

ADB

THE GARBAGE BOOK



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SOLID WASTE MANAGEMENT IN METRO MANILA



Asian Development Bank

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dump

\ˈdʌmp\ *n* [perhaps Middle Dutch *dompen* to immerse, topple; akin to Old Norse *dumpa* to thump, fall suddenly] (circa 14th century) 1 a : an accumulation of refuse and discarded materials b : a place where such materials are dumped transitive 1 a : to let fall in or as if in a heap or mass b : to get rid of unceremoniously or irresponsibly



garbage

\ˈgɑːr-bɪʃ\ *n* [Middle English, *offal*] (circa 15th century) 1 a : food waste b : discarded or useless material c : refuse of any kind 2 a : TRASH



trash

\ˈtræʃ\ *n* [of Scand origin; akin to Norwegian *trask* trash; akin to Old Norse *trōs* fallen leaves or twigs, Old English *trus*] (1518)

1 : something worth little or nothing; as a : JUNK, RUBBISH



re-cycle

\ˌriː-ˈsiː-kl̩\ *vt* (1926) 1 : to pass again through a series of changes or treatments; as a : to process (as liquid body waste, glass, or cans) in order to regain material for human use b : RECOVER 2 : to adapt to a new use ; ALTER 3 : to bring back ; REUSE

land-fill

\ˈlænd-ˈfɪl\ *n* (1942) 1 : a system of trash and garbage disposal in which the waste is buried between layers of earth to build up low-lying land—called also a *sanitary landfill*



www.adb.org

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SOLID WASTE MANAGEMENT IN METRO MANILA

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For most, the **garbage crisis is limited to its collection.** As long as the mounds of garbage are removed...





...it is a problem out of sight and out of mind.

Urgent Need for Change

Metro Manila is a metropolis in crisis. Due to the forced closure of two primary disposal facilities, the metropolis has been without any means to adequately and safely dispose of its garbage. The solid waste management sector requires a massive and urgent overhaul. Change must come.

For most, the garbage crisis is limited to its collection. As long as the mounds of garbage are removed, it is a problem out of sight and out of mind.

But the crisis continues—environmentally, socially—as an unceasing tidal wave of refuse overwhelms the metropolis. In the absence of a functional system of waste reduction, reuse, recycling, and disposal, local governments cope the best they can.



Eric Saltes



Eric Saltes



Eric Saltes



Eric Saltes



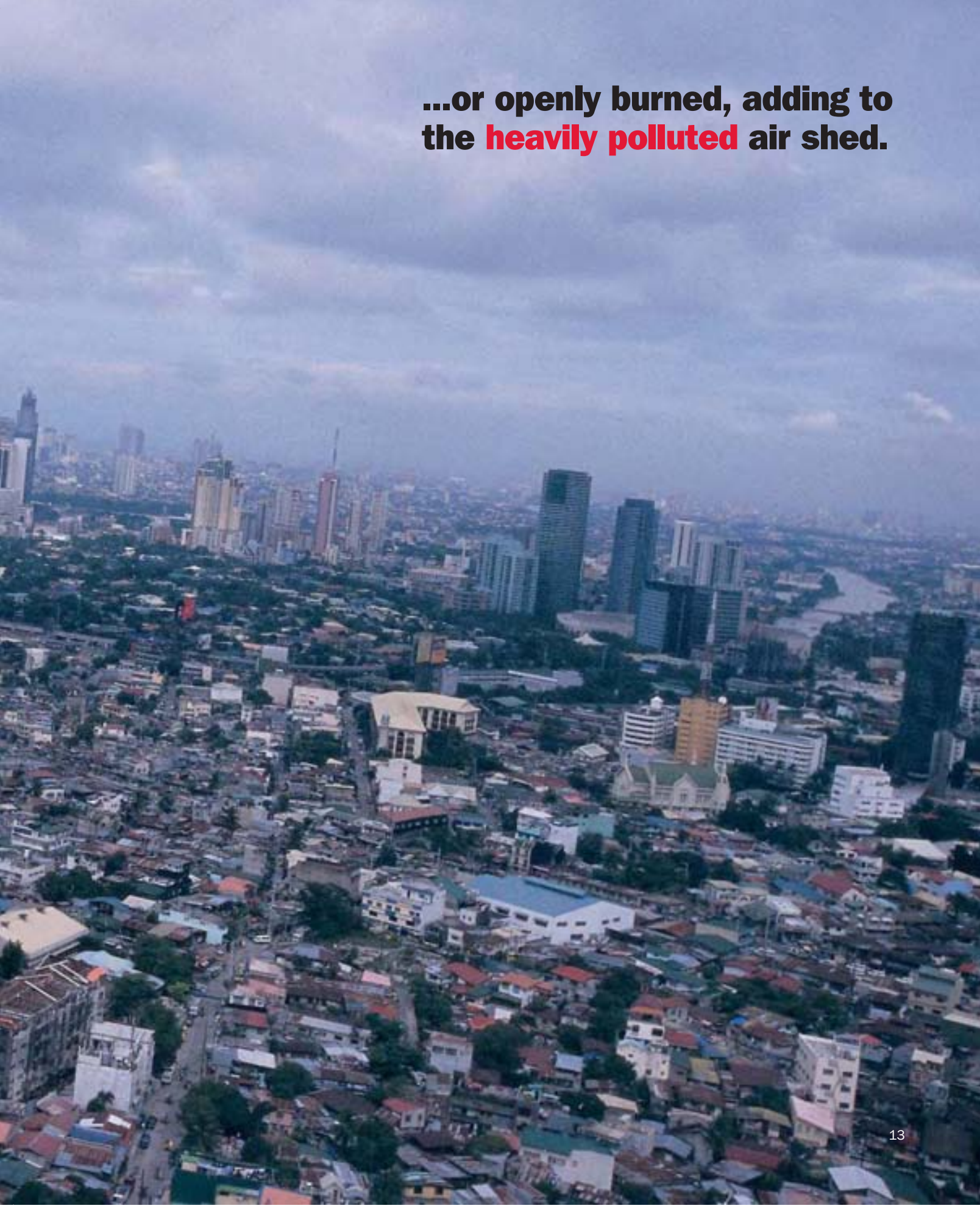


An aerial photograph showing a dense urban area with a river and a highway. The river flows through the center of the image, with a highway running parallel to it on the left. The buildings are tightly packed, and the roofs are in various colors. The text is overlaid on the top right of the image.

**Some 1,500 tons daily is
dumped illegally on private land,
in rivers, creeks, Manila Bay...**



...or openly burned, adding to the heavily polluted air shed.



Of the estimated 6,700 tons generated per day, approximately 720 tons per day is recycled or composted. The balance—some 6,000 tons daily—is either hauled to the city's dump sites, dumped illegally on private land, in rivers, creeks, Manila Bay, or openly burned, adding to the heavily polluted air shed.

Thousands of scavengers and waste pickers live and survive on this waste, eking out a harsh existence on mountains of smoldering waste. Some are children as young as 5 years old. Taking into account their families, the hundreds of junk shops and their workers, the thousands of eco-aides, the thousands of garbage trucks and their crews, and the tens of thousands of slum dwellers living on, around, and near the dump sites, an estimated 150,000 residents of Metro Manila know the sight and smell of garbage as an integral part of their daily lives.



Matthew Westfall



Ram Cabrera





Eric Sates



Eric Sates



Eric Sates



Eric Sates



Eric Sates



...an estimated 150,000 residents of Metro Manila know the **sight and smell of garbage** as an integral part of their daily lives.



Matthew Westfall



Ram Cabrera



In July 2000, after a weekend of heavy rain, a **mountain of garbage collapsed**, burying hundreds of homes.

The severity of Metro Manila's garbage crisis is illustrated by the Payatas dump site tragedy. In July 2000, after a weekend of heavy rain, a mountain of garbage collapsed, burying hundreds of homes. Later, due to a dangerous mix of methane gas and downed electrical utility poles, fires spread across the dump site. The bodies of 205 people were recovered and, reportedly, hundreds more remain missing.

In December 2000, the site was "permanently closed," with plans to fast-track a new sanitary landfill project. A crisis in collection ensued, with mountains of garbage left uncollected throughout the metropolis. Over time, without any alternatives in place, dumping at Payatas has resumed.



Garbage Everywhere

22 October 2001

Philippine Daily Inquirer Editorial

Forget about anthrax. Forget about bioterrorism. We are not going to die from these things. The people of Metro Manila are facing much more lethal, much more immediate threats to their health and well-being. These threats come from the mountains of garbage that dot almost every other block of the metropolis.

Metro Manila's dump sites are dangerous, exposed, and generate potentially toxic liquids called "leachate." As these toxins flow along the surface and seep into the earth, they risk poisoning the surface and groundwater that are used for drinking, aquatic life, and the environment. Waste fires at these sites are common, which send plumes of toxic emissions into the air. Other sites are critically unstable, presenting the possibility of another deadly garbage slide.

The majority of Metro Manila's dump sites will reach capacity during 2004. The likely result may be another visible crisis in collection and the hurried expansion of remaining sites. In this haste, longer-term, more sustainable solutions may be ignored.

Despite the promotion of waste segregation and collection at source, adoption has been at a very slow pace. Efforts must be dramatically scaled up to have any effect on the unceasing wave of garbage generated by Metro Manila.

The not-in-my-backyard (NIMBY) phenomenon is hard at work in Metro Manila. Despite numerous efforts, no community has been willing to take Metro Manila's garbage. A survey found that while 67% of residents believed that Metro Manila has a serious garbage problem, 73% did not want to see a sanitary landfill in their community. Notably, 78% of surveyed house-



Eric Soltes

Metro Manila's dump sites are dangerous, exposed, and generate potentially toxic liquids called 'leachate'.

The Surat, India Experience

In September 1994, nearly 30 years after the last urban outbreak in India, plague struck Surat, a city in western India. This served as a chilling reminder of how rapid urbanization and deterioration of the urban environment can bring people into contact with forgotten diseases. Pneumonic plague, a highly contagious form of the disease, kills 100% of its victims if left untreated. Crowding and poor sanitation provide ideal conditions for its spread. Because it is so contagious, the outbreak caused extreme panic locally and internationally, with one quarter of the populace fleeing the city. Fortunately, the outbreak was diagnosed quickly, widespread treatment began, and the death rate dropped dramatically.

Why an Epidemic?

Evidence points to the squalid conditions in much of Surat and the occurrence of two natural disasters, an earthquake and heavy flooding, which brought plague-infected rats into contact with the human population. Surat's sanitation problems then helped the rat population grow dramatically. A city of 2.2 million, Surat generates close to 1,250 tons of garbage each day, 250 tons of which remain uncollected. To make matters worse, monsoon floodwaters inundated the city, particularly low-lying slum areas.

Death Toll and Damage to the Indian Economy

In relative terms, the death toll of 56 persons was minor. By any other name, the plague probably would not have caused the kind of panic that it did. In financial terms, however, the plague's toll was much greater, costing the Indian economy in excess of \$600 million. More than 45,000 people canceled their travel plans to India, and the country's hotel occupancy rate dipped to 20% from 60%. Many countries stopped air and water traffic to India, while exports suffered a \$420 million loss.

World Resources Institute, *World Resources 1996-97*



Ram Cabrera

holds had no idea where their collected garbage was taken for final disposal.

Medical waste management presents another challenge. Nearly 3,700 health care facilities in Metro Manila generate an estimated 47 tons of medical waste per day, with 56% of this waste, or 26 tons, considered potentially infectious. A significant proportion of this dangerous waste finds its way into the municipal waste stream, and is handled by people who are poorly equipped and trained, exposing them to infections and other health hazards.

The problem of medical waste disposal is further exacerbated by the mandated closure of medical waste incinerators in hospitals in Metro Manila, as required by the Clean Air Act. No alternative is in place.

Against this grim context, a major accomplishment has been the passage of Republic Act 9003—the Ecological Solid Waste Management Act of 2000. While a good beginning, much work remains to be done. Despite the simplicity of its prescription—reduce, reuse, and recycle at the local level—the law awaits serious implementation.

RA 9003 is an enlightened piece of legislation, yet few local governments are familiar with it. The timetable is behind schedule, source reduction and segregation efforts at the local level are sporadic and uneven, and there is little active public participation, understanding, or interest. Significantly, the required Solid Waste Management Fund has not been set aside as mandated by law, limiting the level of investment.



The garbage business is lucrative. Over P3.54 billion is spent annually on waste collection and disposal. Yet despite the amount of money in the system, it does not function in a safe, sustainable way.

The garbage crisis is real, serious, and poses even grave threats to public health if not resolved. The root causes of the problems are not technical or financial, but rather relate to governance and political will.

We owe it to the next generation to resolve this crisis now.

**We owe it to the
next generation
to resolve this
crisis now.**



Eric Sales

History of the Waste Disposal Crisis

The Rise (Early 1991–Mid-1992): Early 1991 marked an important transition in Metro Manila waste disposal. Prior to this, the metropolis operated numerous dump sites, including the internationally infamous Smokey Mountain dump site in the City of Manila. In 1991, and as a result of mounting public pressure to improve waste disposal and close Smokey Mountain, the World Bank-financed 73-hectare (ha) regional sanitary landfill facility opened in San Mateo, Rizal. This was followed in 1992 with the opening of the 65-ha Carmona regional sanitary landfill in Cavite, which coincided with the closure of Smokey Mountain. Both facilities were designed and constructed to international standards and represented a major accomplishment for the Government. Several large dump sites also operated during the early 1990s, including the Payatas and Catmon dump sites.



Ram Cabrera

The Decline (Mid-1992–Late 1997): Over time, operations at San Mateo and Carmona progressively impacted local communities. Design, construction, and operation standards declined with each operational phase, raising concerns about environmental risks. Hundreds of trucks thundered through communities nightly, strewing garbage in their wake. The presence of junk shops, waste pickers, and informal shanties brought social impacts. Public opposition mounted.

Disposal operations continued at the ever-growing Payatas and Catmon dump sites, as well as at the Doña Petra dump site in Marikina, and the C4 dump site in Navotas. Dumping activities commenced at the Lupang Arenda dump site on the north shore of Laguna de Bay.



Bot Patena



Hundreds of trucks thundered through communities nightly, **strewing garbage in their wake.** The presence of junk shops, waste pickers, and informal shanties brought social impacts. **Public opposition mounted.**



The impending crisis led to the opening of the Lingunan dump site in Valenzuela, and the **stockpiling of waste at Pier 18 in Manila.**

Metro Manila was **out of options** for disposal, and waste went largely uncollected.

Prelude to Crisis (Late 1997–Late 1999): In early 1998, heightened public opposition forced the suspension of operations at Carmona. This placed increasing pressure on San Mateo and major dump sites to accommodate the additional waste. The impending crisis led to the opening of the Lingunan dump site in Valenzuela, and the stockpiling of waste at Pier 18 in Manila. During 1998, waste disposal options were further limited by the passage of the Clean Air Act, which effectively stalled plans to build incinerators.

Two major donor-funded studies were also completed during this period, one of which evaluated toxic and hazardous waste, and another that developed a metro-wide master plan for solid waste. The recommendations of these studies were not implemented, even though one warned of an impending disposal crisis.



Matthew Westfall

The Crisis (Late 1999–Early 2001): The waste disposal crisis was a sudden phenomenon, marked by the forced suspension of operations of the San Mateo sanitary landfill in late 1999 due to immense public opposition. Within weeks, it brought about a near-catastrophic collapse of the municipal waste system and severe public health risks. Metro Manila was out of options for disposal, and waste went largely uncollected. Dumping at the existing sites was accelerated, and small-scale, private dump sites were developed.

As the Government searched for immediate relief, private sector initiatives were hastily conceived. These included plans to barge waste to Bataan to the northwest and Semirara Island to the south. Both plans met fierce public opposition, and following the issuance of legal restraining orders, were curtailed. The Government also sponsored a procurement process to select a private sector consortium to develop an integrated waste management system, including a disposal facility in Rizal. This also encountered public opposition and a legal restraining order, and the plan remains stalled to this day.

Uncontrolled dumping at the Payatas dump site led to a catastrophic waste mass failure at the site in July 2000. The tragedy signified the scale of the crisis.

Subsequently, Payatas was temporarily closed, only to reopen later. Other smaller dump sites struggled to cope with the increased waste stream. Waste from the City of Manila continued to pile up at Pier 18.



Eric Sales



Eric Sales



Matthew Westfall

Since 2001, additional controlled dump sites have been developed in an attempt to mitigate the crisis.

The Aftermath (Early 2001–Present): Since 2001, additional controlled dump sites have been developed in an attempt to mitigate the crisis. These include the Rodriguez disposal facility in Montalban and the Tanza facility in Navotas. RA 9003 was also enacted during this time.

A widely held perception is that the crisis has subsided, and that longer-term waste disposal issues have been solved. This, unfortunately, is far from reality.

Metro Manila has less than 2 years disposal capacity, assuming optimistic estimates. The potential for another waste disposal crisis is high unless immediate action is taken.

Without doubt, current waste disposal practices pose significant public health, environmental, and social risks. Over the short term, another tragedy like Payatas is possible, while long-term and increasingly costly damage to the environment is a certainty.



Matthew Westfall



Metro Manila has less than 2 years disposal capacity, assuming optimistic estimates.

WASTE DISPOSAL CRISIS:
International pressure to close the Smokey Mountain Dump Site

Palanyag Dump Site (Paranaque) Opens
San Mateo Landfill Opens
Operational Dump Sites: Smokey Mountain,
Payatas, Catmon, Bagumbong Municipal,
Others

1988 1989 1990 1991 1992



Lupang Arenda (Laguna de Bay)
Dumping Commences During Mid-1990s

1995

Bagumbong Private Dump Site
(Caloocan) Opens

1996

Small C4 Dump Site (Navotas) Opens

1997

Jancom Incinerator Initiative
Considered by Government

JICA Solid Waste
Masterplan Published

1999

San Mateo Disposal Facility
Forced to Suspend Operations

Dumping at Pier 18 Commences

2000

DISPOSAL CRISIS HITS
METRO MANILA

Bataan Landfill Disposal Initiative
(Subsequently Curtailed)

Pro-Environment Selected for
Build-Own-Operate Regional
Facility

Payatas (Quezon City)
Catastrophic Slide Kills
Over 200

Payatas Dump Site (Quezon City) Reopens,
Sanitary Landfill Obtains ECC-Clark
Landfill (Capas)

2004

Sanitary Landfill Opens
Clark Landfill (Capas)

Carmona Landfill Opens.
Smokey Mountain Dump Site Closes

METRO MANILA'S WASTE DISPOSAL TIMELINE

1993



1994

Dona Petra (Marikina) Dump Site Opens

1998



Carmona Disposal Site Forced to Suspend Operations

European Union Toxic and Hazardous Waste Management Study Completed

DAO 98-49
and DAO 98-50
Formulated

Passage of the Clean Air Act

Lingunan Dump Site (Valenzuela) Opens

2001

Barging of Waste To Semirara,
Public Opposition and Cessation

Effectivity of RA 9003 IRRs

2002

RA 9003 Enacted by Congress

2003

ADB Metro Manila Solid Waste Management Study Commences

Government Declines Jancom and Pro-Environment Initiatives

Tanza Dump site (Navotas) Opens,
Pier 18 Dumping Diminishes

Rodriguez Disposal Facility (Montalban) Opens,
Pulang Lupa Dump Site (Las Pinas) Opens

Waste Collection

Under RA 9003, the local government is responsible for collecting nonrecyclable materials and special wastes, while *barangay* units are given the task and responsibility of collecting and segregating the biodegradable, compostable, and reusable wastes. Of Metro Manila's 17 cities and municipalities, 11 contract out garbage collection to the private sector and 6 collect garbage themselves as part of their local government functions.



Eric Sales



Eric Sales




Eric Sales



IN THE NEXT 30 YEARS,
METRO MANILA
WILL GENERATE OVER **70**
MILLION
TONS
of **SOLID WASTE.**

COLLECTION
OF THIS WASTE
WILL REQUIRE...

... A LINE
OF WASTE TRUCKS
GOING **THREE**
ROUND THE EARTH
AND OVER
HALFWAY
TO THE
MOON...



...WITH A
CUMULATIVE
WASTE TRUCK
TRAVEL **DISTANCE**
EQUAL TO A DISTANCE
OVER **4,000** TIMES
AROUND THE EARTH
AND TO THE **SUN...**

...AND AT A **COST**
OF **OVER**
PHP 100 BILLION
(\$1.9 BILLION).

The common collection practice is through **house-to-house collection**. Many local governments have **detailed local plans covering waste collection services**, and detailed route maps for collection vehicles.



Matthew Westfall



Matthew Westfall

Of Metro Manila’s 17 cities and municipalities, 11 contract out garbage collection to the private sector and 6 collect garbage themselves as part of their local government functions.

Marikina

Marikina City has a separated waste collection service within its *barangays*. The city collects solid wastes from households, markets, and commercial establishments, with two trucks traveling in tandem collecting biodegradable or nonbiodegradable wastes. The nonbiodegradable fraction is taken to the recycling station for sorting, where workers extract materials utilizing a mechanized conveyor system. Recyclable materials are then placed in large bins for temporary storage before being transferred to downstream private recyclers for eventual further processing and reuse. The biodegradable fraction is taken to the disposal site where it is spread, compacted, and covered with soil. The *barangays* are not allowed to collect recyclable materials, except for tree cuttings and garden and yard wastes. The dump site is in the process of being closed.



Pasay City

Pasay City’s waste collection and disposal is undertaken through private sector “total package” contracts. The contractors are responsible for the entire collection, transfer, and disposal of wastes. The city is divided into five sectors, for which the number of truck trips has been agreed between the city and the contractors. Four contractors run a total of 102 truck trips. The contractors dump “wherever they can,” including Rodriguez, Montalban. Transfer and disposal are considered “expensive, taking up to 4 hours per load, and costing up to P1,500 (\$27) per truck for tipping fees at private dump sites.”



Current Collection and Disposal System

Local Government Unit	Collection	Reported Coverage (%)	Own Disposal Facility	Reported Waste Disposal Location
Caloocan	Contract		Yes	Rodriguez
Las Piñas	Administration		No	Pulang Lupa
Makati	Contract	80	No	Rodriguez
Malabon	Administration		Yes	Catmon
Mandaluyong	Contract	95	No	Rodriguez
Manila	Contract	100	No	Rodriguez
Marikina	Administration	100	Yes	Doña Petra Rodriguez
Muntinlupa	Contract	85	No	Rodriguez San Pedro Bacoor
Navotas	Contract	95	Yes	Tanza
Parañaque	Contract		Yes	San Pedro
Pasay	Contract			Rodriguez San Pedro
Pasig	Contract	100	No	Rodriguez Taytay Payatas
Pateros	Contract/ MMDA		No	Rodriguez
Quezon City	Contract		Yes	Payatas
San Juan	Contract	90	No	Rodriguez
Taguig	Contract		No	Rodriguez
Valenzuela	Administration	80	Yes	Lingunan



Waste Disposal

Waste disposal is a necessary part of an integrated system for managing solid waste, one in which waste minimization and recycling initiatives should be prioritized. At the same time, practical and achievable waste disposal improvements are required to reduce the acute public health, environmental, and social impacts caused by existing dumping practices.

Accurate engineering and other technical data are virtually absent for existing disposal facilities and practices, and an assessment can only be prepared from cursory site observations and verbal site reports. Nevertheless, Metro Manila must act immediately to improve waste disposal practices and establish sanitary landfill facilities in accordance with RA 9003. Until this is achieved, waste dumping will continue to cause serious public health, environmental, and social damage.



Matthew Westfall



Eric Sales



IN THE NEXT 30 YEARS,
METRO MANILA
WILL GENERATE
OVER

AN AMOUNT

...A **'KNEE DEEP'** LAYER
OF WASTE
OVER THE **ENTIRE**
METROPOLIS
(OVER **630**
SQUARE KILOMETERS)...





230
MILLION
CUBIC METERS
of **SOLID WASTE,**
THAT EQUATES TO...

...WHICH WOULD FILL
THE COUNTRY'S **LARGEST**
SHOPPING MALL
OVER 175 TIMES.

PIER 18, CITY OF MANILA

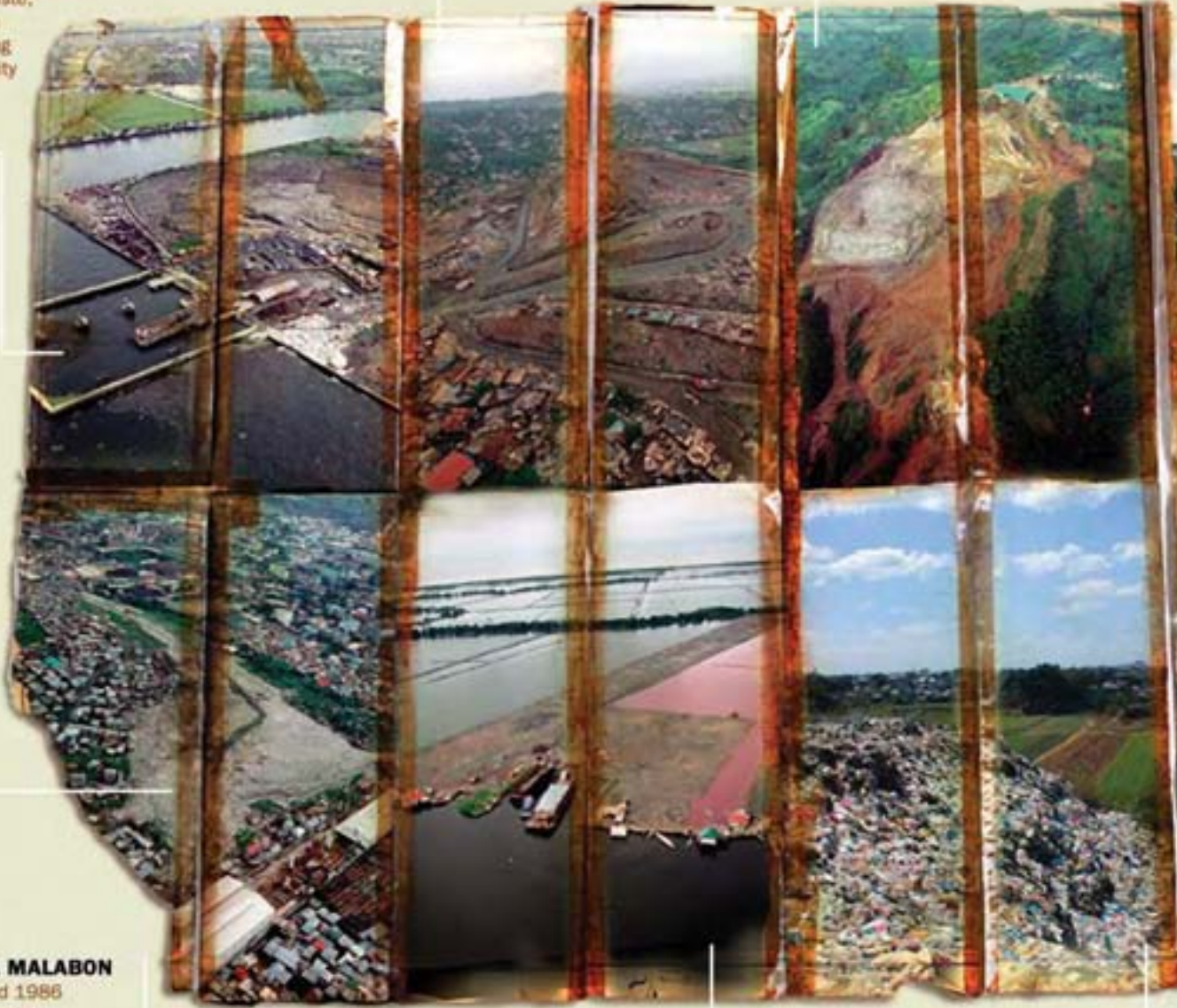
- Opened 1999
- 10-hectare 'temporary' dump site
- 750,000 cubic meters in-place waste volume
- Transfer station for Manila and Navotas waste; barged to Tanza
- Risk of becoming permanent facility

PAYATAS, QUEZON CITY

- Opened 1973
- 22 hectares
- 2,200 tons daily
- Slope instability; leachate threats

RODRIGUEZ, MONTALBAN

- Opened in 2002
- 14 hectares
- 1,200 tons daily
- Slope stability; leachate threats



CATMON, MALABON

- Opened 1986
- 5 hectares
- 210 tons daily
- Flood prone area; leachate threats

TANZA, NAVOTAS

- Opened 2002
- 11 hectares, plans for 100-hectare expansion
- 800 tons daily
- Constructed on former fishponds; surrounded by active fishponds
- Waste is imported by barge from the Pier 18 facility
- Acute leachate threat to nearby fishponds

DONA PETRA, MARIKINA

- Opened 1994, closure is planned
- 2 hectares
- 160 tons daily
- Leachate threats

BAGUMBONG (MUNICIPAL), CALOOCAN

- Operating for many years
- 2.5 hectares
- 35 tons daily

LINGUNAN, VALENZUELA

- Operating for many years
- 13 hectares
- 180 tons daily
- Flood-prone area; leachate threats

DUMP SITE DAILY WASTE IMPORT

Bagumbong

Pulang Lupa

Dona Petra

Lingunan

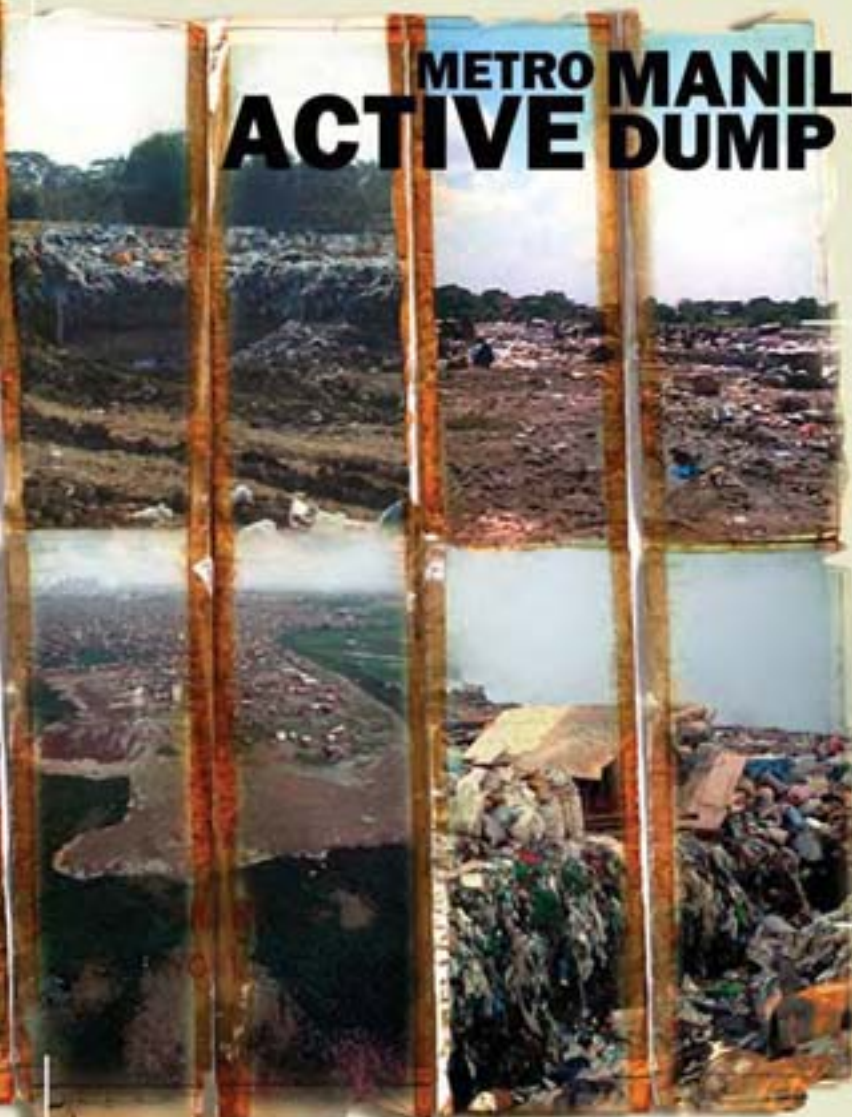
Catmon

Tanza

Rodriguez

Payatas

METRO MANILA ACTIVE DUMP SITES



LUPANG ARENDA, TAYTAY

- Dumping commenced in 1995
- 40-80 hectares, expansion plans to 170 hectares
- Source and amount unknown
- Illicit dump site located on the north shore of Laguna de Bay.
- Waste used as fill to raise surface above the lake flood elevation
- Resettlement housing for 25,000 households directly on waste
- Acute public health and environmental threats

PULANG LUPA, LAS PINAS

- Opened 2002
- 3 hectares
- 200 tons daily



METRO MANILA INACTIVE DUMP SITES



1-hectare dump site
closed in late 2002.

4-hectare
illicit dump site
closed in 2003.
Evidence of
spontaneous
combustion,
acute public health,
and environmental
threats

**PALANYAG,
PARANAQUE**

1-hectare
dump site
closed
in 2002

65-hectare
regional
disposal facility
abandoned
in 1998

**INACTIVE
DUMP SITES**

CARMONA, CAVITE

**SAN MATEO,
RIZAL**

50-hectare
regional
disposal facility
abandoned
in 2000;
reportedly
accepted
17.5 million
cubic meters
of waste

Leachate

Samples of liquid runoff, or leachate, from the Rodriguez and Payatas dump sites were tested and were found to have levels of contaminants that were far above the maximum allowed in drinking water. Most of this leachate seeps untreated into groundwater, a source of drinking water, and runs into the Marikina and Pasig River systems, and Manila Bay, a fisheries resource. The risks to human health are enormous.



Eric Sales



Eric Sales



Matthew Westfall



Matthew Westfall



Lead: Lead levels in the samples were found to be up to 22 times above standards. Lead poisoning is a leading environmentally induced illness in children, causing decreased mental abilities, learning difficulties, and reduced growth. Lead can affect almost every organ and system in the human body. The most sensitive is the central nervous system. Lead also damages kidneys and the human reproductive system. Unborn children can be exposed to lead through their mothers.

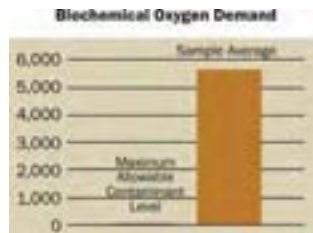
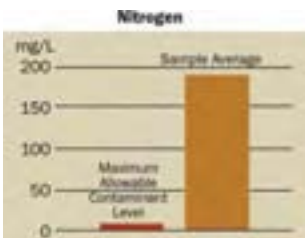


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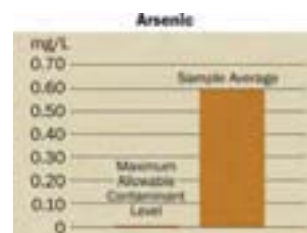
Fecal Coliform: Not necessarily a health threat in itself, this measure is used to indicate whether potentially harmful bacteria may be present, and is generally due to feces. The high levels of fecal coliform confirms the presence of a large amount of human waste in the dump sites and surrounding areas, which is presumably generated by households that lack alternatives to sanitation. In the samples tested, fecal coliform values were found to be an average of 7 million, with a high of 30 million, indicating significant contamination. Risks to waste pickers and others who handle this waste are significant.

Nitrogen: Total nitrogen levels of the tested samples were elevated up to 32 times over safe levels. Infants below the age of 6 months who drink water containing nitrite, a subset of total nitrogen, in excess of safe levels can become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.



Biochemical Oxygen Demand (BOD): High BOD levels that enter surface waters will deplete dissolved oxygen necessary to support fish and other aquatic organisms. Generally, water with BOD levels of 100 parts per million (ppm) or greater is considered very polluted. In the samples tested, BOD levels were up to 98 times above this very polluted level.

Arsenic: Arsenic levels were found to be 60 times above maximum safe levels, with a high of 84 times above safe standards. Potential health effects from contact or ingesting arsenic includes skin damage, circulatory system problems, and an increased risk of cancer.



Other Dangerous Contaminants: While not indicated in the limited sampling taken from these two sites, leachate from municipal landfills is highly variable and typically contains high concentrations of many other dangerous contaminants, such as heavy metals (zinc, copper, barium, manganese, cadmium, and chromium), hazardous organics, and possibly strains of opportunistic pathogens.

**Based on leachate sampling,
Rodriguez and Payatas generate an
estimated 26 kilograms of lead and
76 kilograms of arsenic annually...**





...which is released into the groundwater, rivers, lakes, and bay of Metro Manila.

DANGERS OF DUMP SITES

SITE SECURITY AND CONTROL

Most of the dump sites in Metro Manila have inadequate fencing, signage, or security, and many allow unrestricted access onto waste piles.

SLOPE INSTABILITY

The catastrophic slide at Payatas is an example of the impacts of slope instability. Several dump sites have overly steep slopes, and require urgent slope stability assessment and mitigation.

SITE DRAINAGE

Site drainage measures are needed to prevent ponding and flooding, promote slope stability, and reduce surface erosion and run-off. Many dump sites lack adequate drainage measures and are prone to flooding.

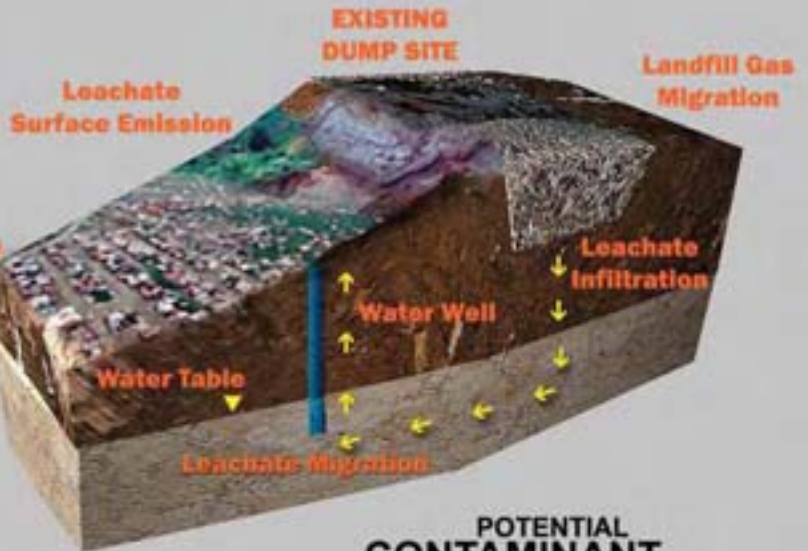
EXPOSED WASTE

It is essential that wastes be fully encapsulated to prevent the direct contact of waste with human receptors and the outside environment. This is normally achieved by covering the waste daily with soil, and by placing and maintaining a final cover system over the entire waste area. None of Metro Manila's dump sites have adequate final covers, and most consist of exposed waste, without any cover.



SURFACE LEACHATE MIGRATION

Leachate is a term used to describe contaminated liquids which form within waste materials. The toxicity of leachate can be considerable, and the generation of leachate can continue for many decades. Currently, leachate from several large dump sites flows untreated into surrounding river systems, and ultimately, into Manila Bay.



POTENTIAL CONTAMINANT PATHWAYS

SUBSURFACE LEACHATE MIGRATION

Since dump sites are devoid of base containment and leachate collection systems, leachate seeps into the earth and into groundwater. Around many dump sites, the potential for groundwater contamination is high.

LANDFILL GAS MIGRATION

Landfill gas is formed as a direct result of waste decomposition. Containing methane, landfill gas is explosive at certain concentrations, and potentially dangerous landfill fires have been observed at several dump sites. A major fire has also been reported at Pier 18.

SITE CLOSURE AND POSTCLOSURE MAINTENANCE

Environmental protection requires that dump sites be closed properly. Closure includes grading, final cover materials and protective vegetation cover, drainage, environmental monitoring of groundwater and surface water, fencing and security and access roads. None of the inactive sites have been closed in accordance with the existing regulations. Ultimately, every dump site in Metro Manila will require adequate closure and postclosure maintenance.



Waste Picking

One of the most serious concerns of the current dump site operations is the presence and operations of waste pickers and scavengers. Over 4,300 waste pickers operate at the dump sites, working in dangerous and filthy conditions. They are poorly organized and largely unprotected against the dangers of waste handling. Children, as young as 5 years, work at some of these dump sites.

Many thousands more live and work within the arena of Metro Manila's garbage dumps—perhaps as many as 150,000 people—and are in constant contact with the city's waste stream.



Matthew Westfall

Eric Scales

Over 4,300 waste pickers operate at the dump sites, working in dangerous and filthy conditions.



Eric Sales



Matthew Westfall



Eric Sales



Disposal Capacity Projections

Short-Term Dump Site Capacity

Based on current approximations, the majority of Metro Manila's dump sites will reach capacity in 2004. The ramifications of this are potentially serious, and could trigger another crisis in garbage collection and disposal, and the hasty development of substandard dump sites throughout the metropolis.



Matthew Westfall



Ram Cabrera

Indicative Remaining Life of Active Dump Sites

Currently Active Dump Sites	Dump Site Volume Remaining (Cu M)	Daily Importation (Tons)	Daily Capacity Requirement (Cu M)	2003	2004	2005	2006
Bagumbong Munic., Caloocan	NA	NA	NA				
Calmon, Malabon	90,000	210	504				
Doña Petra, Marikina	65,000	160	384				
Lingusan, Valenzuela	240,000	180	432				
Lupang Arienda, Taytay	NA	NA	NA				
Payatas, Quezon City	NA	NA	NA				
Pulang Lupa, Las Piñas	40,000	200	480				
Rodriguez, Montalban	5,000,000	1,200	2,880				
Tanza, Navotas	750,000	600	1,920				

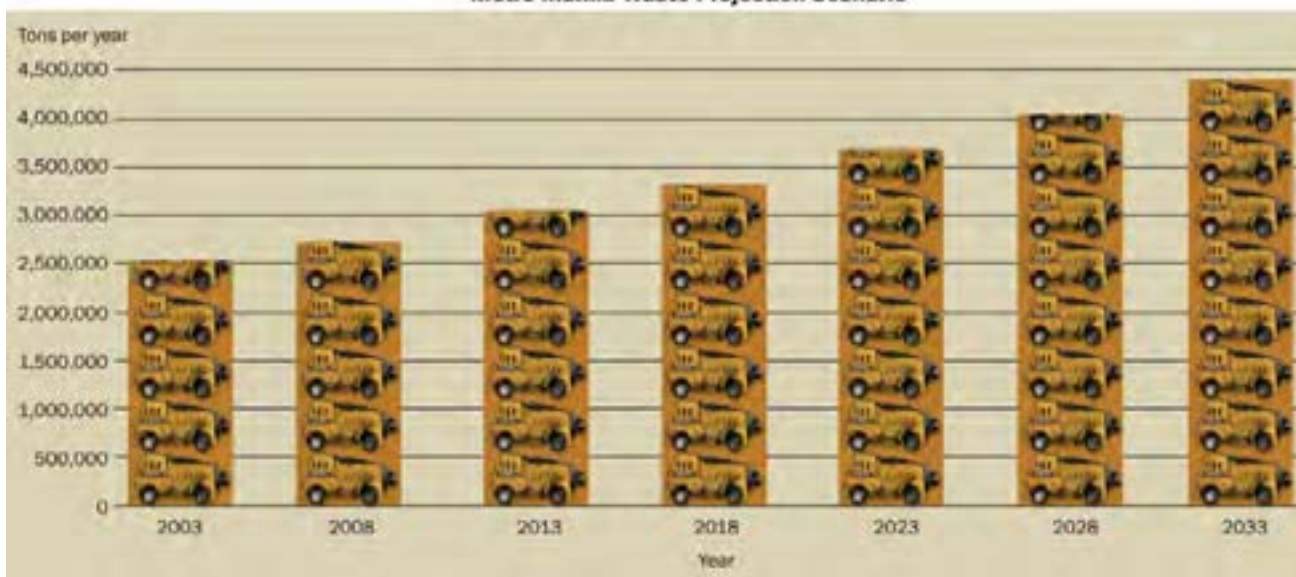
NA = not applicable



Longer-Term Disposal Capacity

Cumulative waste generation over the next 30 years will exceed 70 million tons. This is equivalent to 35 facilities of the size of Payatas, or many hundreds of facilities the size of Doña Petra or Palanyag.

Metro Manila Waste Projection Scenario



Cost of Solid Waste

Over P3.54 billion (US\$64 million) is spent annually on the collection and disposal of Metro Manila's solid waste, at an average cost of about P1,450 (\$26.40) per ton. Despite this high level of spending, the system requires significant improvement. Sound financial management is key to efficient and sustainable operations.

Local governments are mandated by the Local Government Code to collect fees for services. One of these is the collection of waste management fees from business establishments, where the charges are incorporated in the annual application for a business permit. Although local governments are allowed to adjust fees every 5 years, most have not.

Rates remain unrealistically low. For example, a typical fast food restaurant in one city pays only P17 per day for waste disposal, far below the actual cost.

Collection of waste management fees at the household level is being implemented only in a handful of wealthier barangays, but overall the willingness of households to pay is limited.

In 2001, Metro Manila's local government expenses for solid waste management varied significantly, from about 5% to an astonishing 24% of their total expenditures, with an average of approximately 13%. The majority of these expenditures are spent on private hauling contracts.



Matthew Westfall



Matthew Westfall



Matthew Westfall

EACH YEAR IN METRO MANILA,
OVER
P3.54 BILLION
(\$64 MILLION)

FOR EVERY MAN,
WOMAN, AND CHILD,
P295 (\$5.40) IS
SPENT BY THE LOCAL
GOVERNMENTS FOR
GARBAGE.

ON AVERAGE
LESS THAN P25 (\$0.45)
IS COLLECTED PER CAPITA ON A
"USER PAYS" BASIS TO RECOVER COSTS,
THE REMAINDER BEING PROVIDED
BY **CENTRAL**
FUNDING.

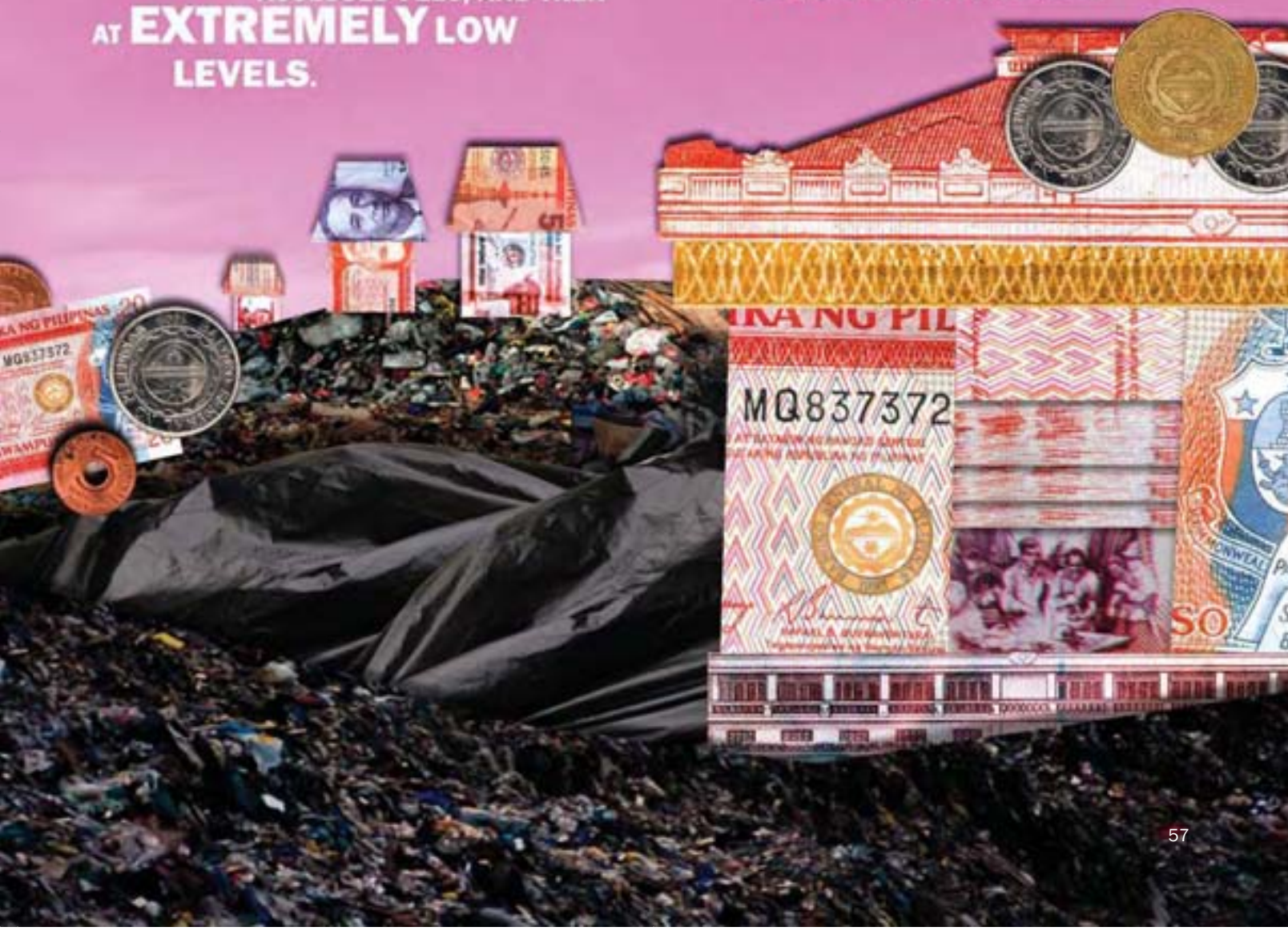


IS SPENT ON

GARBAGE COLLECTION AND DISPOSAL.

IN GENERAL,
ONLY BUSINESSES ARE
ASSESSED FEES, AND THEN
AT **EXTREMELY LOW**
LEVELS.

THE SYSTEM IS
HEAVILY SUBSIDIZED
and **FINANCIALLY**
UNSUSTAINABLE.





Matthew Westfall

Local governments are not recovering the full cost of garbage collection service. Since it is only the business sector that is paying garbage fees, the rate of recovery of expenses is very low, ranging from only 2% to 24%. The large balance is subsidized by local government.

Per capita cost for solid waste management varies widely, from P64 per person in Pateros to P1,164 per person in Makati. The same is true for the cost per ton of solid waste collected and disposed.

Per capita **cost** for solid waste management **varies widely**, from **P64** per person in Pateros to **P1,164** per person in Makati.

Collection of Business Garbage Fees vis-à-vis Total SWM Expenses, 2001 (P'000)

LGU	Garbage Fees ^a	SWM Expenses ^b	Rate of Recovery (%) ^c
Caloocan	20,714	357,007	6%
Las Piñas	12,820	76,361	17%
Makati	13,835	418,577	3%
Malabon	3,777	22,067	17%
Mandaluyong	7,247	94,123	8%
Manila	57,589	574,990	10%
Marikina	7,053	52,804	13%
Muntinlupa	7,012	91,377	8%
Navotas	1,850	43,974	4%
Parañaque	3,114	182,893	2%
Pasay	5,473	243,807	2%
Pasig	11,414	160,458	7%
Pateros	406	2,988	14%
Quezon City	56,107	941,828	6%
San Juan	3,137	46,701	7%
Taguig	4,040	52,370	8%
Valenzuela	10,426	42,716	24%
Average All LGUs	226,014	3,558,345	7%

LGU = local government unit, SWM = solid waste management.

^a Total garbage fees collected from business establishments.

^b Total expenses for SWM.

^c Percentage of total garbage fees collected as to total expenses for SWM.

Annual Per Capita SWM Cost, 2001

LGU	SWM Expenses ^a	Total Population ^b	Percentage ^c	Per Capita Cost
Caloocan	357,077	1,190,087	100%	300
Las Piñas	76,360	477,791	100%	160
Makati	418,577	449,583	80%	1,164
Malabon	22,067	342,447	100%	64
Mandaluyong	94,123	281,426	95%	352
Manila	574,990	1,597,841	100%	360
Marikina	52,804	395,316	100%	134
Muntinlupa	91,377	383,331	85%	280
Navotas	43,974	232,845	95%	199
Parañaque	182,893	454,579	100%	402
Pasay	243,807	358,670	100%	680
Pasig	160,458	510,412	100%	314
Pateros	2,988	58,016	80%	64
Quezon City	941,828	2,196,874	100%	429
San Juan	46,701	118,927	90%	436
Taguig	120,949	472,329	100%	256
Valenzuela	42,716	490,579	80%	109
Average All LGUs			98%	393

LGU = local government unit, SWM = solid waste management.

^a Total expenses for SWM, in P'000.

^b Source: National Statistics Office, 2000 Census of Population and Housing. A growth rate of 2.36% was used to estimate 2001.

^c Percentage of population serviced by LGU waste collection.



Eric Saltes



Eric Saltes

Collection of Business Garbage Fees vis-à-vis Total Local Income, 2001 (P'000)

LGU	Garbage Fees ^a	Local Income ^b	Percentage Share of Garbage Fees ^c
Caloocan	20,714	657,435	3.2%
Las Piñas	12,820	414,004	3.1%
Makati	13,835	3,187,442	0.4%
Malabon	3,777	136,081	2.8%
Mandaluyong	7,247	730,947	1.0%
Manila	57,589	2,815,984	2.0%
Marikina	7,053	460,673	1.5%
Muntinlupa	7,012	491,287	1.4%
Navotas	1,850	94,290	2.0%
Parañaque	3,114	730,607	0.4%
Pasay	5,473	609,778	0.9%
Pasig	11,414	1,519,402	0.8%
Pateros	406	22,551	1.8%
Quezon City	56,107	2,368,986	2.4%
San Juan	3,137	292,276	1.1%
Taguig	4,040	275,560	1.5%
Valenzuela	10,427	429,423	2.4%
Average All LGUs			1.5%

LGU = local government unit.

^aTotal garbage fees collected from business establishments.

^bLocal Income includes taxes, fees, and charges collected by the LGU (excludes IRA, borrowings, and grants).

^cPercentage share of total garbage fees collected as to total local income.

SWM Expenses vis-à-vis Total LGU Expenditures, 2001 (P'000)

LGU	SWM Expenses ^a	Total Expenses ^b	Percentage ^c
Caloocan	357,077	1,491,883	24%
Las Piñas	76,361	850,009	9%
Makati	418,577	5,270,998	8%
Malabon ^d	22,067	348,800	6%
Mandaluyong	94,123	1,129,801	8%
Manila ^e	574,990	4,558,818	13%
Marikina	52,804	778,475	7%
Muntinlupa ^d	91,377	1,059,651	9%
Navotas	43,974	292,836	15%
Parañaque	182,893	1,358,644	13%
Pasay	243,807	1,219,353	20%
Pasig	160,458	1,814,072	9%
Pateros	2,988	62,186	5%
Quezon City	941,828	4,467,316	21%
San Juan	46,701	430,373	11%
Taguig	52,370	432,394	12%
Valenzuela ^d	42,716	734,606	6%
Average All LGUs	3,558,345	26,300,215	13%

LGU = local government unit, SWM = solid waste management.

^aTotal expenses for SWM.

^bTotal current year expenditures of LGU.

^cPercentage total SWM expenses vis-à-vis total current year expense of LGU.

^dGarbage collection was done by administration.

^eGarbage collection was done partly by administration and partly by private hauling contractors.

The rate of recovery of expenses is very low, ranging from only 2% to 24%. The large balance is subsidized by local government.



RECYCLING

- Historically, an informal, economically driven initiative
- Includes community-based schemes, junkshop organizations; and larger commercial consolidators
- Recycling efficiency unknown, possible less than 10%
- Regulatory-driven recycling movement is establishing integrated metrowide system

ISSUES

- Most schemes are community-based, lack integration, economies of scale, and a sector-wide approach
- Many larger-scale government-led recycling initiatives have failed
- Informal recycling industry personnel work in unhealthy, often dangerous conditions

WASTE GENERATION

- 6,700 tons generated per day
- Over 2 million tons generated per year
- In 30 years, over 70 million tons to be generated
- Industrial and medical waste, including hazardous waste, pose additional problems

ISSUES

- About 27% of waste is illegally dumped or burned
- Little motivation and incentives to reduce waste generation
- Lack of public awareness to reduce and recycle

METRO MANILA'S SOLID WASTE MANAGEMENT

REGULATIONS AND ENFORCEMENT

- Historically, regulations have been fragmented and enforcement practices poorly implemented
- Recent regulations mandate widespread reforms throughout the sector
- Regulatory reform is in progress

ISSUES

- Slow progress on enforcing recent regulations
- Legal impediments to problem solving

INSTITUTIONS

- Recent regulations mandate dramatic institutional reorganization
- The National Solid Waste Management Commission, chaired by the DENR Secretary, has nationwide authority and responsibilities
- The Metro Manila Solid Waste Board, chaired by MMDA Chairperson, has metrowide authority and responsibilities

WASTE SYSTEM

COLLECTION AND TRANSFER

- Operations utilize dump trucks and ocean barges
- Reportedly around 1,500 truck trips per day
- 11 of the 17 Metro Manila local governments contract out collection to the private sector

ISSUES

- Lack of transparency in collection contracting
- Inadequate technical and financial accountability, and regulation of operations

DISPOSAL

- Solid waste dumped at dump sites or indiscriminately thrown
- Currently at least nine dump sites accept Metro Manila's solid waste
- Most dump sites are located on private land; many are operated by the private sector
- Dump sites lack adequate engineered protection systems; many face imminent closure
- Metro Manila is without sanitary landfills, and none is currently being developed

ISSUES

- Dump sites are polluting the atmosphere, rivers, reeks, lakes, ocean, and groundwater resources; threaten aquatic food resources; and put the human population at risk
- Many dump sites are poorly controlled, and endanger the health and safety of site personnel and surrounding residents
- Metro Manila is running out of disposal capacity, and mandated sanitary landfills are not being developed

FINANCING AND COST RECOVERY

- Reportedly, over P3.5 billion spent annually by the 17 local governments on solid waste management
- Equates to P295 for every man, woman and child
- Nearly the entire funding amount is through local government appropriation

ISSUES

- Need to encourage responsible private sector participation and user pays systems
- Need to rationalize expenditures between local governments and system components
- Lack of accountability for funds spent on solid waste management

ISSUES

- Institutions are poorly funded
- Institutions lack technical resources



Garbage, Poverty, and the Environment



PAYATAS, SEPTEMBER 2003

For the past **30 years**, the Payatas dump site has most likely been **releasing leachate** into groundwater and river systems...

...an amount currently estimated at 2 liters per second or

63 million liters each year...

...a rate that would fill **one 18-wheeled tractor trailer tanker** truck every 5 hours.



Matthew Westfall



Eric Sales



Eric Sales



Eric Sales



Eric Sales



Eric Sales



CATMON, SEPTEMBER 2003

Located in a **dense residential area** prone to flooding, the Catmon dump site has most likely been **generating leachate** for the past **17 years** with unknown consequences.



Eric Saitis



Matthew Westfall



Eric Sales



Matthew Westraill



Matthew Westraill



Eric Sales

PIER 18, SEPTEMBER 2003

Planned as a temporary facility, Pier 18 is fast becoming a permanent fixture in the Port area, and risks **becoming the next Smokey Mountain.**





Matthew Westfall



Eric Sales



Eric Sales



Matthew Westfall



Eric Sales



Matthew Westfall

TANZA, SEPTEMBER 2003

The 11-hectare Tanza dump site, with a planned expansion to another 100 hectares, **risks seriously contaminating nearby fish and shrimp ponds**, a key food resource for Metro Manila.



Eric Sales



Matthew Westfall



Eric Sales



Matthew Westfall



Eric Sales

LUPANG ARENDA, SEPTEMBER 2003

On the edge of Laguna de Bay, **a community of 125,000 urban poor** is being built over **2 million cubic meters of decomposing garbage**, at great risk to public health and the surrounding natural environment.





Eric Sales



Eric Sales



Eric Sales



Eric Sales



Matthew Westfall

RODRIGUEZ, SEPTEMBER 2003

Each year, the Rodriguez facility generates over **63 million liters of leachate**, enough to **fill over 28 Olympic-size swimming pools**, the bulk of which flows into the Marikina River system.



Eric Sales



Eric Sales



Matthew Westfall



Eric Sales

Opportunities for Change

RA 9003 has the **potential to effectively address** solid waste management





Eric Sales



Eric Sales



Eric Sales

RA 9003

RA 9003 is a sweeping legislation that has the potential to radically transform and improve the solid waste management sector. Key elements include

- a national ecology center to provide information, training, and networking services;
- mandatory segregation and recycling of solid waste at the *barangay* level;
- formation of solid waste management boards at the provincial, city, and municipality levels; and
- forming multipurpose environment cooperatives in every local government.

The National Solid Waste Management Commission is tasked with developing a national status report and framework. Local governments are required to formulate 10-year solid waste management plans; divert 25% of all solid waste through reuse, recycling, and composting by 2006; and establish reclamation and buy-back centers for recyclables.

Linda Eggerth



Linda Eggerth



Linda Eggerth



Linda Eggerth



At the *barangay* level, materials recovery facilities are to be established for final sorting, segregation, composting, and recycling, with residual wastes to be transferred to a sanitary landfill or other long-term facility.

RA 9003 has the potential to effectively address solid waste management. However, implementation is behind schedule, source reduction and segregation are happening on an individual *barangay* level or not at all, and there is little or no active public participation. Significantly, the Solid Waste Management Fund has not been set aside.

A comprehensive, integrated information, education, and communication plan is critical to the successful implementation of RA 9003.

Linda Eggerth





Eric Sates



Eric Sates

Community-Based Initiatives

While the extent of formal recycling through local government initiatives has been limited, informal and private sector recycling is extensive, at all points from waste generation through to final disposal. Scavenging forms a significant element of this activity.

It is estimated that between around 10% of total solid waste generated is recycled. With the passage of RA 9003, increased recycling is taking place, with an ambitious target of 25% waste reduction over a 5-year period.

Civic-minded professionals, with a strong sense of environmental conservation, started the zero-waste recycling movement in the Philippines in the 1970s. Their dedication to promoting a clean and better environment has in-

spired others to initiate the concept with community-based solid waste management programs in their communities.

Zero-waste recycling does not mean there is no waste to be collected or disposed of because everything will be recycled. Rather, it is a holistic approach at handling solid waste materials where any waste materials that are still useful are not allowed to go to waste.

Community-based initiatives involve waste segregation at source, recycling, and composting. Programs have been attempted in many *barangays* throughout Metro Manila—some have succeeded, others have failed for one reason or another. Leadership is the key factor in successful programs. In most cases, the initiative is led by the *Barangay* Captain or nongovernment organization aligned with the zero-waste movement.



Matthew Westfall



Matthew Westfall

Recycling

Recyclable materials include “factory-returnable” fractions such as paper, plastics, glass and metals, and also certain biodegradable materials which are composted. They are primarily recovered at source through community-based and recycling organizations from households and other establishments, by collection truck personnel during transfer to the dump sites, and by informal waste pickers who scour the waste piles and dump sites of Metro Manila.

The market demand for certain recyclable materials appears to be unmatched by the limited available supply. One large paper company, for instance, is willing to buy all recyclable paper materials obtainable from Metro Manila, but only 10% of its requirements can be supplied.

Most eco-aides who collect recyclable materials in Metro Manila are part of a network organized by the *Linis-Ganda* Foundation. The network includes the Metro Manila Federation of Environmental Multi-Purpose Coop-



eratives; the federation's 17 individual member multipurpose cooperatives representing the 17 local governments of Metro Manila; 572 junk shops, 2,500 junk shop workers, 1,200 eco-aides; and 132 drivers.

Matthew Westfall



Matthew Westfall



Matthew Westfall





Eric Sales



Eric Sales



Eric Sales



Eric Sales



Eric Sales

Composting

Over 2,000 tons of biodegradable household waste is estimated to be generated daily in Metro Manila. At a standard conversion rate of 50% from raw material to compost, a potential daily production of some 1,000 tons of compost could be obtained. But the few composting facilities in Metro Manila, at full capacity, can only process 10 tons of compost per day.

An assessment of implementing metrowide composting in each *barangay* as mandated under RA 9003 suggests problems with its viability. An annual required investment of P1.5 billion would generate an estimated return of only P750 million, or only half the amount required to make the system financially viable.

The greater problem is the marketing of compost, since its enormous potential supply can hardly be matched by demand in Metro Manila or even that in nearby provinces. Quality of compost and adhering to standards are also critical to keep shredded waste, and its contaminants, from entering the food supply chain.

Moving to Sanitary Landfills

An incremental three-step progression is the logical path to transforming Metro Manila's dangerous open dump sites to more controlled, environmentally sound dump sites, followed by their phase out and closure, and the establishment of properly engineered sanitary landfills.



Matthew Westfall

Open Dump Sites

Dangerous, with high environmental, public health, and social risks.



Matthew Westfall

Controlled Dump Sites

Short-term measures in the absence of longer-term, environmentally sound approaches.



Matthew Westfall

Metro Manila's local government officials visit the Waimanalo Sanitary Landfill in Honolulu, Hawaii, during the Mayors' Asia-Pacific Environmental Summit, September 2003.



Sanitary Landfills

Inevitably, a rational system of engineered sanitary landfills will need to be constructed. A metrowide system would likely include transfer stations to receive, disinfect, process, and compact residual wastes collected in Metro Manila. The wastes would then be sent to one or more regional sanitary landfills, where waste would be placed in sanitary landfill cells equipped with engineered environmental protection systems, including landfill lining systems, to act as a barrier between the original ground and the waste.

Typically, a sanitary landfill has leachate and landfill gas collection and treatment systems, groundwater monitoring wells, and landfill cover systems. Once full, a soundly managed sanitary landfill can be closed and converted to other uses, such as a park, golf course, or other open space.



Matthew Westfall

Action Plan for Change

Sector Planning

Issue

Prior to RA 9003, there was little guidance, regulation, or coordination of solid waste management in Metro Manila

Solutions

RA 9003 empowers local governments to take primary responsibility for, and enforcement of, their solid waste management systems. They are now required to

- establish city-level solid waste management boards;
- develop and implement 10-year solid waste management plans; and
- serve as members on the Metro Manila Board.

Next Steps

- Prepare and implement long-term financial plans setting out required capital and recurrent expenditures over a 10-year planning period.
- Progressively introduce market principles in solid waste management, including household garbage fees for collection and disposal.
- Expand local government's role to provide monitoring and enforcement of required standards.
- Establish and enhance recycling initiatives to progressively reduce the waste taken to dump sites.



Eric Sales

Eric Sales



Matthew Westfall



Dump Site Deficiencies and Environmental Risks

Issue

Dump sites lack engineered control systems. They seriously damage the environment, threaten public health, and cause significant social impacts.

Solutions

RA 9003 provides for

- closure of “open dump sites” in 2004;
- operation of “controlled dump sites” to 2006; and
- establishment of fully operational sanitary landfills by 2006.

Next Steps

Emergency Action Plan

- Urgent stability assessments and mitigation for the Payatas and Rodriguez sites
- Leachate mitigation at the Payatas and Tanza sites
- Cease dumping and construction at Lupang Arenda and the provision of emergency measures to protect the communities living on the waste
- Cease housing construction over waste at the Bagumbong (private) site

Short-Term Improvement Program

- Implement basic low-cost engineering and environmental upgrades at each facility to comply with interim controlled dump site standards

Disposal Capacity

Issue

The majority of Metro Manila's dump sites will reach capacity in 2004. Attempts to develop facilities face extreme public opposition and legal challenges.

Solutions

- Rationalize available dump site capacity in conjunction with dump site improvements
- Establish an integrated, metrowide disposal facility development program
- Accelerate waste segregation and recycling

Next Steps

Long-Term Solid Waste Disposal Program

- Formulate dump site closure plans followed by postclosure maintenance for at least 10 years.
- Urgently develop long-term, regulatory-compliant regional sanitary landfill facilities.
- Expand existing dump sites needed on an emergency, short-term basis, which must be properly designed with environmental protection systems, and be fully integrated with the proposed short-term improvements.



Matthew Westfall

Recycling

Issue

Historically, recycling operations have been informal, inefficient, and unregulated, with high social impacts.

Solutions

RA 9003 mandates comprehensive source reduction, waste minimization, and increased recycling at the *barangay* level.

Next Steps

- Hold promotional campaigns at the *barangay* level to promote community-based solid waste management.
- Review and evaluate composting technologies and programs and explore how processing capability can be improved.
- Establish the needed material recovery facilities and support systems in every *barangay* or *barangay* cluster and synchronize with the intensive market promotion of compost.



Eric Sales



Eric Sales



Eric Sales



Eric Sales



System Accountability

Issue

Historical lack of technical and financial information, and overall lack of accountability in system operations, particularly in waste collection and disposal.

Solutions

RA 9003 mandates progressive improvements, such as a 10-year plan development, waste characterization studies, information databases, and advocacy.

Next Steps

- Improve contracting procedures, regulate private sector waste disposal performance, and improve record keeping and access to information
- Undertake independent audits of costs of all parts of the waste management system
- Introduce true cost accounting systems for waste management services (identifying all social, hidden, and transferred costs)
- Establish itemized accounts to identify annual capital and operational costs, creating separate cost centers for each part of the waste management system
- Introduce the concept of sustainability into financial management procedures, and continue to search for innovative methods of financing



Matthew Westfall



Matthew Westfall



Matthew Westfall



Matthew Westfall

Institutional Capacity

Issue

Local governments face extreme capacity deficiencies, especially relating to waste disposal.

Solution

RA 9003 provides the mandate and authority to local governments to progressively improve institutional capacity to manage their own systems.

Next Steps

- Implement an extensive training program for staff involved in waste management operations
- Improve overall coordination and cooperation at the regional, city, municipal, and *barangay* levels
- Provide an incentive system to award excellence and innovation



Eric Sales



Eric Sales

Regulatory Enforcement

Issue

Historically, regulations have been poorly interpreted and difficult to enforce, and regulators have been inadequately trained and funded.

Solutions

RA 9003 mandates widespread regulatory reforms, sets regulatory standards, rationalizes responsibilities, and strengthens enforcement mechanisms.

Next Steps

- Strengthen metrowide and local regulatory enforcement procedures and practices at the regional level, including capacity building programs and training of regulatory enforcement personnel
- Establish and implement regulatory monitoring programs together with measurable objectives, strategies, and schedules
- Provide adequate and sustainable funding for regulatory enforcement programs



Eric Salles

End Note

For anyone who has lived or worked in Metro Manila, the garbage crisis has been a stark and highly visible reminder of the challenges we face in managing one of Asia's largest urban centers—a sprawling metropolis comprised of 17 separate local governments, bounded together by history, geography, and increasingly, the shared burden of solid waste management.

Solving the crisis and developing long-term, sustainable solutions remain the key priorities of the Government. Given the critical need to provide useful information and work together to adopt lasting solutions, I am pleased to share with you *The Garbage Book: Solid Waste Management in Metro Manila*.

This publication is a synthesis of the findings and recommendations developed under an advisory technical assistance funded by the Asian Development Bank, the Metro Manila Solid Waste Management Project, carried out in collaboration with the Department of Environment and Natural Resources and the Department of Health. Undertaken from

July 2002 to February 2004, the study provided support to the National Solid Waste Management Commission and other agencies involved in solid waste management in Metro Manila. The results of the study can be viewed on the web site of the National Solid Waste Management Commission at www.nswmc.gov.ph.

I hope this publication will provide the basis for enlightened discussion on Metro Manila's solid waste crisis, contribute to a better understanding of the issues, raise the level of policy debate, and more importantly, encourage everyone to assume responsibility for waste management, as we are all producers of waste. Only by doing this can we achieve a cleaner, greener, and more sustainable metropolis.

ELISEA GOZUN

Secretary, Department of Environment
and Natural Resources

Calculations and Assumptions

Page 10: Some 1,500 tons daily is dumped illegally on private land, in rivers, creeks, Manila Bay... Accurate information on the amount of illegally dumped waste is not available, and therefore must be inferred. This estimate is based on the calculations noted in the paragraph below, findings of ADB TA 3848-PHI: *Metro Manila Solid Waste Management Project*, 2003, and by updating and refining the 1999 JICA-funded Metro Manila Masterplan Study estimate that 27% of all Metro Manila's solid waste is illegally dumped.

Page 14: Of the estimated 6,700 tons generated per day, approximately 720 tons per day is recycled or composted. The balance—some 6,000 tons daily—is either hauled to dump sites, dumped illegally on private land, in rivers, creeks, Manila Bay, or openly burned, adding to the heavily polluted air shed. The daily population of Metro Manila (2003) is estimated to be approximately 11,989,297, or rounded to approximately 12 million. This is estimated by adding the official Philippine Government National Statistics Office medium assumption projection for 2003 (10,899,361 population) to a Metro Manila Development Authority estimate of an additional 10% population increase (1,089,936) to account for the additional daytime population within the metropolis. The average per capita waste generation rate for Metro Manila (0.56 kg/person/day) is estimated from the results of the Metro Manila Solid Waste Management Masterplan, funded by the Japanese International Cooperation Agency (JICA), in 1999. The total solid waste generation rate estimate is therefore calculated by multiplying the estimated population (11,989,297) by the estimated average per capita waste generation rate (0.56 kg/person/day), equating to approximately 6,700 tons. The estimate of recycled and composted waste of 720 tons per day is based on: (i) information from the major Metro Manila recycling association (500 tons per day); (ii) an extrapolation that other recyclers recycle an additional 200 tons per day; and (iii) an extrapolation that approximately 20 tons daily of biodegradable waste is composted.

Page 17: An estimated 150,000 residents of Metro Manila know the sight and smell of garbage as an integral part of their daily lives. This estimate is considered conservative, and is based on visual observations and extrapolations including (i) registered waste pickers reported at the dump sites (4,300); (ii) junk shop workers (2,500); (iii) "eco-aides" (1,200); (iv) drivers and crews of collection vehicles (5,000); (v) dump site personnel (90); (vi) low-income residents at Lupang Arenda (reported at 125,000); (vii) occupants of dwellings near the major dump sites and trucking routes, including Payatas (5,000), Catmon (2,000), Lingunan (2,000), Pulang Lupa (2,000), Bagumbong (1,000), and Pier 18 (1,000); (viii) solid waste management staff of the 17 cities and municipalities (over 5,000); (ix) MMDA operations staff (50); and (x) MMDA street sweepers (1,000).

Page 19: A total of 78% of surveyed households had no idea where their collected garbage was taken for final disposal. Based on a Metro Manila household survey completed under ADB TA 3848-PHI: *Metro Manila Solid Waste Management Project*, 2003.

Page 20: Nearly 3,700 health care facilities in Metro Manila generate an estimated 47 tons of medical waste per day, with 56% of this waste, or 26 tons, considered potentially infectious. Based on the findings of ADB TA 3848-PHI: *Metro Manila Solid Waste Management Project*, 2003, which collated and synthesized available data from surveys conducted by the Department of Health, JICA, and the ADB TA.

Page 21: Over P3.54 billion is spent annually on waste collection and disposal. Based on review of available financial information provided by the 17 Metro Manila local government units (LGUs) during the conduct of ADB TA 3848-PHI: *Metro Manila Solid Waste Management Project*, 2003.

Page 32: In the next 30 years, Metro Manila will generate over 70 million tons of solid waste. Currently, Metro Manila generates an estimated 6,700 tons per day of solid waste (above). This equates to approximately

2.4 million tons per year (6,700 tons per day multiplied by 365 days), which equates to over 70 million tons in 30 years (2.4 million tons per year multiplied by 30 years). This is significantly conservative, as it does not include waste generation increases due to population and economic growth.

Page 32-33: Collection of this waste will require...

a ...a line of waste trucks going three times round the earth and over halfway to the moon. On average, collection trucks are assumed to transport approximately 3.25 tons of waste. In 30 years, the cumulative 70 million tons of waste generated will, therefore, require 21.5 million truck trips (70 million tons divided by the average truck carrying capacity of 3.25 tons). Assuming an average length of a truck plus the gap to the next truck of 15 meters, the 21.5 million trucks would extend 322 million meters (21.5 million trucks multiplied by 15 meters average length and gap), which equates to 322,000 kilometers (km). The circumference of the earth is approximately 39,000 km, therefore three times round the earth is 117,000 km (the circumference of the earth, 39,000 km, multiplied by 3). The distance to the moon is approximately 384,000 km, therefore half way to the moon is 192,000 km (the total distance of 384,000 km divided by 2). The distance of three times round the earth and half way to the moon is, therefore, 309,000 km (192,000 km plus 117,000 km).

b. ...a cumulative waste truck travel distance equal to a distance over 4,000 times around the earth and to the sun. Assuming each of the 21.5 million truck trips (mentioned in a.) travels an average distance of 15 km, then the cumulative waste truck travel distance equates to 322 million km (21.5 million truck trips multiplied by 15 km). Since the circumference of the earth is 39,000 km (mentioned in a.), then 4,000 times round it equates to 156 million km (39,000 km multiplied by 4,000). Since the distance to the sun is approximately 150 million km, then the cumulative distance of 4,000 times round the earth and to the sun equates to 306 million km (156 million km plus 150 million km)

c. ...at a cost of over P100 billion (\$1.9 billion). This conservatively assumes the current annual expenditure on Metro Manila solid waste management (P3.54 billion) multiplied by 30 years.

Page 38-39: In the next 30 years, Metro Manila will generate over 230 million cubic meters of solid waste. This is calculated by dividing the estimated 70 million tons of waste over the 30-year period by an assumed loose solid waste density of 0.3 tons per cubic meter, equating to over 233 million cubic meters.

a. An amount that equates to ... a “knee-deep” layer of waste over the entire metropolis (over 630 km²). Since the approximate land area of the 17 cities and municipalities of Metro Manila is 630 km² or 630 million m², then dividing this into the generated solid waste volume (233 million cubic meters) over the 30-year period equates to an average depth of approximately 0.35 meters.

b. ...which would fill the country’s largest shopping mall over 175 times. Since the largest shopping mall has an approximate volume of 1.3 million cubic meters, dividing this into the total 30-year solid waste volume of 233 million cubic meters equates to filling the shopping mall over 175 times (233 million cubic meters divided by 1.3 million cubic meters).

Page 46-47: Based on leachate sampling, Payatas and Rodriguez generate an estimated 26 kg of lead, and 76 kg of arsenic annually, which is released into the groundwater, rivers, lakes, and the bay of Metro Manila. Leachate sampling at Payatas and Rodriguez indicates combined average concentrations for the two sites of lead (0.21 milligram[mg]/liter) and arsenic (0.6 mg/liter). Assuming that each site emits on average 2 liters per second of leachate (therefore 0.42 mg of lead and 1.2 mg of arsenic per second), then in 1 year, this equates to an average for each site of 13 kg of lead and 38 kg of arsenic. This is calculated by multiplying the quantity per second (in mg) by 3,600 seconds per hour, 24 hours per day, 365 days per year, and dividing the total by 1 million for the conversion factor of mg to kg).

Page 53: Cumulative waste generation over the next 30 years will exceed 70 million tons. This is equivalent to 35 facilities of the size of Payatas, or many hundreds of facilities the size of Doña Petra or Palanyag. Although accurate survey data and volume calculations are not available for the

dump sites, the order of magnitude of the Payatas dump site waste mass is around 3-4 million cubic meters, or possibly up to 2 million tons, therefore 35 such facilities would be needed to dispose of 70 million tons of solid waste. The smaller dump sites have inferred volumes ranging from less than 10,000 cubic meters up to several hundred thousand cubic meters; therefore several hundreds of such small dump sites would be required to accommodate 70 million tons of solid waste.

Page 54: Over P3.54 billion (\$64 million) is spent on the collection and disposal of Metro Manila’s solid waste, at an average cost of about P1,450 (P26.40) per ton.

Based on review of available financial information provided by the 17 Metro Manila local government units (LGUs) during the conduct of ADB TA 3848-PHI: *Metro Manila Solid Waste Management Project*, 2003. Dividing the total estimated annual expenditure (P3.54 billion) by the estimated total annual waste generation (2.44 million tons) provides an average cost per ton (P1,450).

Page 56. On average less than P25 (\$0.45, forty-five cents) is collected per capita to recover costs through direct user charges.

Based on review of available financial information provided by the 17 Metro Manila LGUs during the conduct of ADB TA 3848-PHI: *Metro Manila Solid Waste Management Project*, 2003. Dividing the total estimated annual expenditure (P3.54 billion) by the estimated population of Metro Manila (11,989,297), provides an average of P295 per person.

Page 64: For the past 30 years, the Payatas dump site has most likely been releasing leachate into groundwater and river systems. As with many dump sites, due to the lack of engineered environmental protection systems, it is assumed that leachate has been emitted from the site over the long term, possibly approaching the entire life of the dump site, which reportedly is approximately 30 years.

a. An amount currently estimated at 2 liters per second or 63 million liters each year. Based on visual field observations and site personnel discussions, surface leachate emissions are estimated to average 2 liters per second. Annually, this equates to 63 million liters, calculated by multiplying the quantity per second (2 liters) by 3,600 seconds per hour, 24 hours per day, 365 days per year.

b. A rate that would fill one 18-wheeled tractor trailer tanker truck every 5 hours. Multiplying an assumed leachate emission rate of 2 liters per second by 3,600 seconds provides an estimate volume of 7,200 liters per hour. This is equivalent to one 18-wheeled tractor trailer tanker every 5 hours (having a volume of approximately 34,000 liters).

Page 72: On the edge of Laguna de Bay, a community of 125,000 urban poor is being built on 2 million cubic meters of decomposing garbage, at great risk to public health. Although accurate topographic, engineering, demographic, and other records are unavailable for the area, verbal statements from site personnel infer that the entire area of dumping extends to 80 hectares, and houses an urban poor population of 125,000 (25,000 homes with an average family size of 5 persons). From verbal accounts and visual observations, solid waste is placed at an average thickness of approximately 2.5 meters over the entire 80-hectare area, inferring that approximately 2 million cubic meters is present immediately beneath the residential areas (2.5 meters thickness, multiplied by 10,000 square meters per hectare, multiplied by 80 hectares).

Page 74: Each year, the Rodriguez facility generates over 63 million liters of leachate, enough to fill over 28 Olympic-size swimming pools, the bulk of which flows into the Marikina River system. Based on visual field observations and site personnel discussions, surface leachate emissions are estimated to average 2 liters per second. Annually, this equates to 63 million liters, calculated by multiplying the quantity per second (2 liters) by 3,600 seconds per hour, 24 hours per day, 365 days per year). Since an average Olympic-size swimming pool contains approximately 2.2 million liters (50 meters length multiplied by 22 meters width, multiplied by average 2 meters deep, multiplied by 1,000 liters per cubic meter) then the annual 63 million liters of leachate would fill over 28 Olympic-size swimming pools (63 million liters divided by 2.2 million liters).

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