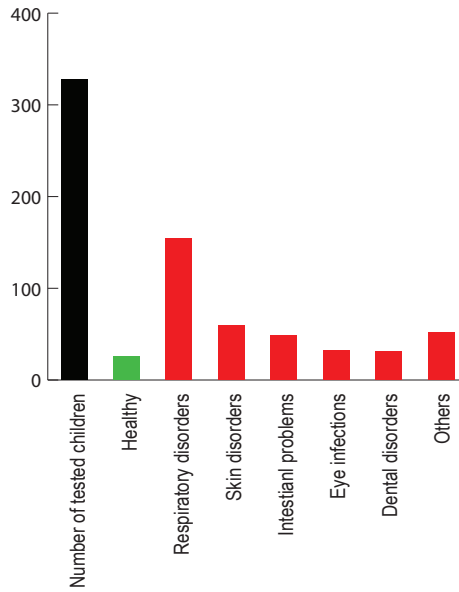


Heavy metal concentration in soil samples in Dandora and in Waitthaka, a residential area in western Nairobi



Source: UNEP, Environmental Pollution and Impacts on Public Health, 2007

Diseases amongst children living on or adjacent to the dumpsite







*"Living in a town with serious pollution  
is like living under a death sentence."*

Blacksmith Institute, 'The world's worst polluted places' report 2007





*“There are very serious medical problems because of the dumpsite. Children get sick because they inhale the toxic gases, a lot of pregnant women are having miscarriages.”*

Fanuel Tolo, Climate Network Africa





*“You’re not allowed to drink on the dumpsite.  
Because if you pass out, you might get run over by a truck”*

Network Al Kaida, Waste-picker on the dumpsite





*“When the gas comes out of the garbage and the weather is hot, it will just ignite spontaneously and start a fire.”*

Victor Omulo, Climate Network Africa







*“The chaotic state of the Dandora dumpsite offers another opportunity. For criminals, the dumpsite is a place where they can actually hide guns.”*

Dr. Alfred Omenya, Eco-Build Africa





*“The City Council doesn’t have any solutions for the future of the dumpsite. They usually come up with some ideas around election time, but they’ll quickly forget about it once elections are over.”*

Dr. Alfred Omenya, Eco-Build Africa





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# TRASH IS TRASH

**HISTORY OF DANDORA**

## History of Dandora

Planning on the Dandora Project started in the 1970ies as a response to the urgent need for affordable housing units for lower income households in the eastern parts of Nairobi.

The project was financed by the World Bank and planned as a site and service project. Site and service projects provide urban land in small plots so that individual households can build their own dwellings. In Dandora, 6000 plots of sizes between 100 and 160 square meters were to be developed in a total area of 350 hectares. Preparation work on the project started in January 1973, the actual project implementation began in 1975 and was carried out in two phases: Phase one consisted of residential area 1, Phase 2 consisted of residential areas 2-5 and a central spine of community facilities.

The Nairobi City Council, with the finances from the World Bank, was to prepare the plots and build circumferential roads as well as educational, social and health facilities. On the plots, wet cores for the houses were built; some comprising of just a toilet and a shower, some also including a kitchen. The NCC also had to prepare the building materials necessary to construct the housing units. Successful applicants for the plots were given a loan for the construction of the houses. The project provided a range of alternative plot layouts with different plan types to choose from. The plot holders had to build the dwellings within 18 months of the signing of the lease and had to follow minimum building standards laid down by the City Council. On average, five rooms were expected to be built on each plot, resulting in an assumed occupancy rate of ten people per plot and a density of 320 people per hectare.

The number of dwellings planned proved to be too small to keep up with the increasing population, which was mostly moving into the city from the rural areas. In addition, the project was planned to be a low-rise development. Lack of control however led to the construction of many mid-rise housing blocks; in fact, big parts of Dandora today comprise of 6- or 7-storey buildings. This all resulted in a population density much higher than intended. Today, an estimated number of over 250'000 people (Ikiara, 2006) live in Dandora and the adjoining informal settlements, which equals to a density of more than 600 people per hectare.

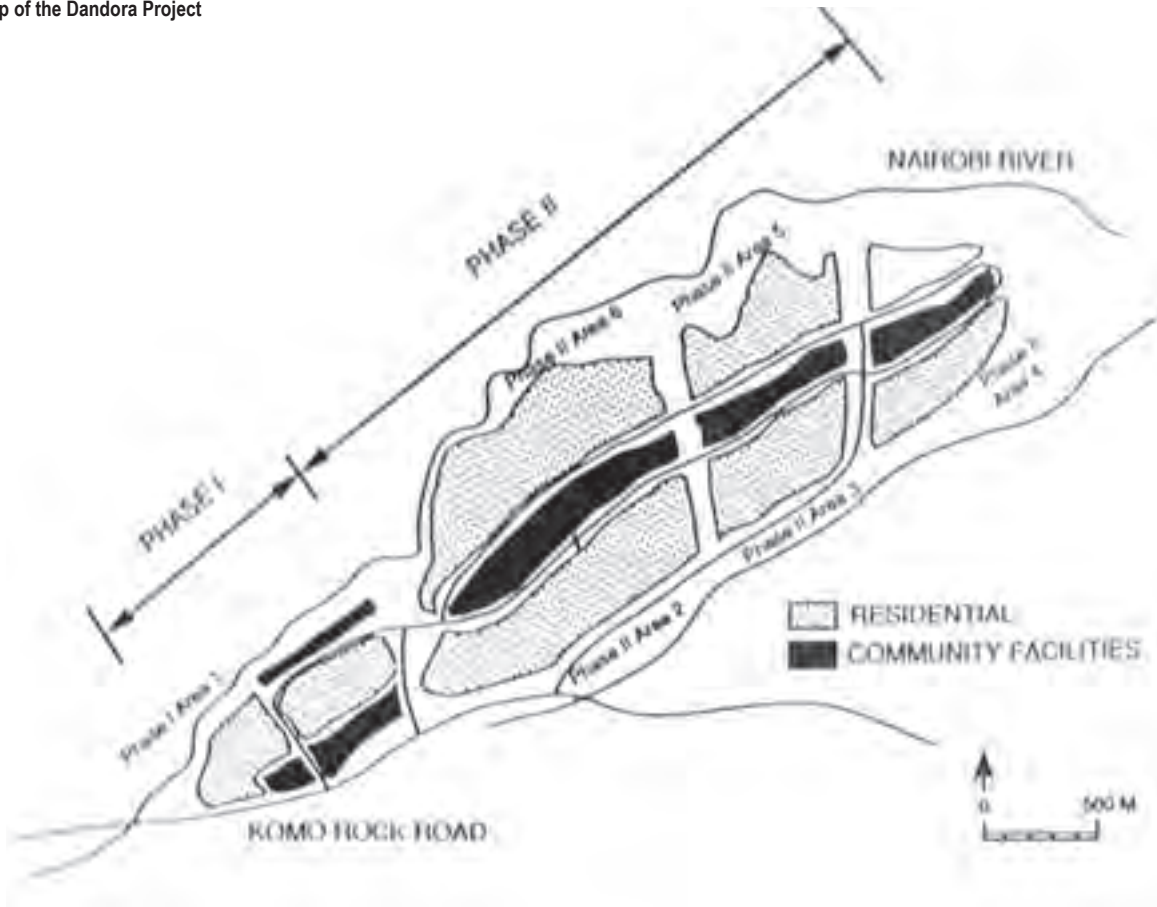
### Location



### Street in Dandora Phase I



Map of the Dandora Project

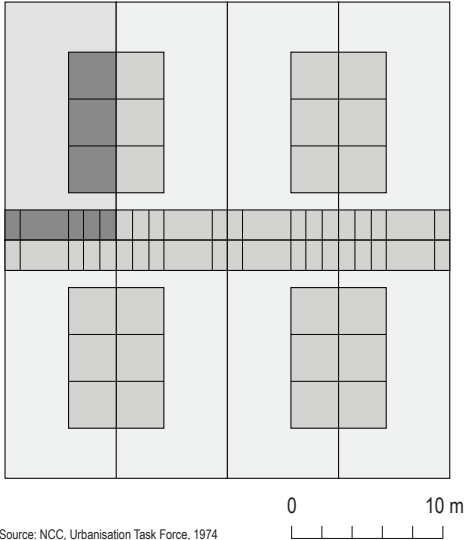


Source: Joyce M. Malombe / Chana, 1984



## House type plans for the Dandora project

### Configuration of 8 plots (Scale 1/500)



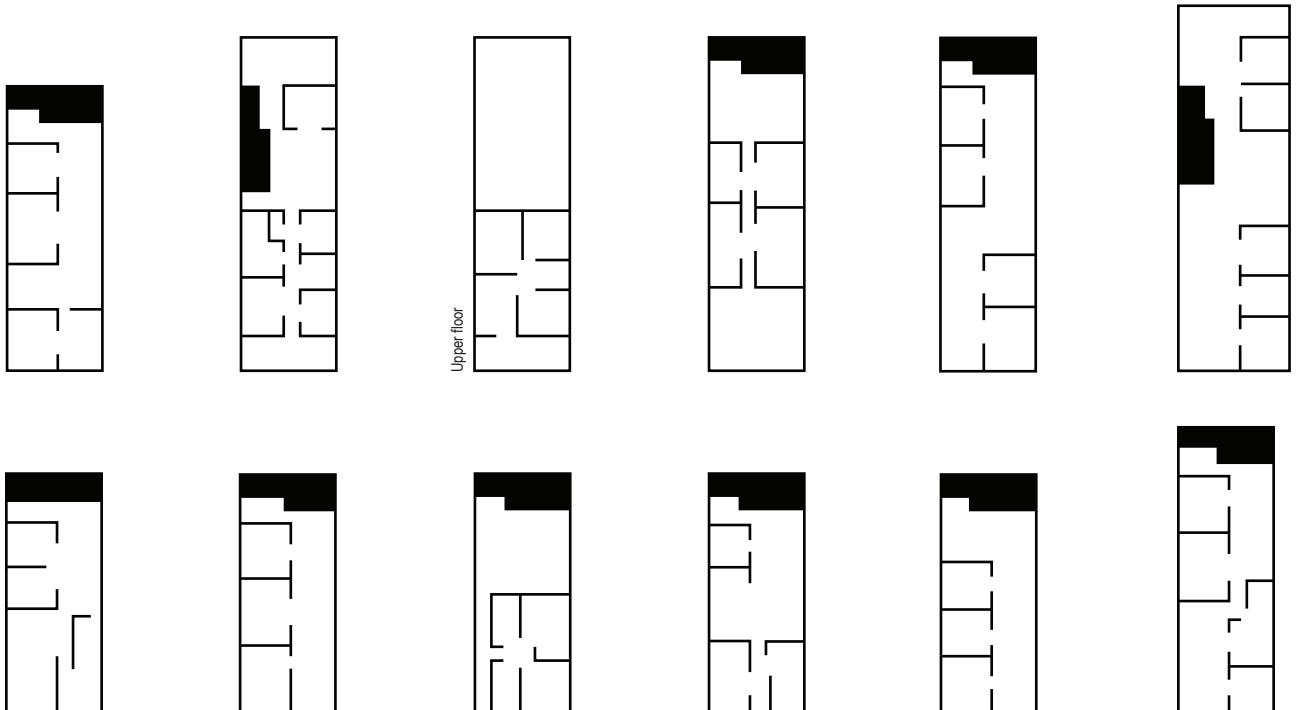
Source: NCC, Urbanisation Task Force, 1974

Plot sizes are between 100 m<sup>2</sup> and 160 m<sup>2</sup> (15.75m x 6.3m, 18.81m x 6.3m, 22.05m x 6.3m and 24.15m x 7.35m), corner plots have sizes from 180-240 m<sup>2</sup> and are designed for bigger dwellings. **There's only type plan for a two-storey building, the rest are one-storey buildings.**

The first two rooms on a plot had to be built within 18 months after the loan was granted. The rest of the rooms could be built whenever the owner had finances to do so.

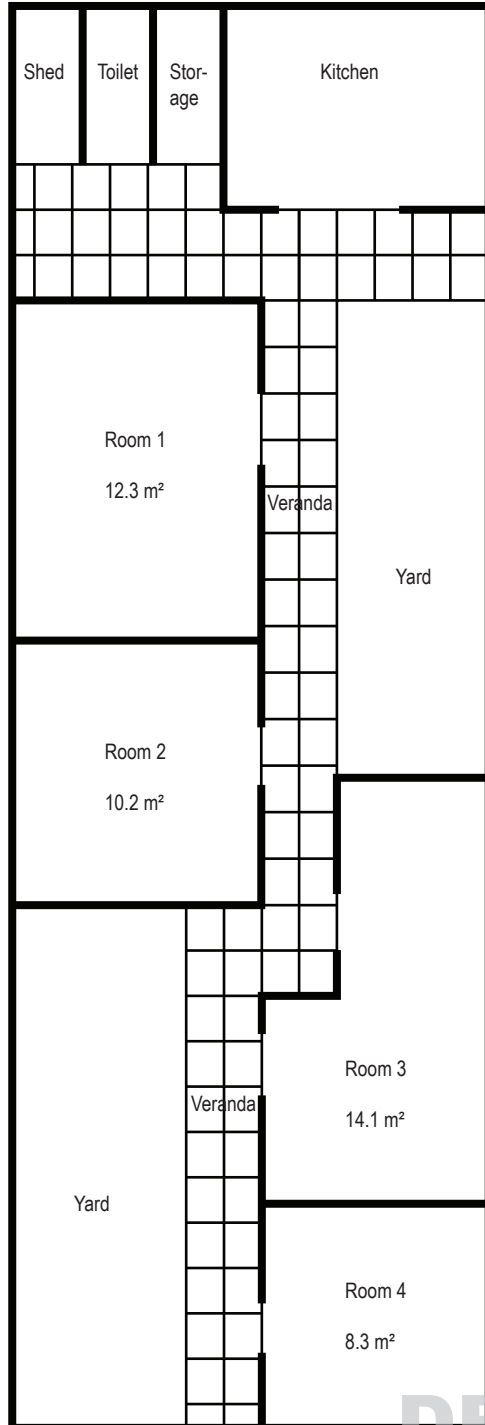
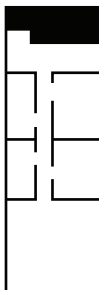
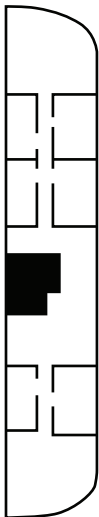
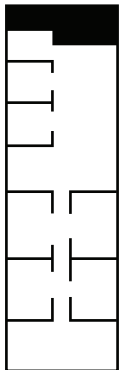
**Plot owners were expected to build a total of 4-6 rooms. In reality, some owners built up to 9 rooms on their plots or more than one storey.**

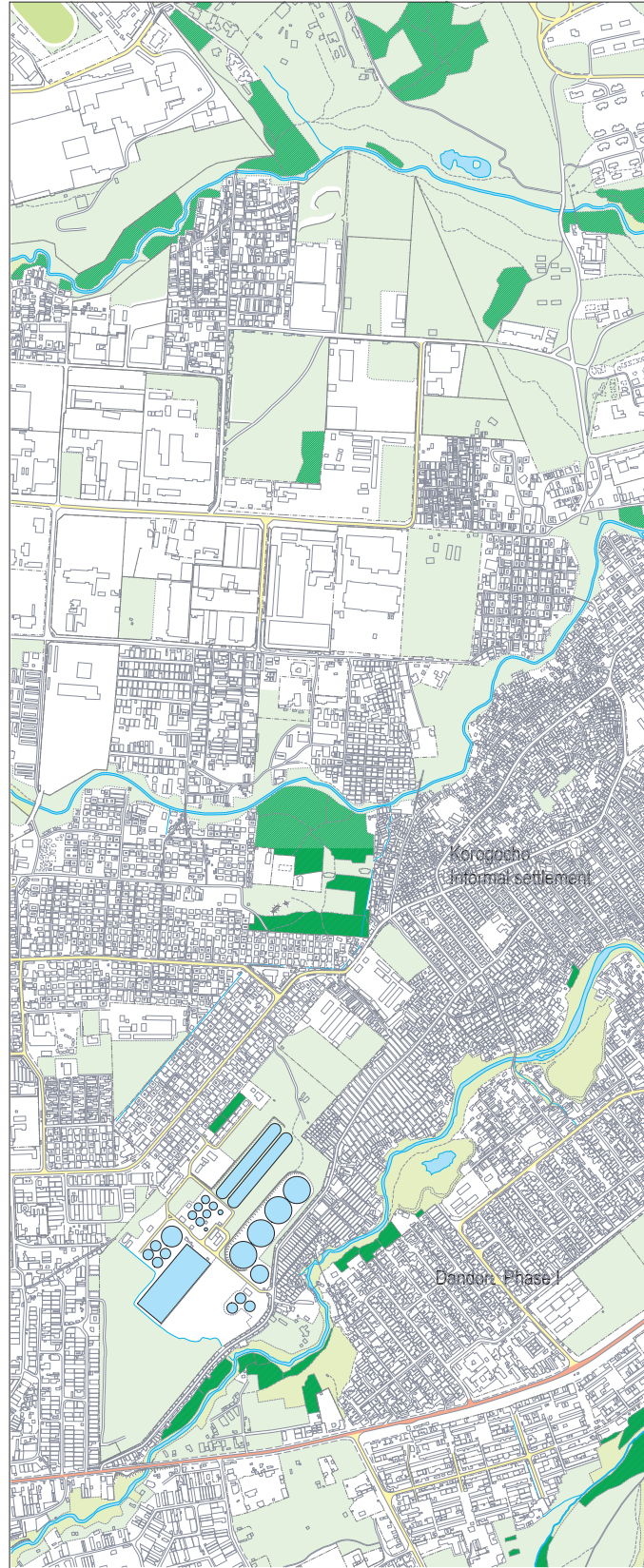
### House type design options (Scale 1/500)



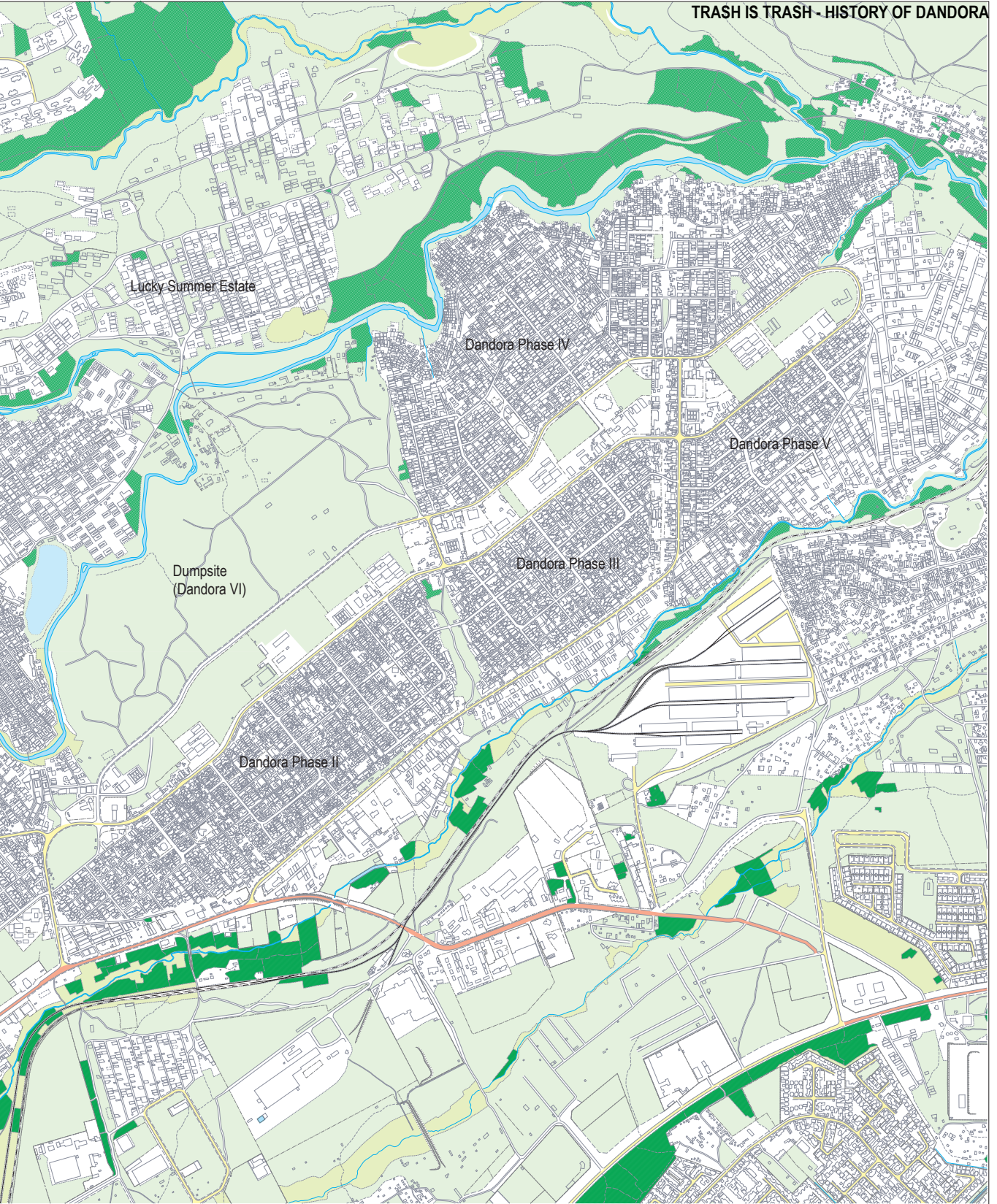


Typical house type plan for Dandora project -  
Four room unit (Scale 1/100)





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Figure-ground plan of Dandora Phase I (Scale 1/1000)





**Street in Dandora Phase I**

Most of the surrounding buildings are low-rises, like it was initially planned



**Houses in Dandora Phase III**

In reality, large parts of Dandora comprise of mid-rise buildings today





Children playing on the schoolyard of James Gichuru Primary School  
Dumpsite in the background



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# TRASH IS TRASH

DANDORA PHOTOGRAPHIC SURVEY



C

Border Dandora Phase I/Phasell

Dandora Phase II



A

Dandora Phase I



B

Dandora Phase I



D



E

Dandora Phase II



F

Dandora Phase II



Dandora Phase II



Dandora Phase II



G

H

Dandora Secondary School/Dandora Phasell



I

Playground Dandora Secondary School/Dandora Phasell



J

K

Wangu Primary School/Dandora Phasell



L

Dandora Phase IV



N

Dandora Phase IV



P

Border Dandora Phase IV/Phase V



M

Dandora Phase IV



O

Dandora Phase IV



Q



R

Dandora Phase V



S

Dandora Phase V



T

Dandora Phase V



U

Dandora Phase V



ROUTE

- A** Dandora Phase I
- B** Dandora Phase I
- C** Border Dandora Phase I/Phase II
- D** Dandora Phase II
- E** Dandora Phase II
- F** Dandora Phase II
- G** Dandora Secondary School/Dandora Phase II
- H** Playground Dandora Secondary School/Dandora Phase II
- I** Dandora Phase II
- J** Wangu Primary School/Dandora Phase II
- K** Dandora Phase II
- L** Dandora Phase IV
- M** Dandora Phase IV
- N** Dandora Phase IV
- O** Dandora Phase IV
- P** Border Dandora Phase IV/Phase V
- Q** Dandora Phase V
- R** Dandora Phase V
- S** Dandora Phase V
- T** Dandora Phase V
- U** Dandora Phase V





# TRASH IS CASH





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# TRASH IS CASH



THE WASTE NETWORK

## Failure of Nairobi City Council

Waste management can be simplified with a cycle consisting of three components: Collection, dumping and recycling. A good collection system ensures clean streets, and well-organized dumping keeps the negative effects of waste on the environment and the health of people to a minimum. Recycling is important for a sustainable use of resources and to reduce the amount of waste.

**In a city it is the responsibility of the council to ensure all three components of the cycle work well;** through enacting by-laws and making policies it has the capabilities to do so.

**Nairobi is a good example to see what happens if this doesn't happen.** The Nairobi City Council is not able to make all three components work, in fact, it doesn't really have full control over any of them. The result is a disaster; streets in poor neighbourhoods and informal settlements are full of litter, and the only official dumpsite, Dandora, is polluting the environment and affecting the health of many people.

Nairobi City Council doesn't play a very important role in the collection of waste. Street cleaners keep the central business district very clean, but all other parts of the city rely on private collection services. The council operates a small fleet of trucks to clear collection points in the CBD, near markets or in poorer areas, however this system doesn't work very well in all the places it is supposed to.

COLLECTION

**Street cleaners**

**Collection trucks**

The NCC doesn't support or encourage any recycling activities and doesn't plan on doing so in the future.

RECYCLING

**Dandora dumpsite**

The city council operates the only official dumpsite of Nairobi in Dandora. Due to mismanagement and lack of planning the dumpsite is very chaotic. 18 NCC officers working at the dumpsite are failing miserably in trying to keep things under control.

**New actors filling the gaps**

The failure of the City Council on so many levels as a consequence offers opportunities for groups and individuals to enter the solid waste management sector to make a living. People recognized the deficiencies in waste collection and started companies offering collection services or they realized they can make money by recycling products.

While this lets the diagram come to full cycle, the outcome is still very chaotic. While the council has some control over some of the new actors, a lot of them are individuals or informal groups who do whatever brings them the most profit.

So the result is not a well-working waste management system, but rather a complex network of interacting actors depending on each other in various forms and ways. The network not being organized as a whole makes it very stable, since the people involved don't want to lose their position.

Waste collection works very well in middle- or high-income neighbourhoods, where the residents can afford to pay a monthly fee to a private company to get their waste collected. People in poorer areas are not able to pay for collection services and have to organize themselves. Community based organizations or youth groups are organizing clean-up days to improve the situation. NCC is supposed to clear designated collection points, but the service is lacking, partly also because trucks can't access the places anymore.

Due to the council's complete absence in recycling, this sector offers the most opportunities for individuals or companies. For many poor people, on the dumpsite or throughout the city, separating and collecting waste is the only way to earn a living. They sell valuables like plastic bottles or paper to waste dealers, who sell it to wholesalers, who sell it to large recycling firms. The powerful firms at the end of the chain make the biggest profit, the poorest people are the most disadvantaged. Community based organizations or NGO's are trying to help them by cutting out all the different middlemen.

**Waste pickers**

**Itinerant Buyers**

**Private recycling firms**

**Waste dealers**

**Community based organisations**

**Private collection companies**

**Community based Organisations**

**Youth groups**

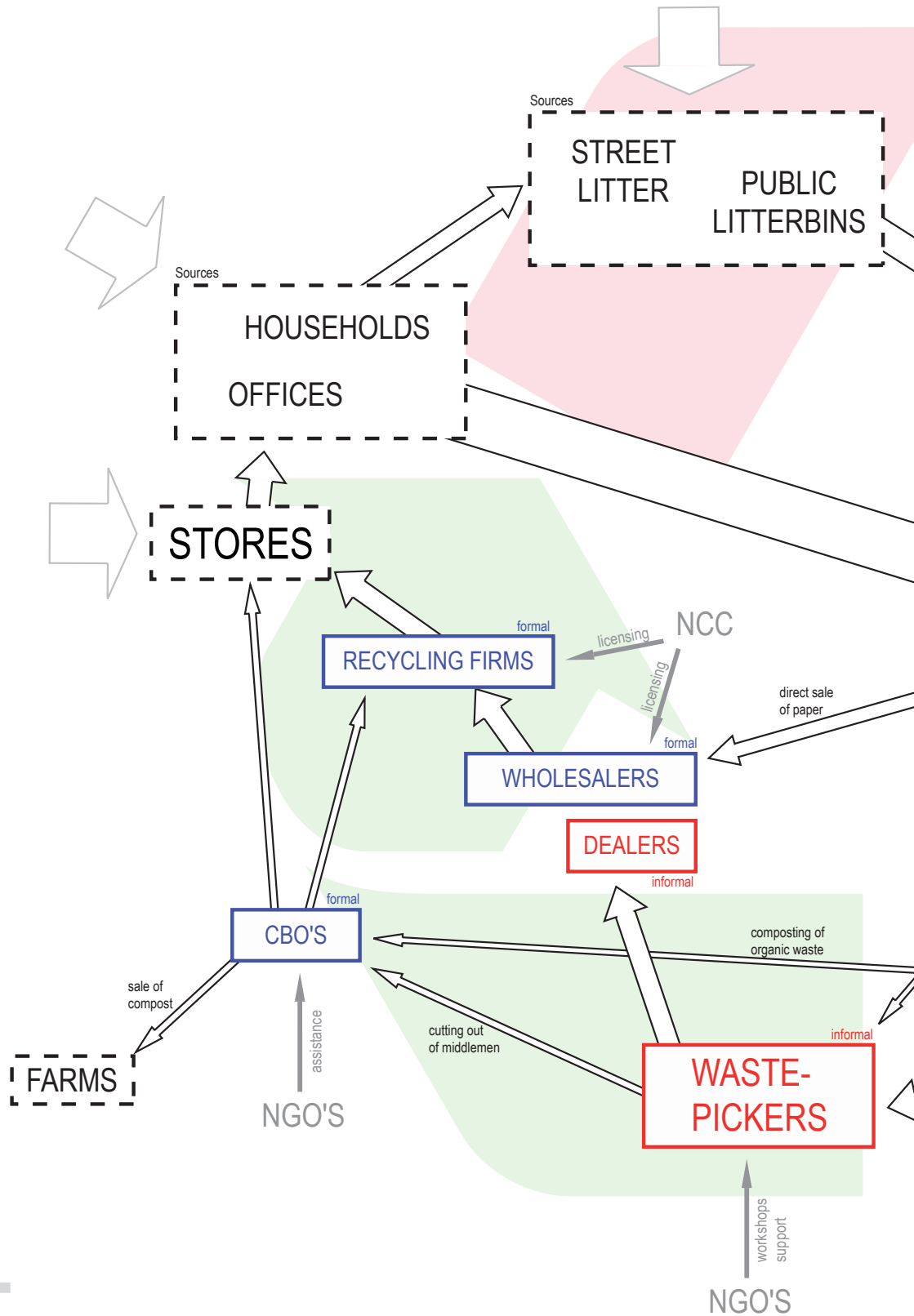
**Privately run dumpsites**

Dandora is a very insecure and chaotic place. Trucks getting stuck in the mud when the weather is bad, the security fee that has to be paid and the distance from the city center is the reason many firms don't want to dump in Dandora, particularly small companies or companies operating in the western parts of Nairobi. Several smaller dumpsites across the city on people's private property offer an alternative. These dumpsites are illegal and the NCC is aware of their presence, but still they continue to exist.

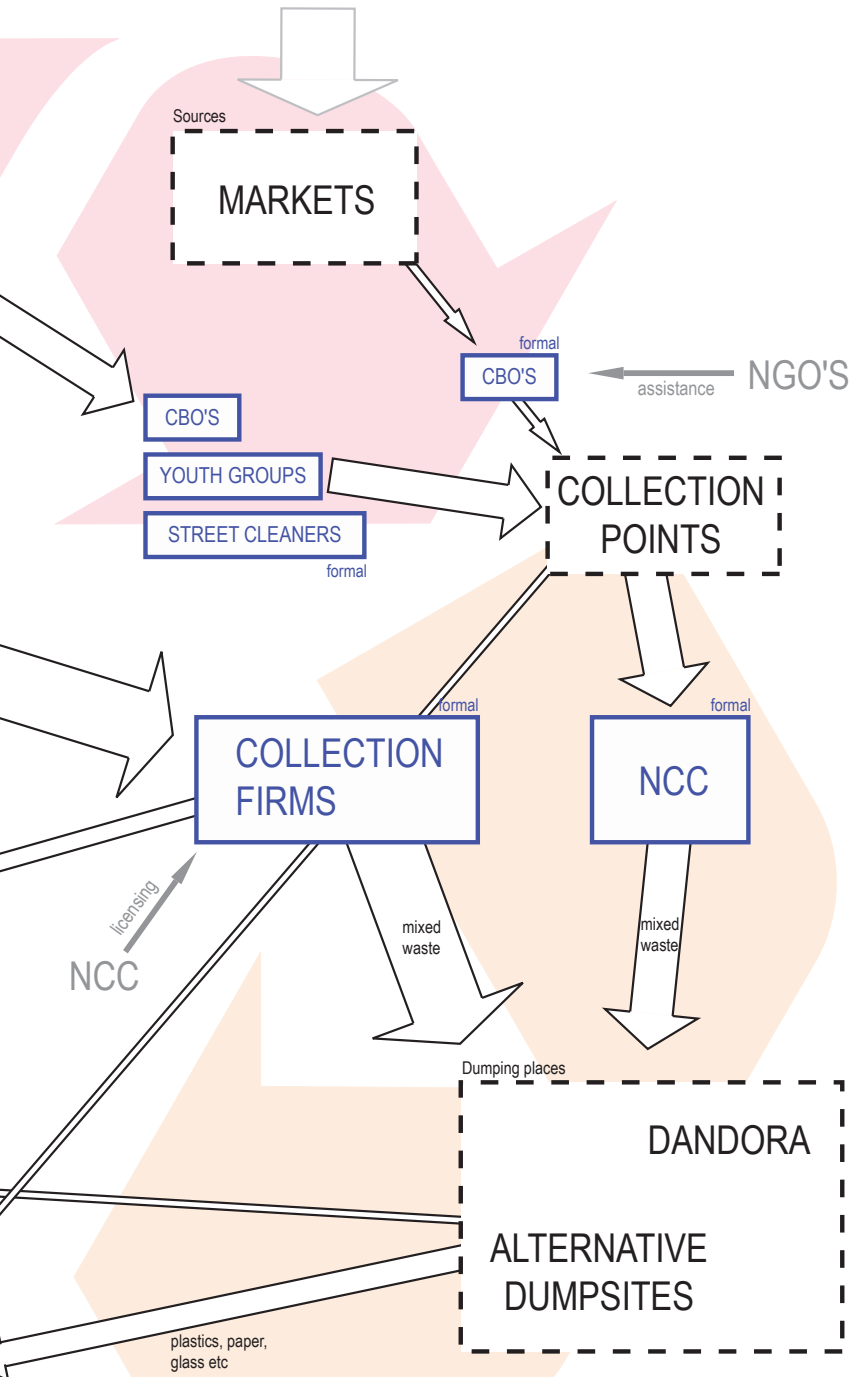
COLLECTION

RECYCLING

DUMPING









**DRAFT**

© 74TH Studio Basel

# TRASH IS CASH

## ACTORS IN THE WASTE NETWORK



COLLECTION

DUMPING

RECYCLING





COLLECTION  
DUMPING  
RECYCLING

## Waste Collection - Serviced and unserved areas

Source: UNDP, Waste Digest, 2005



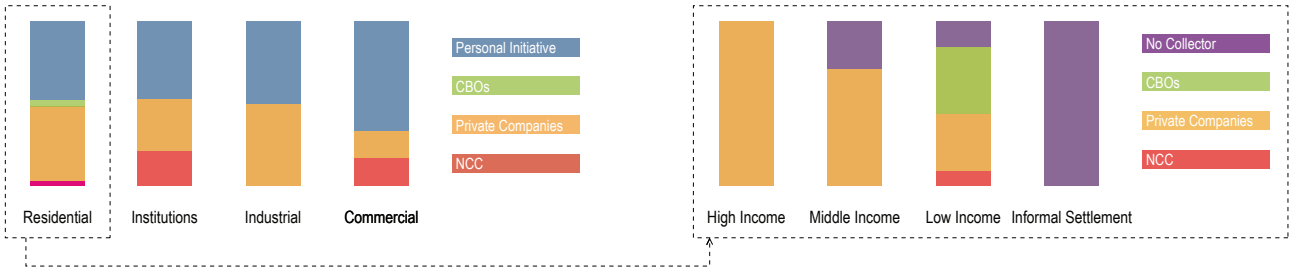
Areas with waste collection services



No waste collection

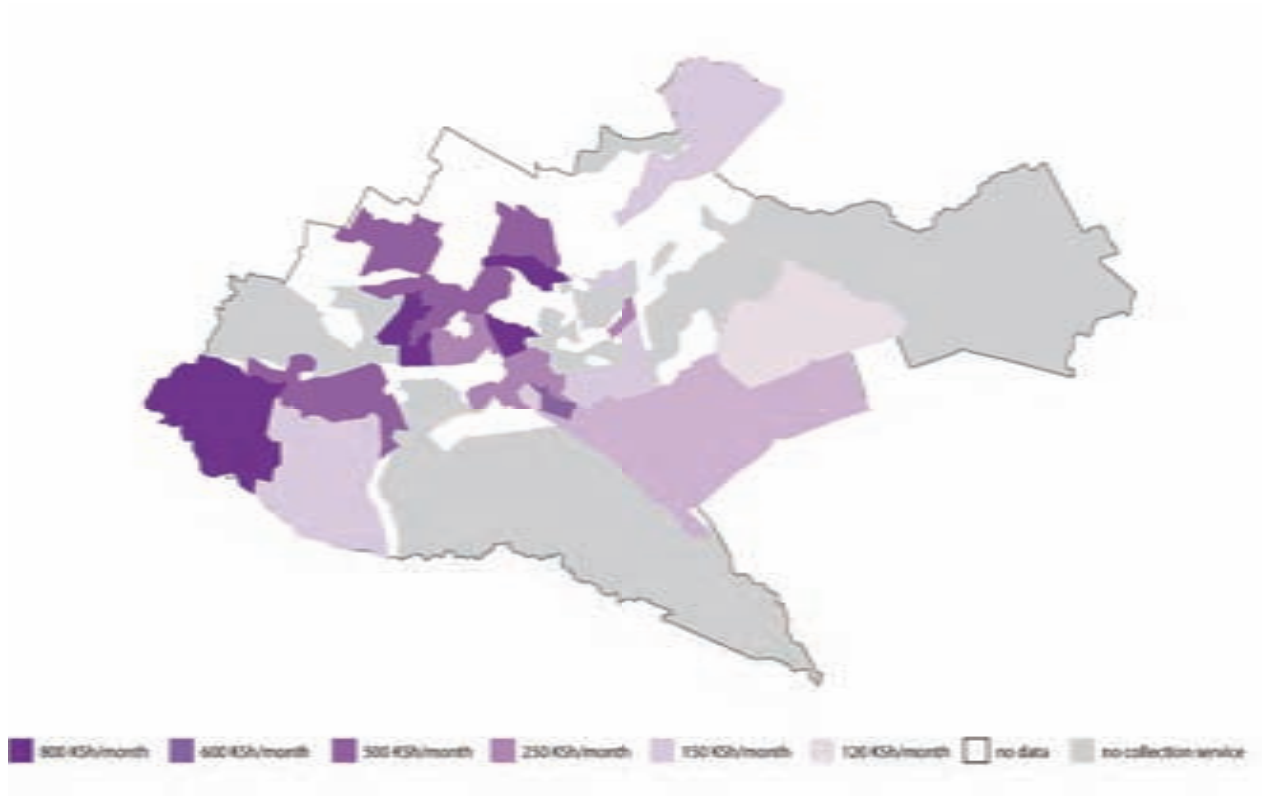
## Participation of actors in solid waste collection

Sources: Eunice and Grace Muchane, Solid Waste Management in Nairobi, 2006



### Waste Collection - Prices for collection services

Source: Karanja, 2005 / own construction





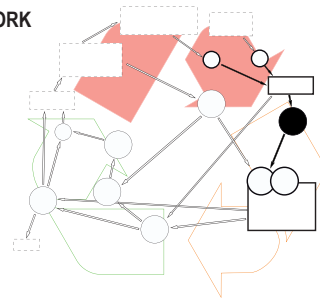
**IBRAHIM DIYAR** SUPER INTENDANT CLEANSING SECTION NAIROBI CITY COUNCIL

The failure of Nairobi City Council in the waste management sector is evident. Ibrahim Diyar, the superintendent of the Cleansing Sector of the Department of Environment, points out that the City Council is delegating some of its duties. **The city is divided into nine collection zones, each of which is assigned to a private contractor.** A direct result of this segregation of duties is a huge and complex network including contracts with private firms and youth groups. Because of this, **the superintendent sees the poor collection performance as a failure of the contractors, not of the City Council itself.**

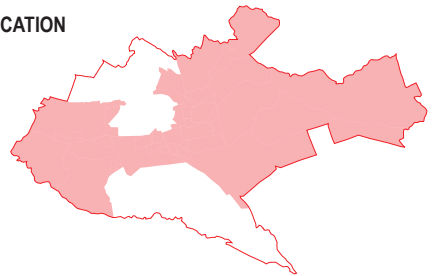
When asked about the health issues at Dandora, Diyar emphasizes that the City Council is aware of the dangers and concerned about the situation. On a sketch he shows his future plans for a rehabilitation of Dandora dumpsite. While the dumping area would be smaller, one part of the current dumpsite would be zoned as a park.

Despite the fact that the City Council is promising changes of the situation since years, Diyar affirms: „**The dumpsite will be relocated to Ruai in July 2008.**“

**NETWORK**



**LOCATION**



**ESTIMATED AMOUNT OF TRASH**

80 Tons per Day

**EQUIPMENT**

10 - 15 Trucks

2'500 Employees in the Solid Waste Management Sector

**ESTIMATED AMOUNT OF CASH**







**LYNETTE A. SHASUVILA** DIRECTOR MASTER'S REFUSE HANDLERS AND CLEANING SERVICES

Master's Refuse Handlers and Cleaning Services is a private company owned and founded by Lynette A. Shasuvila and her husband. They are operating in the waste-collection business since 2002 and the company incorporates about 25 employees. When they first started, they had to ask around for clients, but now their business is fully established. They have contracts with over 100 clients that are mostly restaurants and offices and located in the Industrial Area or in middle and higher income areas such as Lavington, Parklands and Upper Hill and in the Central Business District, where their own office is located as well.

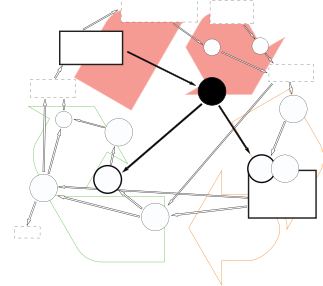
Their clients pay per bag so for a restaurant its about 2000 KSh per month, for a household about 250 per month. Lynette Shasuvila describes the situation as follows: „Our turnover is quite good [...] but most of the money goes into the repair of the trucks “

Four people are working per truck and the working schedule goes from Monday to Sunday, with only two trucks working on Sunday to give to the employees the chance of going to church. The licence, which is issued by Nairobi City Council, is limited on the numbers of trucks declared at the introduction of the enterprise. So Master's Service and other collection firms cannot expand, or can only increase their size in hiding their trucks. In the case of Master's Service, they are bound to their six trucks. Once on Dandora Dumpsite, the trucks pay 280 KSh per truck to access the Dumpsite plus 100 KSh for security escort while being on the dumpsite. The waste collection business is a very dangerous business.

„After raining, when it's wet it's very very bad. Sometimes the drivers have to sleep at the dumpsite, when the trucks are stuck.“

„Our workers earn about 12'000 KSH per month... We give them the opportunity to sell the paper on their own before they drive to the dumpsite.“

**NETWORK**



**LOCATION**



**EQUIPMENT**

\* 6 Trucks

\* about 25 employees (4 Workers per Truck)



**ESTIMATED AMOUNT OF CASH**

collection fee for restaurants: 2000 KSh/month  
 collection fee for households: 200 KSh/month  
 ca. 120 clients mainly restaurants

→ 168'000 KSh/month

Salary truck driver 12'000 KSh/month





**NO DUMPING**  
BY ORDER  
N.C.C



COLLECTION  
DUMPING  
RECYCLING



Waste pickers from adjacent residential areas coming to Dandora to work

Korogocho

**Informal settlements**

Official entrance

Weighbridge

Truck arrival

Dandora Phase I

Office of the Chief of Dandora



Lucky Summer Estate

Informal settlements

Dandora Phase IV

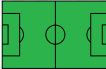
Dandora Phase III

Dumpsite

Unauthorized entrance

Dandora Phase II

Dandora dumpsite - Map  
(Scale 1/7500)



Size of a soccer field: 105 x 68 m



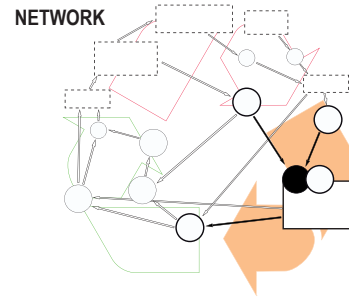
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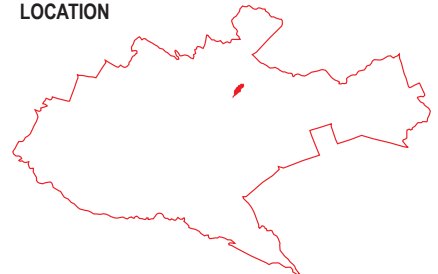
**WAMBUA NDAKA CITY COUNCIL OFFICIAL**

Wambua Ndaka is one of 18 City Council officials who are in charge of Dandora Dumpsite for helping and preserving the ground in readiness for the waste. Ndaka is in direct collaboration with the wastepickers on Dandora and is familiar with them. „All wastepickers are from the informal settlements surrounding the dumpsite, there is nobody living on the dumpsite itself.“

During dry periods, the climate on the dumpsite is very dusty and smokey, whereas in the rainy season the ground is too muddy and slippery to allow proper circulation of the trucks. The main waste problems of Dandora are the chemical wastes that would require proper sanitary land-filling and the plastic bags that have an extremely long half-life and that are nearly impossible to integrate in recycling processes. Still, he says that the City Council doesn't want to exclude materials from getting dumped at Dandora. He also claims that „There are no plans to start separating waste on the dumpsite.“



**LOCATION**



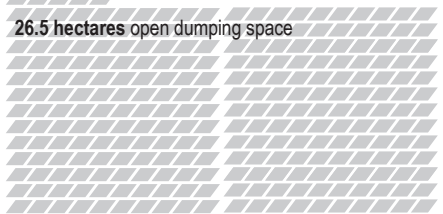
**ESTIMATED AMOUNT OF TRASH**

400 tons of new waste are entering daily

1.3 million cubic meters is the volume of waste in the dumpsite

**EQUIPMENT**

26.5 hectares open dumping space



**AMOUNT OF CASH (ROUGH ESTIMATION)**

85 Trucks enter the dumpsite per day and pay a fee of each 280 KSh

Total Income through dumping fees: 23'800 KSh per day



D.O. NYAKACH CHIEF OF DANDORA

Nobody who wants to visit the Dumpsite can avoid D.O.Nyakach's office. As the chief of Dandora he is the one who can decide who may enter and who may not. Even NGO's and CBO's have to pass to his office before getting the allowance to enter.

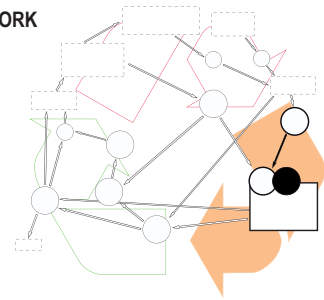
He describes the dumpsite as a peaceful place, with 3000 inhabitants and even a hotel in it.

„You can compare it to California. There have been famous people here, like Larry Jones“

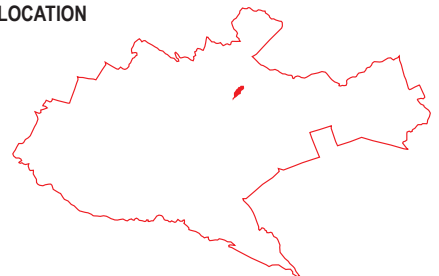
He is doubting that the dumpsite will get removed soon, because of political interferences. Besides, 3000 „recycling experts“ who are residing inside the dumpsite are making a living out of the waste laying about on the dumpsite. He says that the chance for changes depend on the cooperation of the residents. „If you want to change something in Dandora, you have to incorporate the community.“



NETWORK



LOCATION



AMOUNT OF CASH







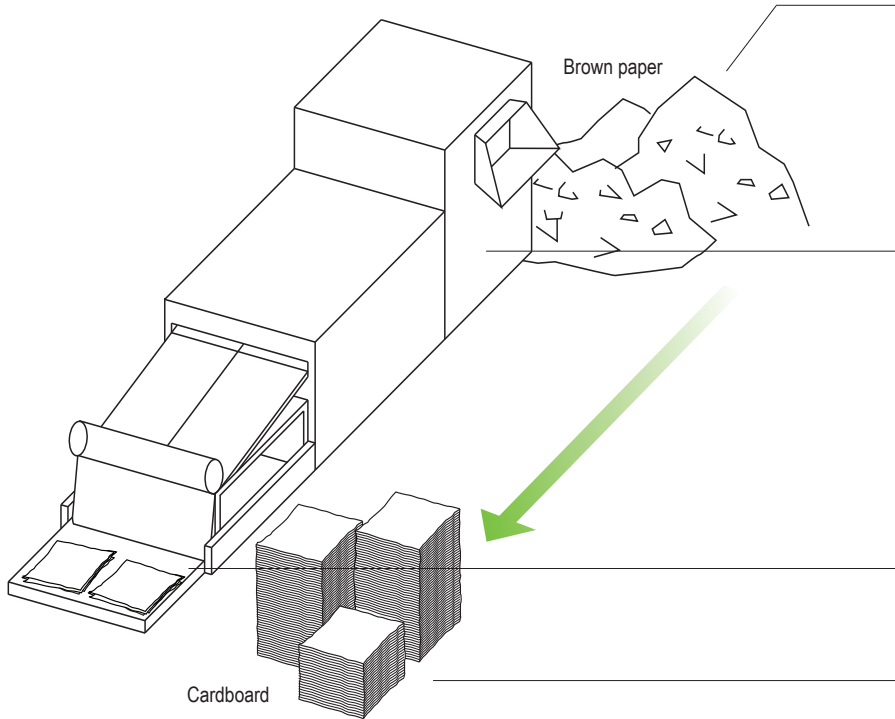
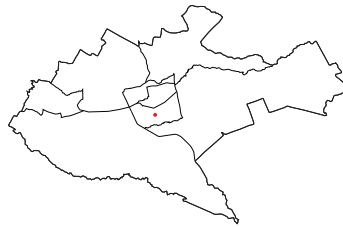


COLLECTION  
DUMPING  
RECYCLING

## Inorganic recycling: Kamongo Waste Paper Ltd., Industrial Area

Kamongo Paper Industries in Nairobi for the most part buys all kinds of paper from different sources, sorts it, bails it and sells it to large recycling companies. But they also recycle a small part of brown paper and make cardboard out of it.

Sorted brown paper gets put into a machine for milling and crushing. Then it gets mixed with water, rolled out and pressed. The sheets get brought outside for drying, before they get pressed again, cut and stacked in bundles.

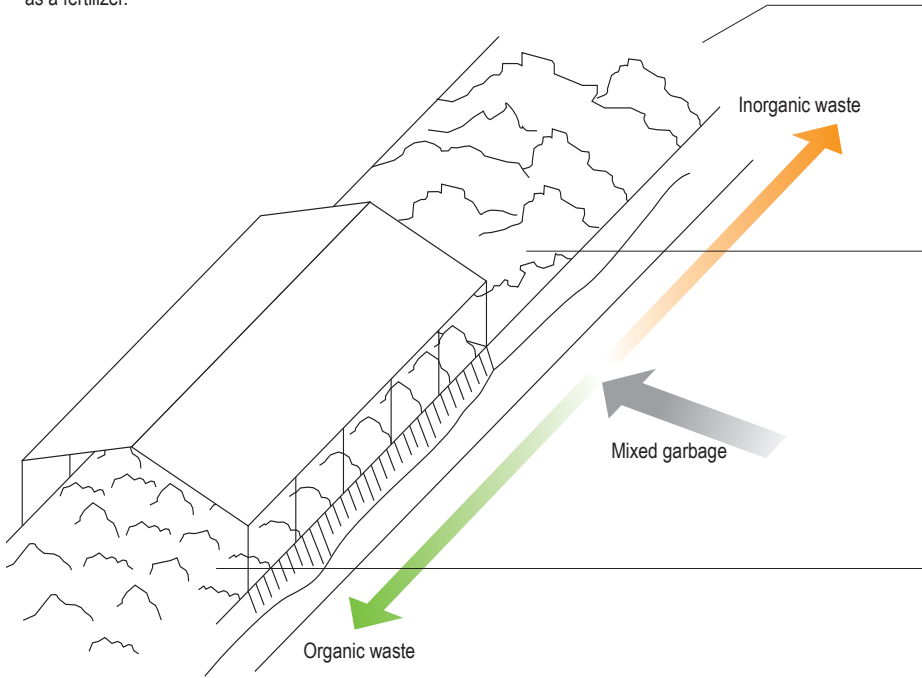
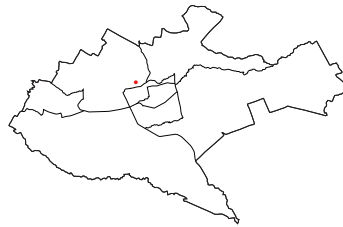


Drying of the cardboard



**Organic recycling: Hawkers Market, City Park**

The dumping site of the Hawkers Market next to the City Park is an example for recycling of organic waste. People from the market bring their mixed waste to the dumping place. Here it gets separated; the organic parts gets brought under a tent for composting. Inorganic waste gets moved in the other direction to a collection point. In the process, waste pickers can collect the valuable stuff and sell it to waste dealers. Trucks from the NCC (are supposed to) clear the collection point every to months and bring the waste to Dandora. The fully decomposed organic waste can be sold to farmers as a fertilizer.





„NETWORK AL KAIDA“ WASTEPICKER ON DANDORA DUMPSITE

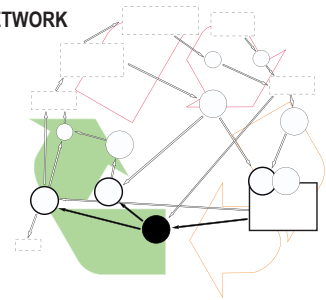
„Network al Kaida“ is one of 3'000 wastepickers that are earning their livelihood on the dumpsite. All workers on Dandora Dumpsite are part of a complex but informal network including the drivers of the vehicles dumping waste at the dumpsite. He points out that they are living an orderly life; „We are living here. We are celebrating christmas in Dandora.“

His daily income varies between 50 and 100 KSh, depending on the weather. There are also price differences between the recycable materials. Some lightweight and less profitable materials such as plastic bags are collected mainly by women. „Most women are widows or neglected by their husbands, so they have to come here to earn their living and to feed their kids.“

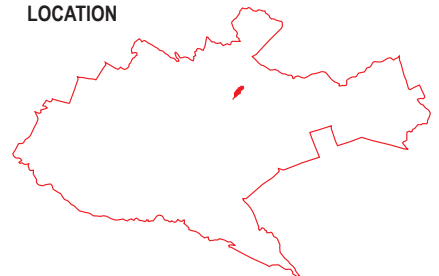
His colleague Girago, who is married and has a kid, works on the dumpsite since 9 years. He lives in one of the surrounding informal settlements, but comes here every day. For him the dumpsite is the only possibility for a job. He describes the coherence between the dandora recycling activity and crime as a direct linkage: „If the dumpsite gets moved, crime would rise in Dandora because there would be no more jobs.“



#### NETWORK



#### LOCATION



#### ESTIMATED AMOUNT OF TRASH

15 - 20 Kilograms of Collected Waste per Day

#### EQUIPMENT

None

#### AMOUNT OF CASH (ESTIMATION)



1 bag of organic waste = 20 KSh

1 kg plastic waste = 4 KSh

Daily Income: 50 - 100 KSh

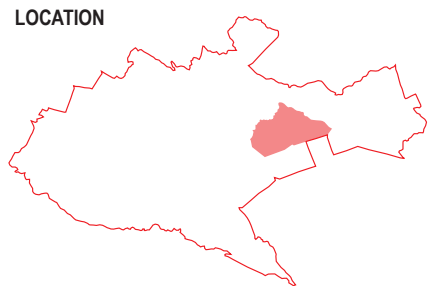
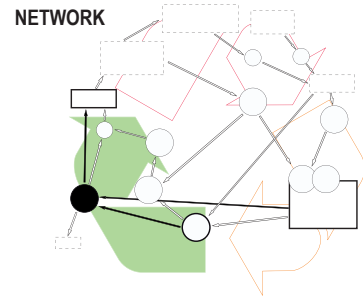


**SIMON N. MUNYWE** DIRECTOR KAYOLE ENVIRONMENT MANAGEMENT FOUNDATION

In Kayole, a neighbouring area of Dandora, Simon N. Muniwe wanted to change the fact that the district he lives in was left out in the cities garbage collection service. He has built up a waste collection and recycling business, the Kayole Environmental Management Association (KEMA). Together with the community of Kayole he tries to improve the garbage situation in the low income district Kayole and to generate new income possibilities.

Muniwe sees himself as business man, innovator and teacher. Nine years ago he started with garbage collection and soon went into trying out different new recycling methods. Today he is parttime teacher at Jomo Kenyatta Univerity. **His innovations range from recycling waste paper and wood waste into fuel briquets and plastic waste into roofing tiles, fences and handbags.** He developed different tools for recycling, for example an oven to melt plastics. He sells these and gives workshops on how to use them, so people can open up their own small recycling „enterprise“. He points out that he is not interested in personal gain, but in teaching and in giving an income basis to people in the recycling business with his innovations.

**„KEMA has even been awarded by UNEP, but still, Nairobi City Council is not supporting our efforts.“**



Recycled roof tiles and fencing poles

AMOUNT OF CASH

?



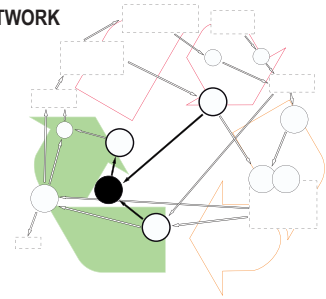
**KING ODHIAMBO** DIRECTOR „FRIENDS WASTE PAPER“

In Shauri Moyo, an area bordering the industrial area in the north, backyard activities are very common. One of these occupied backyards is rented by King Odhiambo, a small scale waste trader, who is specialised in paper materials and plastic bottles. On his rented 100 square meters storage area, he employs about 15 workers, men and women. As well as on the dumpsite women do the sorting while men are in charge of loading the trucks and shifting the recycled materials. Due to his specialisation caused by the lack of space Odhiambo's business is very dependent on the demand and market value of his materials. Right now, he explains, the business with plastic bottles is very low. „There are many wastepickers still collecting plastic bottles but no recycling firm wants to buy them.“

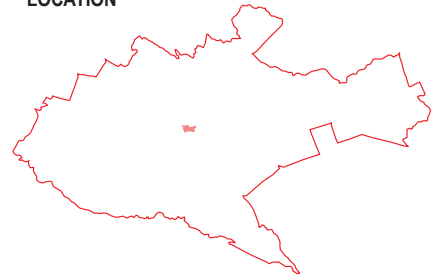
Beside the sensitivity of his business to market changes, there is a problem in proper storing the materials. There is no shelter for the collected materials and the separated paper is exposed to wind and rain. „If I would have more money, I would build up a structure to protect the materials from rainfall... and I would buy a machine to compress the materials.“



**NETWORK**



**LOCATION**



**ESTIMATED AMOUNT OF TRASH**

Buys 0.5 Tons per Day

**EQUIPMENT**

\* 100 Square meters Rented Area

\* 15 Employees

\* 1 Truck



**AMOUNT OF CASH (ESTIMATION)**



Average Purchase Price = 2 KSh per kg

Average Selling Price = 3 KSh per kg

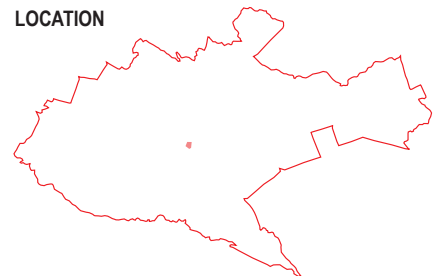
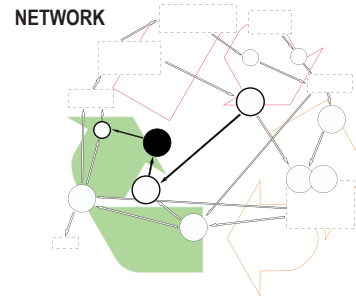


PETER JABUYA KAMONGO WASTE PAPER LTD.

Kamongo Waste Paper is the leading firm in terms of dealing with paper in Kenya. They are located in the industrial area of Nairobi. The company has 180 employees, but Peter Jabuya says that „Around 5000 people live out of Kamongo, if you count all the families of the employees, and the waste collectors and dealers who are connected to Kamongo through their business.“

Kamongo buys mixed paper from different sources; from street collectors, other waste dealers, supermarkets, but also from factories or printing presses. They sort the paper into different categories, like assorted paper, de-inking paper, cheap board or pure white. Pure white paper is the most valuable and can be sold for 13 Ksh per kilogram. After the sorting, the paper gets baled and sold to large recycling companies. A small part of the paper, about five tons a day, is recycled within the company itself. To recycle a bigger part wouldn't be profitable, since the costs for electricity are very high.

Peter Jabuya complains about the City Council and NEMA, the National Environment Management Authority. He claims that they are not at all appreciative of what the company is doing for the environment. Instead, Kamongo gets harassed constantly and has to pay a lot of money for fees and licences. „Our sell margin would be more than 10%, but it goes all the way down to 2% because of all the licensing fees we have to pay.“



ESTIMATED AMOUNT OF TRASH

100 Tons per Day

EQUIPMENT

\* 2 Hectares Plot

\* 180 Employees

\* 30 Trucks

AMOUNT OF CASH (ESTIMATION)

Average Purchase Price: 5 KSH per Kilogramm

Highest Selling Price: 13 KSH per Kilogramm  
(Used for White Paper)

Average Daily Sales Revenue: 1'100'000 KSH



**DRAFT**

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# TRASH IS CASH



**CASE STUDY: BROWN PAPERBAG**



**+ 2  
KSH/KG**



**PRICE**



**+ 1  
KSH/KG**





**+ 2.5**  
**KSH/KG**



**/KG = 0** KSH



**+ 0.4**  
**KSH/KG**



**+ 3.75**  
**KSH/KG**



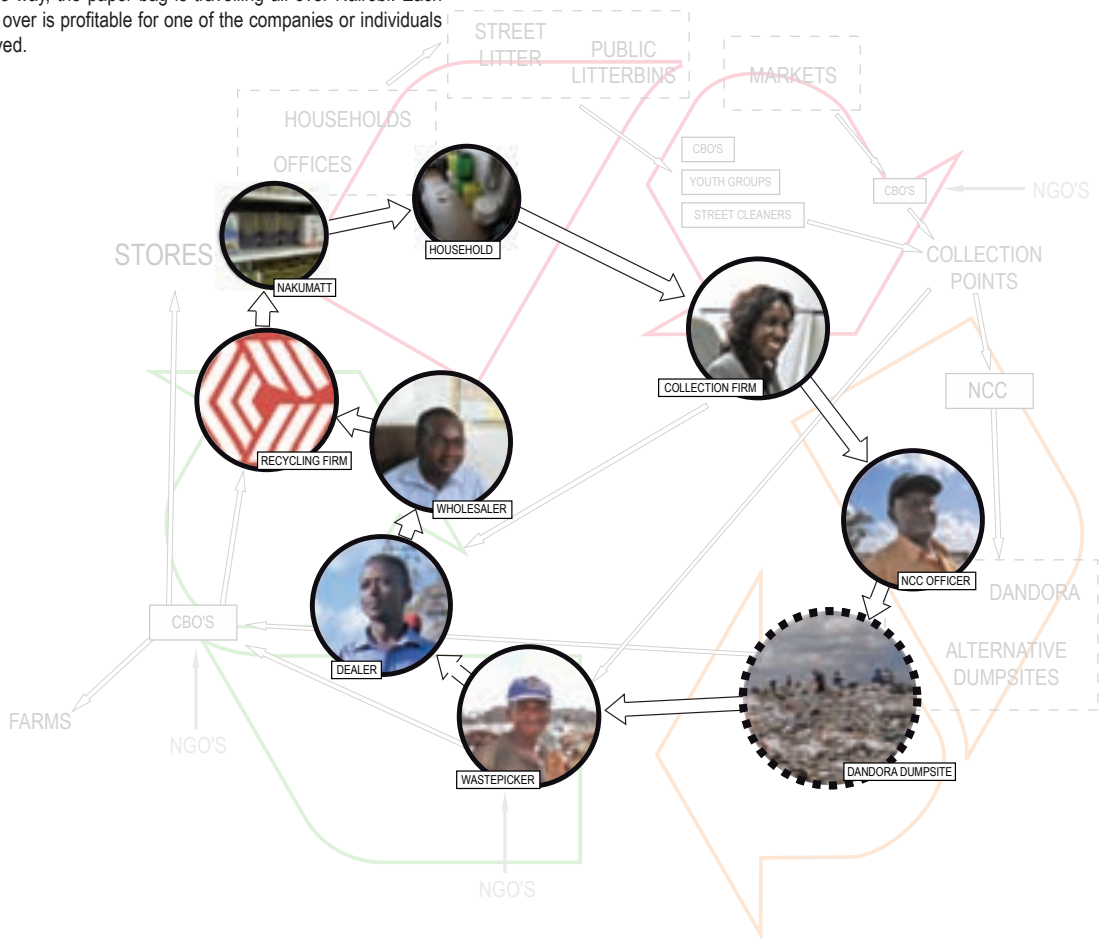
**+ 52.75**  
**KSH/KG**

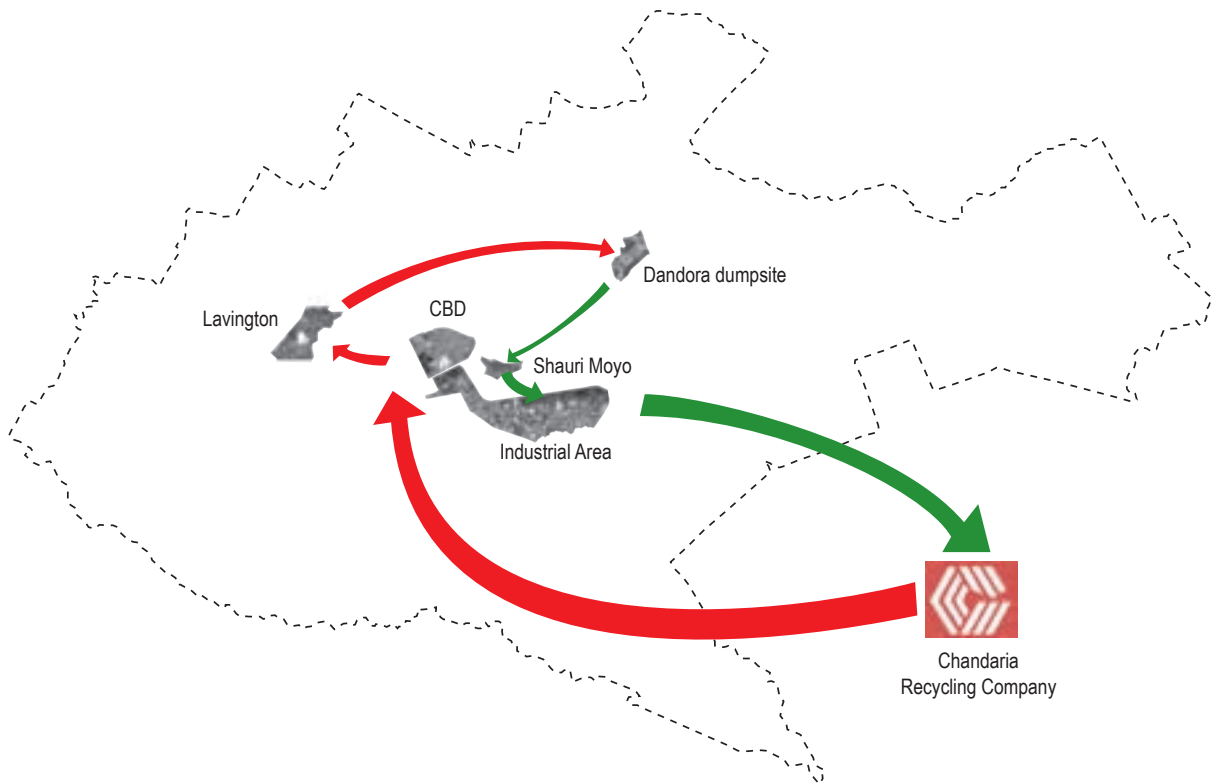
## Case Study: Brown Paperbag

Tracing a recyclable flour paper bag on its way through the waste network shows the social, geographical and economical dimensions of the network very well.

The cycle starts in the supermarket; from here the bag gets passed to a household, to the collection company and to Dandora, where it gets picked up by a waste picker and sold to a waste dealer, a wholesaler and a recycling firm, who brings the paper back into the store.

On its way, the paper bag is travelling all over Nairobi. Each hand over is profitable for one of the companies or individuals involved.





COLLECTION SERVICE

NCC DUMPING

DUMPSITE

WAS

MASTER'S SERVICE

DANDORA

DANDORA

NET

8 KSH  
7 KSH  
6 KSH  
5 KSH  
4 KSH  
3 KSH  
2 KSH  
1 KSH  
0 KSH  
-1 KSH  
-2 KSH  
-3 KSH

DANDORA DUMPSITE

+2.1

+0.4

+2



uncollected trash

1 KG



collected trash

1 KG



dumped trash

1 KG



TRASH IS CASH - CASE STUDY: BROWN PAPERBAG

STEPICKER  
WORK AL KAIDA

WASTE DEALER  
FRIENDS WASTE PAPER

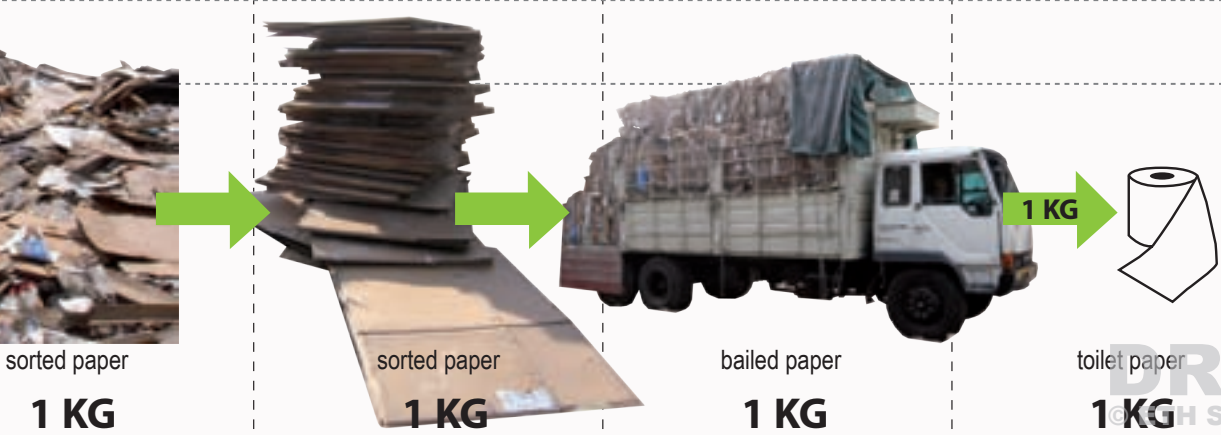
WHOLESALE  
KAMONGO PAPER

LARGE-SCALE RECYCLING  
COMPANY  
CHANDARIA

+59.5

+3.75

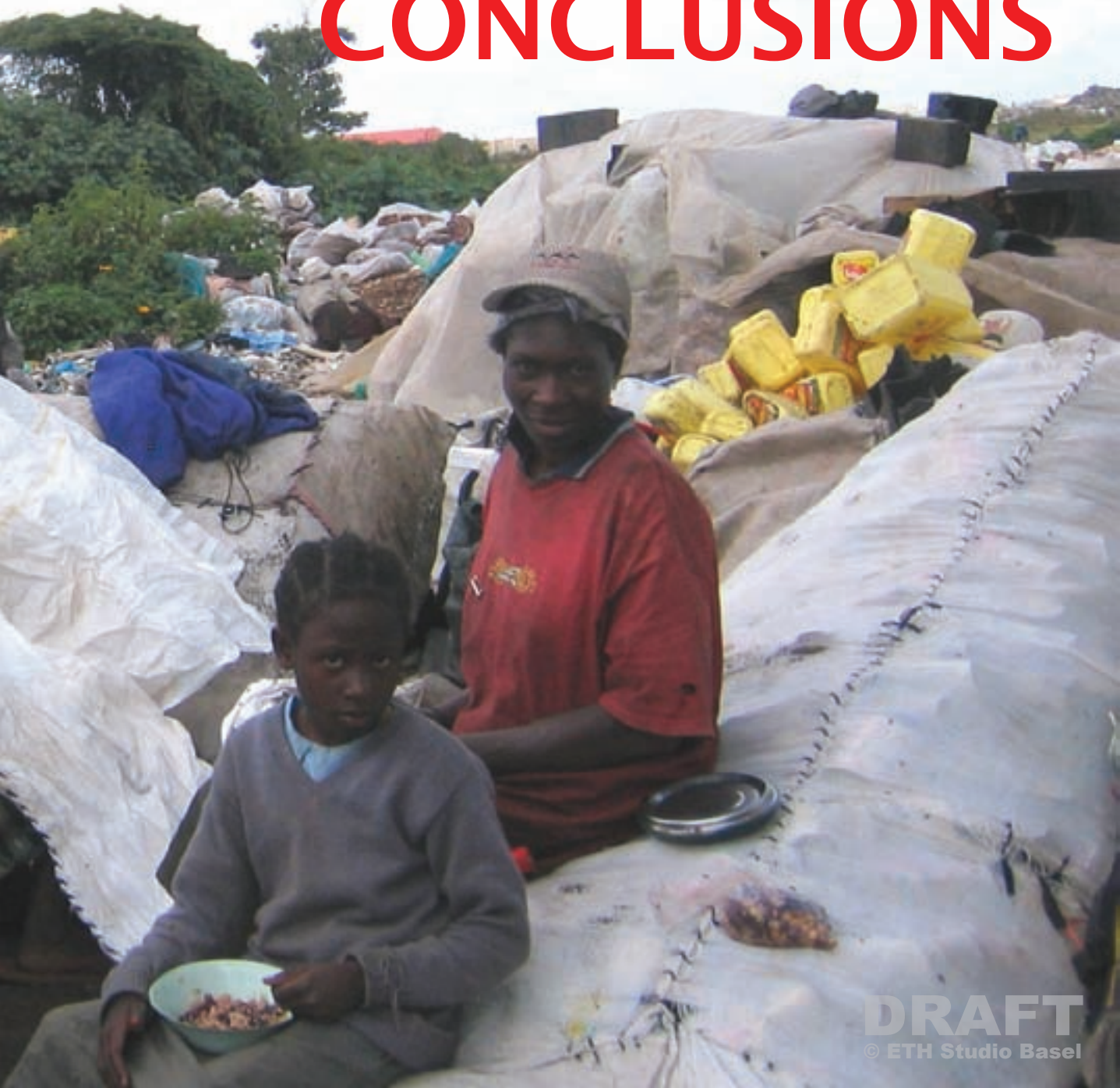
+1







# TRASH VS. CASH - CONCLUSIONS





**DRAFT**

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# TRASH VS. CASH - CONCLUSIONS

**RESPONSIBILITIES**

## Responsibilities of Nairobi City Council

The state of solid waste management in Nairobi appears to have an ambiguous character: On the one side, **the failure of the City Council on so many levels created opportunities for many people who were able to open businesses in the waste management sector.** As well, for many poor people activities like scavenging are the only possibilities they have to earn their livelihood. **On the other hand, the same poor people suffer most from the current situation;** by working on the dumpsite or living nearby they expose themselves to big health risks. In addition, there are severe damages done to the environment that can hardly be measured.

It is evident that the current situation has to change and that a place like the Dandora dumpsite must not exist any longer.

**Yet the current state appears to be very stable.** The network is very complex; the many people involved are only interested in their own profit and are very protective of it. Furthermore, the stance of the Nairobi City Council in the whole issue makes it hard to believe that things will effectively change in the next years, since **the Council doesn't seem to accept the responsibility it has and to acknowledge the seriousness of the current situation.**

There have been plans on relocating the dumpsite further east to Ruai and to let a private sector investor run it. But these plans doesn't seem to be well thought-out, and a clear vision of how the whole situation could develop is lacking.

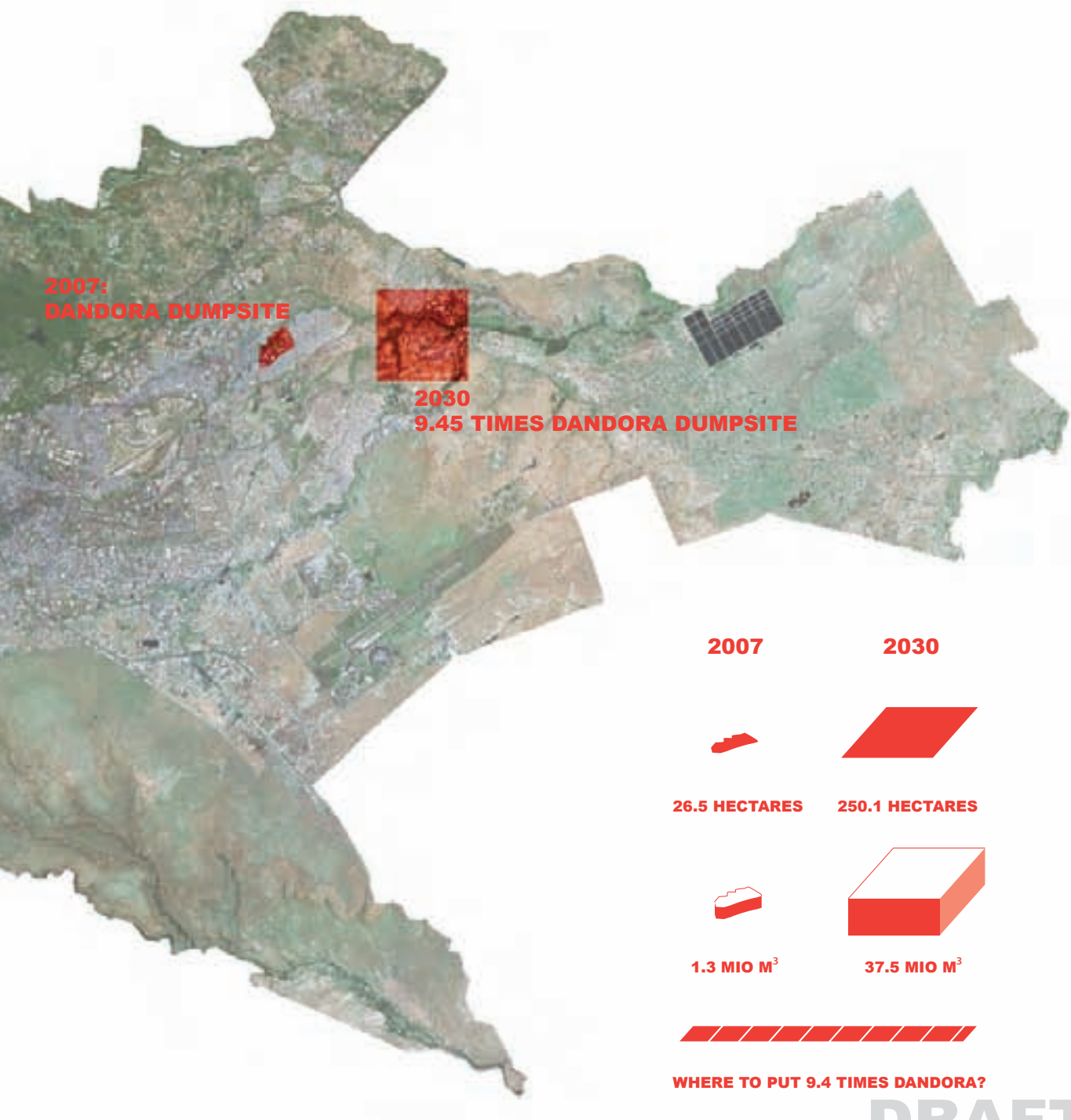
Dr. Alfred Omenya summarizes it like this:

"The City Council needs to spend a bit more time thinking about what their intentions are. Not just with Dandora, but also with a possible relocation to Ruai. It is a problem that the current situation is so stable, but the bigger problem is that the Council doesn't even seem to be thinking about a real solution. NCC is saying that they will open a new dumpsite in Ruai, but what will happen to Dandora? Are they going to physically remove waste from Dandora and carry it to Ruai? Common sense is telling us that this is actually not going to happen. If they want to close Dandora they have to have very clear ideas about rehabilitation, or people will just continue to dump there.

The big problem in Dandora is that the council does not have a clear policy on waste management, does not have clear plans of the dumpsite, does not have clear plans of the management of the dumpsite, that the council does not think long enough in terms of future solutions for the dumpsite. That is the reason for this disaster.

**There's always a way to simplify things and say that the involvement of private sector investors will solve the problems. But the private sector doesn't even want to get involved when they can't see a practicable solution for the problem.** Generally, the private sector needs a particular level of preparation, of information, of legal framework, a particular level of confidence in terms of planning. They need a policy change and a level of control that in fact as of now is not there. I think right now nobody would be interested in running the Dandora dumpsite if





**2007**

**2030**



**26.5 HECTARES**

**250.1 HECTARES**



**1.3 MIO M<sup>3</sup>**

**37.5 MIO M<sup>3</sup>**



**WHERE TO PUT 9.4 TIMES DANDORA?**



# TRASH VS. CASH - CONCLUSIONS

**BACKGROUND**

LANDFILLING AND INCINERATION IN DEVELOPING COUNTRIES

WASTE MANAGEMENT PRACTICES ACROSS THE WORLD

## Landfills and incineration in developing countries

Solid waste management has become a major issue of concern in many under-developed nations, especially as populations increase. However, there are difficulties in adopting management methods from industrialized countries, because of different financial and technological premises. Another reason is that developing countries have waste management problems different than those found in fully industrialized countries. For instance, the composition of their waste is different than that of developed countries. Most notably it is denser, has a higher moisture content and a different composition of organic and inorganic waste, which makes it impossible to adopt certain technologies directly.

In general there are two main treatment methods for waste disposal; landfilling and incineration.

**The placement of solid waste in landfills is probably the oldest and definitely the most prevalent form of garbage disposal.**

In many countries, most landfills are nothing more than open dumps.

Open dumps are characterized by the lack of engineering measures, no leachate management and no consideration of landfill gas management and pose serious risk to the environment and human health. **In Africa most nations practice open dumping**, since this has the lowest initial capital investment and operating costs of all dumping practices. Inadequate technical, financial and managerial resources in many countries can make it difficult to close open dumps and construct controlled or sanitary landfills, but it is possible to improve open dumps with little capital and small increased costs.

Sanitary landfills are sites where waste is allowed to decompose into biologically and chemically inert materials in a setting isolated from the environment. Necessary for a landfill to be considered sanitary are permanent control over construction and use and planned waste emplacement and covering. It is also important that landfills are located within reasonable distance from the urban areas and along a good road system, in order to ensure that costs for the transports to the dumpsite remain bearable, or unregulated dumping may become financially attractive once again.

**Compared to open dumpsites, it is obvious that it is more expensive to implement and design a sanitary landfill, however this is the standard to strive for in developing countries in the long term.** It is also important to note that although financial support and technical assistance may be provided by organizations or developed countries, it will be the responsibility of local and national governments to ensure proper waste disposal is a practical and viable option.

**Waste incineration is the second important option for waste disposal**, though in fact it should not be considered a disposal option, but more a possibility to reduce the volume of the waste significantly (reduction of up to 90%). Another benefit of incineration is the potential to generate electricity, which can partially offset the high costs.

**Waste incineration is typically only cost-effective in regions where land suitable for landfilling is scarce, and several factors make incineration inappropriate in developing countries.** Notable is for instance the high capital and operating costs involved, especially compared to the comparatively low cost of sanitary landfilling. It is also difficult to burn wastes in many developing countries due to their high moisture and low energy content. In addition, the infrastructure to maintain incineration plants is generally not available.

There are several examples for unsuccessful attempts to adopt the technology to developing countries. Buenos Aires, Mexico City, New Delhi and Sao Paulo among other cities have had to shut down incinerators due to high costs or environmental considerations. Financial aid from industrialized countries is an option, but even in cases where the initial costs are accounted for by an outside country or organization, the costs of properly operating and maintaining an incinerator and its environmental controls will still be unattractive in most countries.

The situation is different in many industrialized countries where land prices are often high, landfill space is limited and environmental controls are more strictly limited. Many regions in Europe, Japan and the United States incinerate a significant portion of their solid waste in an environmental-friendly manner.

### Waste combustion in a mass-burn system

Waste is tipped into the holding area of the incineration plant by trucks. From there, it's picked up by grabs and dropped into the incinerator. A grate system moves the garbage through the incinerator. The ash is collected, cleaned and disposed. The heat from the combustion chamber can be used for heating and electricity production. The flue gases from the burning process have to go through a clean-up process before getting released to the air. Removed pollutants include oxides, dioxins and heavy metals. Emissions consist mostly of carbon dioxide and water vapor and aren't a big hazard for health and environment, if the technology necessary for proper cleaning and filtering is available.

### Waste disposal in a sanitary landfill

Necessary for a dumpsite to be defined as a 'sanitary landfill' is the isolation of the disposed wastes from the environment.

A layer of compacted soil or clay provides this separation, a drainage system collects the leachate and ensures it can't contaminate the ground water.

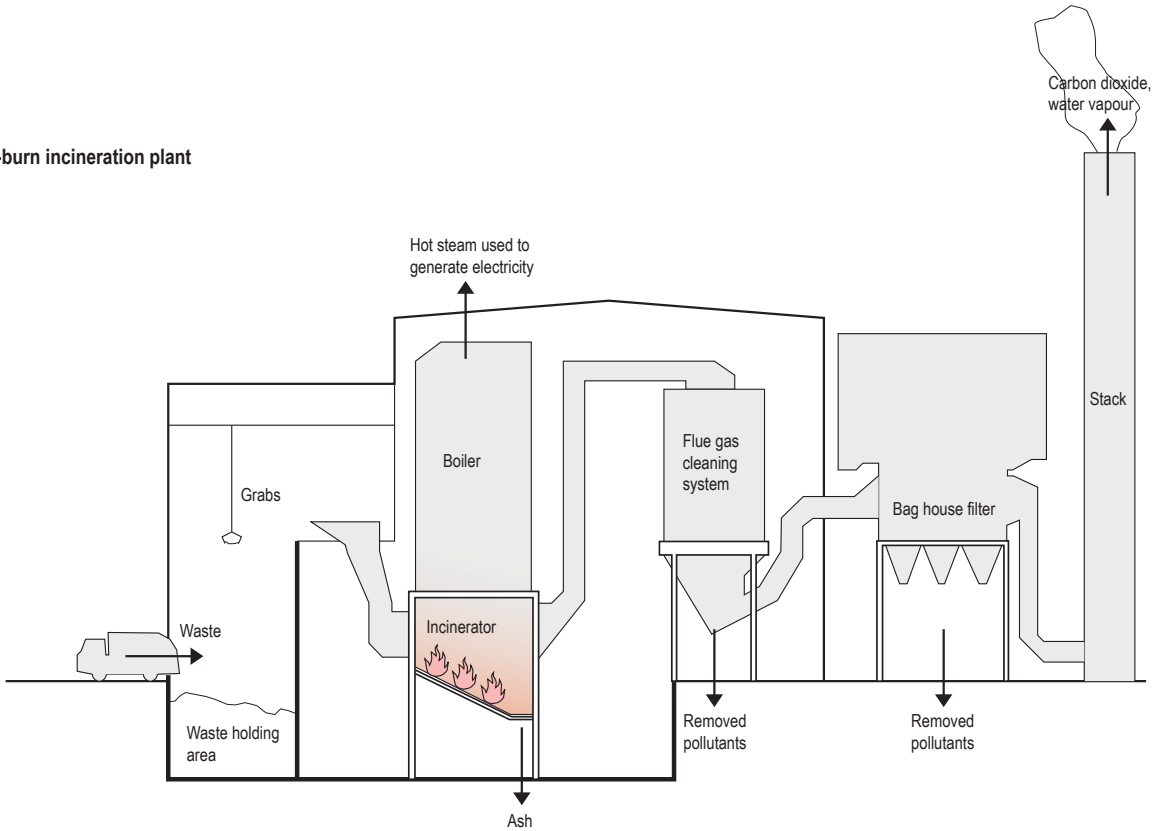
Waste gets disposed by waste collection trucks. Heavy equipment such as bulldozers compact the waste. After each day it gets covered with a layer of soil to keep odor and contamination to a minimum. Once the dump is filled up by enough layers of compacted waste, a final cover seals the site.

Landfill gas management is necessary in order to reduce emissions of mainly methane. Collected gas can be burnt or used as an energy source.

Monitoring systems for ground water and gas are used to keep the negative impact on public health and environment under control.

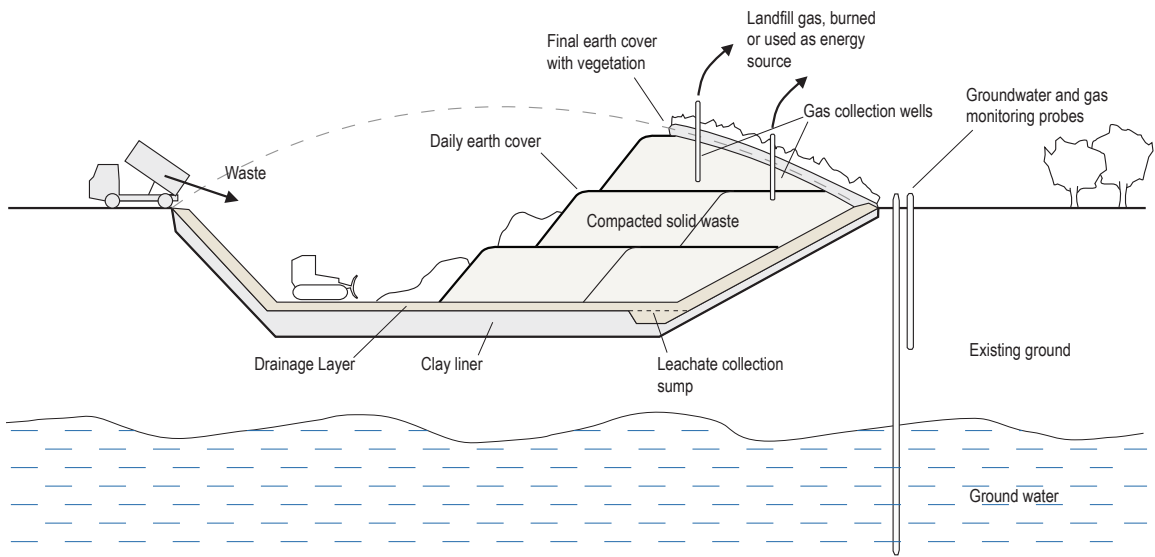


Mass-burn incineration plant



Source: <http://www.wasteresearch.co.uk/ade/efw/mmswcombustion.htm>

Sanitary landfill



## Waste management practices across the world

### Africa

In Africa open dumping is the common practice for waste management. Landfills in Africa are primarily open dumps without leachate or recovery systems and pose a serious risk to human health and the environment. The landfills are generally operated below the standards of sanitary practice. Often waste pickers remove materials to sell them for recycling. The standards of modern sanitary landfills may be too expensive for most African cities today, but there are possibilities for improvement of the current practices.

Incineration doesn't play a significant role in Africa. High costs and a limited infrastructure of human, mechanical and institutional resources as well as the composition of the waste itself suggest that it is an inappropriate technology for Africa now and for the foreseeable future.

### Asia

Landfilling is the cheapest and most prevalent method of waste disposal. In East Asia and the Pacific region, developed countries operate well-designed and -maintained dumpsites. In developing countries of the region open dumping is the main disposal practice. With the exception of some cities who operate sanitary landfills, these dumps are essentially uncontrolled and hazardous. In South and West Asia, open dumping is the most common method of waste disposal throughout the region. Some metropolitan areas may have designated landfills, though they rarely meet the standards of a good landfill.

In East Asia and the Pacific, up-to-date incinerators are in service only in cities of some of the more industrialized countries. Some cities had to shut down incinerators because air pollution standards could not be met, but new plants are planned and incineration will remain popular in cities where space for landfills is scarce. Many developing countries in the region have had problems with incinerators because the composition of the waste is often not suitable for incineration. In South and West Asia, most large cities have experimented with incinerators, but most of them proved to be failures and had to be shut down.

### Europe

Landfilling is an unavoidable component of all European waste systems. While in some countries almost no waste is landfilled, some countries in southern or eastern Europe dispose most of their waste on landfills. While small, uncontrolled landfills were the norm twenty years ago, things have changed or are beginning to change at least. Concerns about health issues and pollution have led to an emphasis towards bigger and environmentally sound landfills.

Reliance on incineration varies between different countries. In Western Europe, usually a big part or most of the waste is burnt. There's a strong commitment to pollution control and the energy generated by the incineration plant is usually used for heating. Many European countries have are phasing out older generations of incinerators, and in Eastern Europe many plants are older ones and don't have adequate environmental control.

### Latin America and the Caribbean

In Latin America and the Caribbean, landfill use has increased in recent time. Most large cities in Central and South America have landfills, however, many of them are more like controlled dumps with no environmental measures and monitoring. Only selected cities have sanitary landfills. Central American countries don't have landfills, and wastes are disposed in open-air dumps and pose significant environmental risks.

Currently, virtually no incinerators operate in Latin America or the Caribbean. In different cities old incinerators had to be closed because they could not meet emission standards.

### North America

In North America, landfilling is the primary means of managing solid waste and still handles more than half of generated solid waste, although this percentage decreased in recent years. Newly introduced policies ensure that landfills meet strict design and operating requirements to minimize hazards to public health and the environment. This is resulting in fewer but larger landfills. Cleanup of old landfills is expensive and siting of new landfills can be very difficult.

Incineration is also used, though the number of operating incinerators has decreased in the last 20 years, because several older generation incinerators had to be closed down. Most of current waste combustion in North America incorporates energy recovery in the form of hot steam, which is used either directly for heating or to generate electricity.

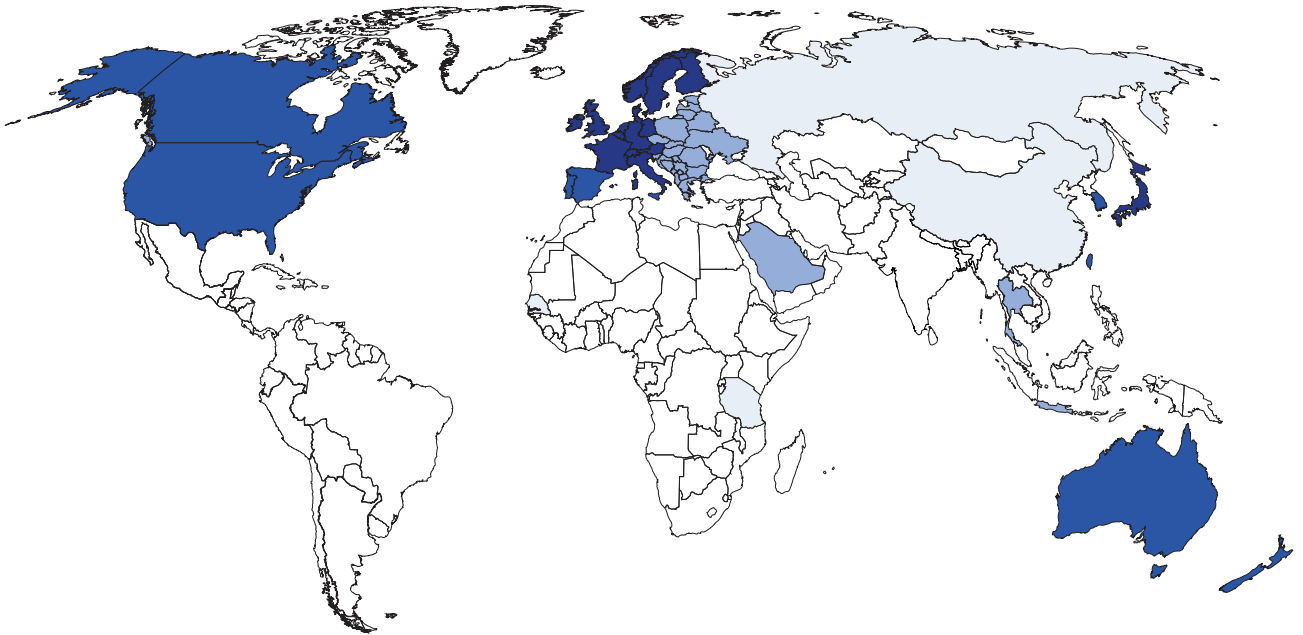
### Rough maps showing the use of incineration plants and landfills across the world

- No incineration plants at all, or incinerators had to be shut down
- Few incinerators in use, often pilot projects, or considerations of incineration has been made
- Incinerators are in use but environmental controls may be lacking
- Most larger cities use modern incinerators, importance of incineration throughout the countries varies
- Incineration plays a very important part in waste management. Percentage of total waste burnt varies
- Importance of landfilling varies, but landfills in use meet environmental standards
- Waste disposal is done in landfills, though some are not environmentally sound
- Landfills may be planned, but monitoring can be problematic
- Many landfills are open dumps. Use or consideration of sanitary landfills is increasing, mostly in large cities
- Landfilling are generally open dumps and pose a serious risk to human health and the environment

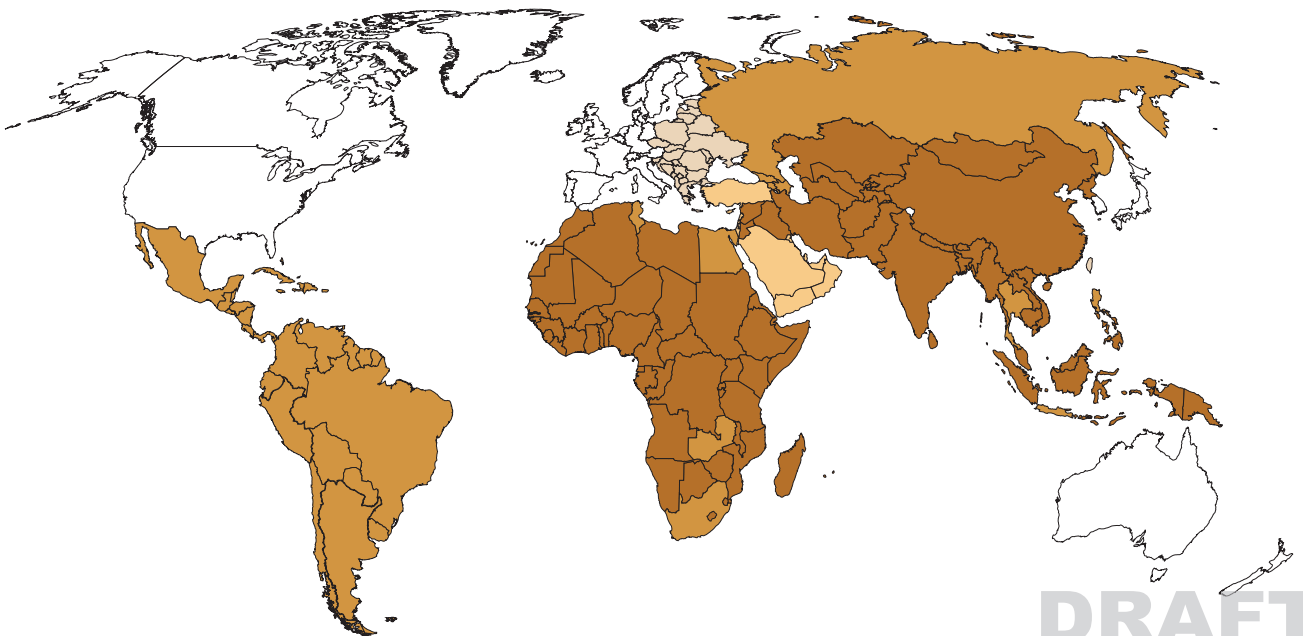
The maps show a rough overview and can be used to compare the situation in the different parts of the world, however they are incomplete and may be imprecise.

Source for the maps was the UNEP 'Source Book on Solid Waste Management' (1996).

Presence and state of incineration plants



State of landfills and manner of disposal





# TRASH VS. CASH - CONCLUSIONS

**POSSIBLE APPROACHES**

DUMPSITE UPGRADING

GOVERNMENTAL INITIATIVE

PRIVATE SECTOR INITIATIVE

## Approach 1: Dumpsite upgrading

### Landfill Gas Project in Dandora

The project starts from the fact that any dumpsite will produce gas as the organic part of the garbage starts to decompose. The amount and the composition of the gas depends on various factors, such as the amount of waste on the dumpsite, the percentage of organic waste present or the amount of rainfall in the area. In general, landfill gas emissions comprise mainly of methane (40-60%). Due to this, dumpsites are some of the leading sources of methane globally. Methane is a greenhouse gas. It is the second biggest contributor to global warming, but in fact it has 21 times the global warming potential of carbon dioxide. The gases have other effects as well; they can be dangerous for people working on the dumpsite, because they can ignite spontaneously. They also pose a health risk to people working on the dumpsite or living adjacent.

The idea of the project is to capture the emitting landfill gases. The captured gas can be used as a fuel, and thus be a cheap energy source for the people in the neighbourhood. Hence, there are positive effects on many levels; there's a socio-economic benefit for the neighbouring communities, there's an improvement of the ambient air quality and a reduction of greenhouse gas emissions.

In a first step a feasibility study had to be made, in order to determine the exact composition of the gas and the potential of Dandora for such a project. The pictures show the drilling of pipes into the garbage and the installation of the equipment necessary to compress and capture the gas.

The landfill gas project in Dandora was implemented by Eco-Build Africa and Climate Network Africa and is supported by the Dutch development agency.

One thing that justifies such a project, is the fact that the dumpsite is there and has to be dealt with. A project like this will lessen the negative impact of the dumpsite on the environment and on public health and it can bring a benefit to the people living adjacent to the dumpsite. However, it's not a solution for the waste management problem as a whole and no reason to stop looking for integral solutions. Given the fact that the status quo will most likely continue to exist in the next couple of years it can make sense, and it can be a good tool to find new ways of dealing with the waste and to gain knowledge on how to rehabilitate the dumpsite once it will be closed.





## Approach 2: Governmental initiative

### Case Study: Porto Alegre

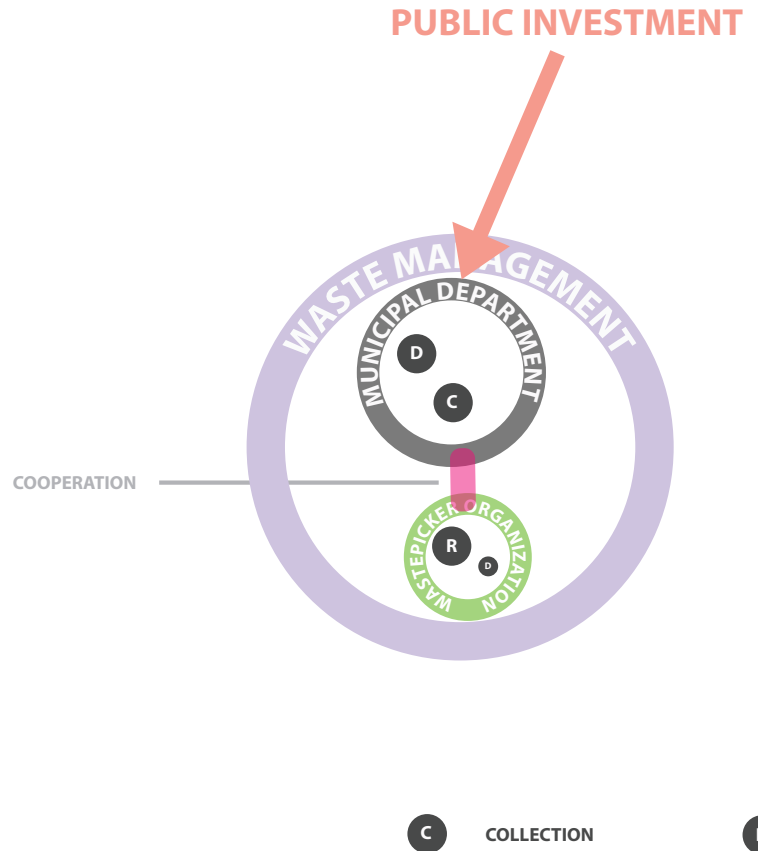
**Initial Position:** In 1989, Porto Alegre faced an emergency situation. **The dumpsite of the city had reached its capacity, its soil was contaminated and pollution levels were threatening environmentally protected areas.**

At that time, a large number of people were making a living by searching for and collecting recyclable waste from inside the dumpsite and were economically dependent from it.

**A New System:** In 1990, the Municipal Department of Urban Cleansing implemented an ISWM (Integrated Solid Waste Management) system, that should not only allow a sustainable development but also contain a strategy to fight poverty through income generation.

First, **there was an organization created for those who were living by collecting recyclable wastes,** and after that a partnership to introduce selective collection in the city was brought in. Based on a mutual agreement, it was established that the local government would be responsible for collection and delivery of recyclable waste to the former scavengers, who would separate, store and sell the recyclable materials to recycling factories. **Through this partnership, the former scavengers managed to obtain higher prices for their recyclable materials** and a larger quantity could be sold directly to the formal recycling industries, thus avoiding the middlemen. As a result of the new system, the amount of recycled waste in the city increased.

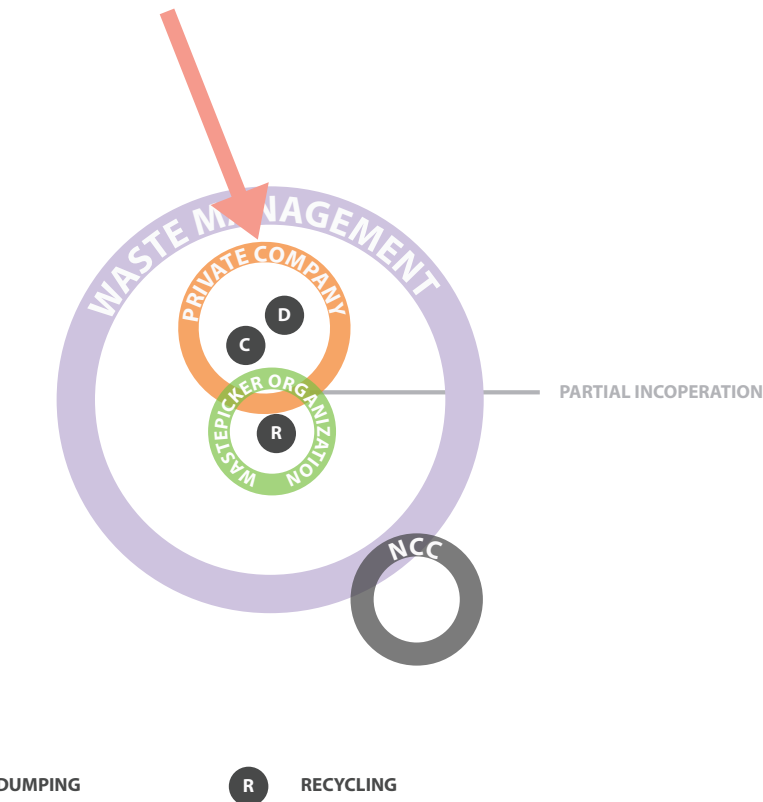
**Causes for Success:** The progress of Porto Alegre in solid waste management is primarily linked to the way in which the city has been managed since 1989, with **the introduction of the Participatory Budget, in which citizens and local government divide the responsibility to designate the municipal budget.** The elaboration of public attendance in environmental matters was an UNEP Best Practice award winning model.





Approach 3: Private initiative

PRIVATE INVESTMENT



“The situation at Dandora depicts a city that is clearly unable to develop and sustain a functional infrastructure for the disposal of solid waste. When thinking about possible solutions for the problem, two things have to be kept in mind: First the fact of the presence of various parties, other than Nairobi City Council, that have interest in the dumpsite and the waste management system in general. Second, the extensive damage on human health and the environment that has resulted from the current state.

In consideration of the lacking financial capabilities of NCC and the urgent need for a change in waste management, **privatisation of landfill activities seems to be a necessary option in Nairobi.** Contrary to other cities in the developing world, Nairobi has been welcoming or even demanding of the privatisation of the dumpsite. The reason for this demand is the extreme dissatisfaction with lack of service by the NCC.

Investment from companies can result in disadvantages for the existing local actors, since for example activities of scavengers or CBOs active on the dumpsite contradict the interests of sanitary landfill maintenance.

**Several points should be considered in order to ensure positive returns for the municipality and city residents:** Landfill activities should be privatised to a company with the capacity to invest in a sanitary landfill. By promoting recycling, currently active actors can be incorporated. Investing companies could operate private yards for sorting of waste and connect their landfill activities to recycling either at the landfill itself or at a separate plant. For this, the landfill management can contract individuals or small companies to sort recyclables.

**By having decentralized landfill sites, different parts of the city could profit** from this. But it would also reduce transportation distances in comparison to the usage of one centralized dumpsite and thus make it more effective.

**The relocation of Dandora dumpsite is inevitable in view of the current state.** Relocation has to consider a few important factors: One is how to re-integrate existing operators into realigned waste management activities. Though it may be easy to integrate many of the people working at the dumpsite today, it may be more difficult to eliminate the current cartels such as the Mungiki and they may demand re-negotiations of their status in the sector. A plan for the resettlement of the people living on the dumpsite would be necessary in order to reduce their resistance to dumpsite rehabilitation.

Rehabilitation of the site with an environmental clean-up is necessary, though in reality this could prove to be very difficult to realize, considering the current state of the site. Funds generated from new waste management activities could be used for such a rehabilitation.

Another concern should be the compensation for the lost incomes in Dandora. Most workers have fears that alternative sites will be inaccessible to them due to distance or different dumpsite management. For instance, **new jobs could be created in the area by promoting recycling activities and introducing sites for sorting of wastes.**”

## TRASH VS. CASH - COMPONENTS

Even if the Dandora dumpsite would be closed, there would still be the problem of more than 1.3 Million cubic-meters of dump remaining in the middle of these settlements, overshadowing and still polluting the area.

Waste pickers, the weakest and to changes most violable actors in this network, hold a key position in the waste cycle. If basic changes in the waste system would be introduced, it has to be assured that these actors will be integrated into a new system to maintain or upgrade their position.

With the capacity of Dandora dumpsite already at an end, the city runs the risk of a sprawl of illegal dumpsites and improper planned landfills. In about twenty years the demand for land for landfilling will be nearly ten times as big as the area of Dandora Dumpsite.

If a cooperation with Nairobi City Council or private waste collectors could be established, waste pickers would have direct access to recyclable resources. The material itself would be in better condition and could avoid the obsolescence it experiences on a dumpsite. A rising financial output and an increasing amount of recycled materials would be a direct result of this collaboration.





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Our thanks go to

Embassy of Switzerland in Nairobi, Ambassador Mr. Georges Martin, Winnie Mittullah, and the staff of University of Nairobi, School of Built Environment especially its students Newton Korir, Mike Onyoyo, David and Jackson, Alfred Omenya, Jeniffer Mbiti and Victor Omulo for their support for Dandorra research, the Community of Dandora, especially Mary, Monica and Olivia, D.O.Nyakach, Wambua Ndaka, "Network Al Kaida", Lynette A. Shasuvila, King Odhambo, Simon N. Muniwe and Peter Jabuya for insight information in the waste network, and very special thanks to Abraham and Humphrey Mwaka.

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