



## THE SCIENCE OF ENVIRONMENTAL COMPLIANCE : EVIDENCE-BASED ACTIONS FOR EMIS

10TH ENVIRONMENTAL COMPLIANCE AND ENFORCEMENT LEKGOTLA | 18 - 21 NOVEMBER 2024 | KZN

### Evaluating system cost – the nexus of technical and financial data in the waste sector – gaining a deeper understanding of the waste circular economy and the compliance and enforcement interface

Aiden Bowers

DFFE (Waste Management Bureau)



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[www.dffe.gov.za](http://www.dffe.gov.za)



## Key messages

- **Lack of compliance** has **systemic impacts** on the **funding and implementation** of SWM policy, particularly moving towards a circular economy
- Waste **systems are not considered holistically**, which may lead to non-optimal solutions especially as landfills reach the end of their lifespan
- **Full cost accounting** for municipal SWM services **is not generally practiced**.
  - This leads to underinvestment in the service, underpricing (particularly the real cost of disposal) and deterioration in performance.



# Emerging vulnerabilities (SWM in Metros)

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**Waste management remains an under-prioritised service**

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**Available data and reporting are not fit for purpose**

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**There is little publicly available reporting on compliance performance where waste management activities are carried out**

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**Poor fleet management has systemic impacts**

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**Weak economic performance and narrowing fiscal headroom will constrain the transition to a circular economy**

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**The lack of airspace in several metros represents a significant near-term operational risk**

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**Metros are not institutionally structured or capacitated for waste diversion**





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**Asset management deficiencies (fleet and airspace) have systemic impacts on service delivery**

Added to this, the city's contracted refuse collector, Pikitup, is plagued by an ineffective fleet that breaks down, leading to a high overtime bill of R31.84m which has been directly linked to fleet breakdowns...

## More than half of Nelson Mandela metro refuse trucks out of action

BY NOMAZIMA NKOSI - 19 AUGUST 2021

Premium



The Nelson Mandela Bay municipality has been operating for months with less than half of its waste management fleet as 30 vehicles have been in for repairs.

Public health executive director Sizwe Mvunelwa told councillors on Wednesday that the fleet had been at 38% of its capacity for the last four months of the 2020/2021 financial year (March to June).

MERCURY NEWS

eThekweni's Durban Solid Waste unit says refuse collection services hampered by vehicle breakdowns, ageing fleet



City of Cape Town

February 28, 2020 · 🌐

Residents advised of possible delays in refuse collection service.

Residents throughout the City should be aware that there may be delays in the refuse collection service. This is due to a shortage of standby vehicles that operate in case of a breakdown.

## Rubbish piles up in Ekurhuleni

Broken down trucks wait for budget to be fixed in workshops

🕒 29 July 2022 - 08:13

Local News

### Garbage 'not being collected in Bloemfontein'

He says there are trucks to collect the waste, however, they are either not serviced, not running or there is no fuel for waste collection. He adds that it is not only garbage collection services that experience this problem, parks are in a state too and the municipality is doing nothing to improve the situation.

### TSHWANE PROMISES TO CLEAR GARBAGE BACKLOG AFTER CONTRACT LAPSE HALTS SERVICE

Rubbish has been piling up across the metro and open fields have been turned into informal dumping sites because waste removal vehicles were unavailable.



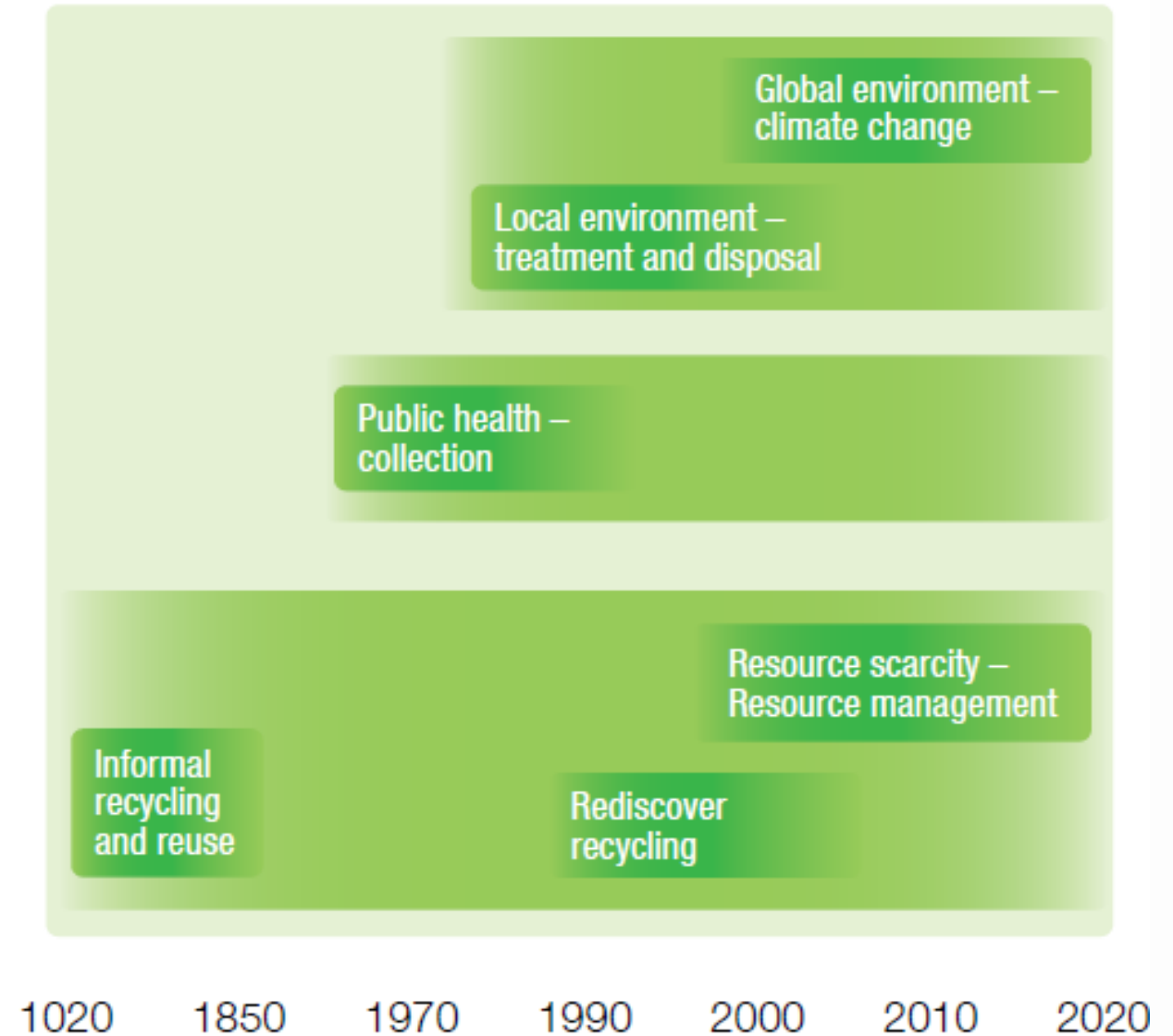
## The drivers of SWM

Policy shift

Environmental protection

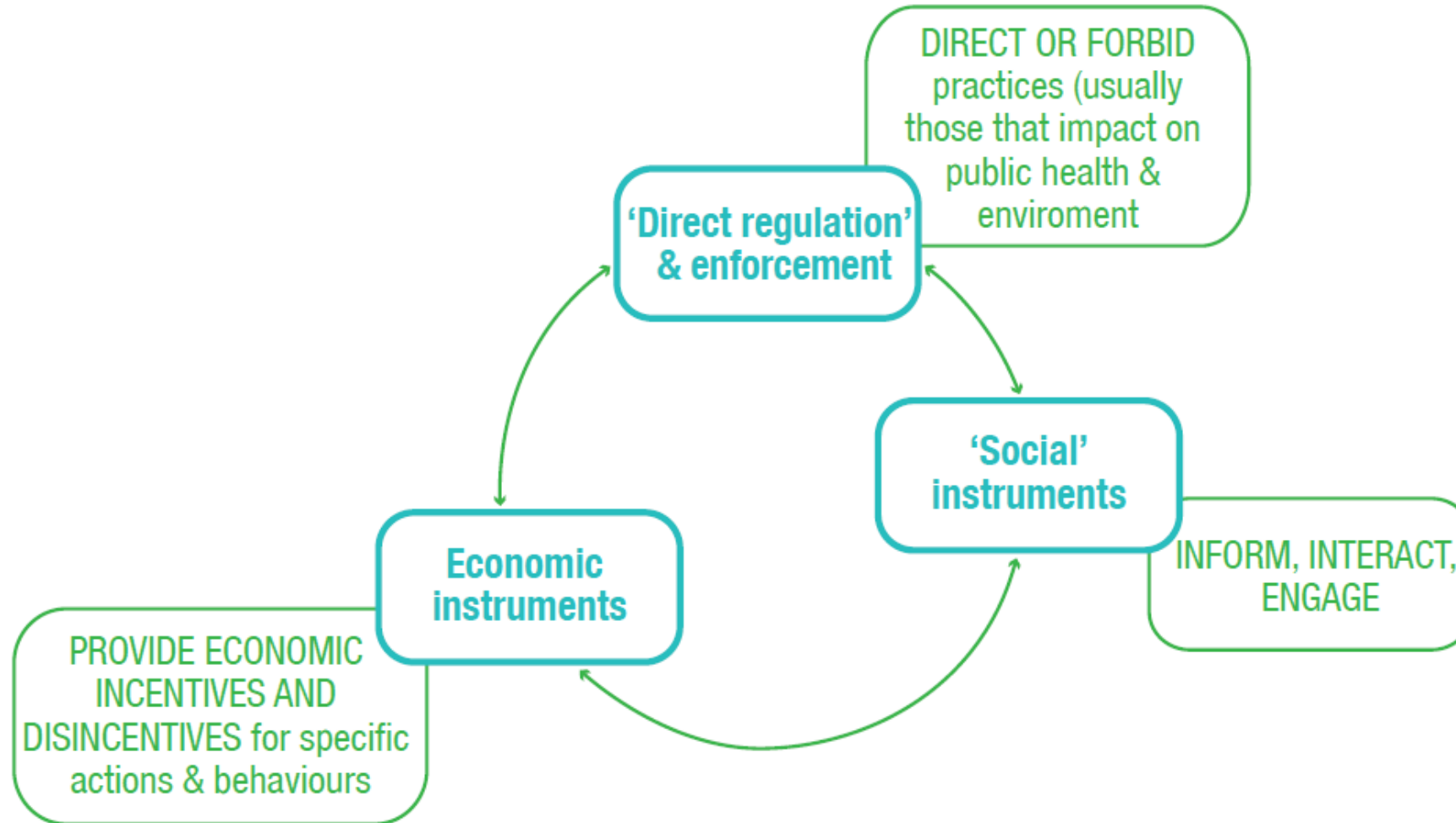
Public health

Resource value of the waste





## Our toolkit for managing SWM





# Social costs, private costs and externalities in environmental economics

$$\textit{Social cost} = \textit{private cost} + \textit{externalities}$$

- The **social cost** is what it costs society as a whole to manage waste
- The **private cost** is the cost to a household or business for their waste
- **Externalities** are what society pays for waste management that is not internalised in the cost to users





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## THE WIZARD OF ID

by Brant Parker & Johnny Hart







# Social costs, private costs and externalities in environmental economics

$$\text{Social cost} = \text{private cost} + \text{externalities}$$

- low private costs will mean society pays a high price in externalities (typically health and pollution effects).
- It is therefore **imperative that prices for waste management are set correctly**. This not only reduces externalities but **prevents overuse of scarce resources** such as landfill airspace (form of tragedy of the commons)



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Picture: C. Laude,  
RWA (Hulene  
Dumpsite, Maputo)





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Picture: News24  
(29 June 2022)





## Waste disposal – regulation, non-compliance, tragedy

- There are stringent regulations governing waste disposal in SA and serve the purpose of reducing external costs of landfilling - ‘command and control’
- Landfills impose societal costs (externalities)
- Externalities are higher where regulations are not adhered to/enforced
- Non-compliance with regulations means lower costs for disposal (because less resources are allocated) and in turn lower private costs to landfill users.







# Underpriced airspace as an implicit tax on alternative SWM options

- When landfill disposal is cheap, businesses and consumers are **incentivized to dispose of waste in landfills** rather than using recycling, composting, or other recovery methods
- In economic terms, this setup creates a "**negative subsidy**" or "**implicit tax**" on recycling and other waste-diversion options
- This indirect tax effect **suppresses investment in alternative infrastructure and innovation**, reducing the overall **competitiveness** and **adoption of more sustainable practices**.



# Moving towards full cost accounting is about balance

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## **Full cost accounting/full cost recovery**

Systematic approach to identifying and quantifying the full cost involved in providing a service

Ensure that tariff services are adequately funded over the long term, resulting in an efficient, sustainable and reliable service

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## **Affordability**

Waste management services have to be affordable to the citizens of the city and ultimately to the country

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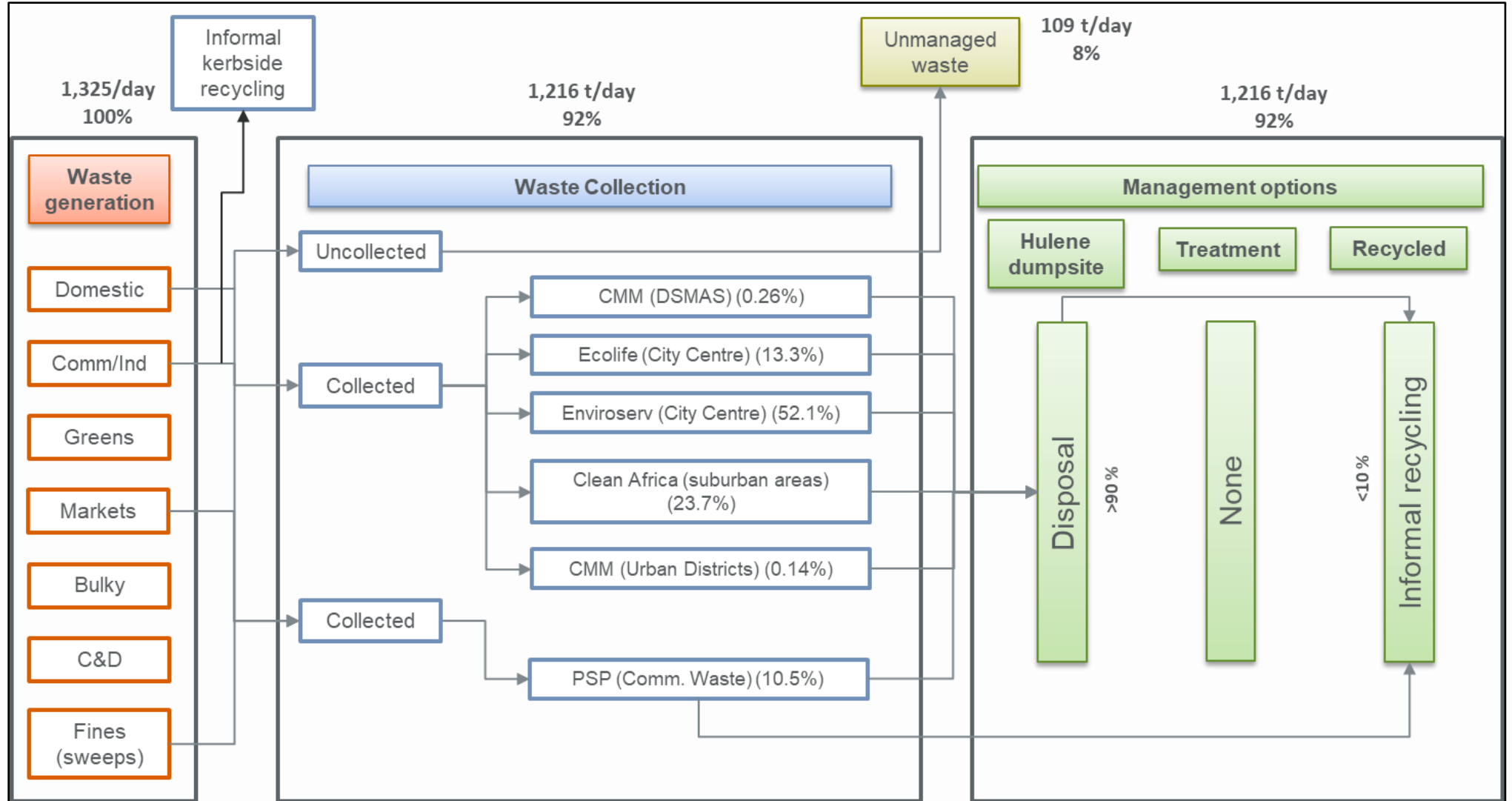


# How do we know what the ‘correct price’ is?

- **Good quality data** is the **foundation of planning** and preparation for the transition away from landfill
- A **baseline analysis of the current system** should be undertaken, with primary data inputs:
  - Waste mass flows through the system
  - Financial information related to the handling of waste in each part of the system
- This **requires weighbridges** at waste management facilities and a data capture system that can attribute contextual information to vehicles weighed
- Financial transactions should be captured in accordance with standard accounting frameworks



## Understanding waste flows







## Attributing important detail to weighbridge data (CCT example)

XLLUsageReport ZU23/U4/U1 - ZU23/U4/U3U

Registration Num	Transaction	In Transaction	Out Transaction	Contract Acc	Total Netmass	Reven	Reference Num	Waste Ty	Facility C	Origin of wa	Business Pa	Company Na	Vehicle Ov	Vehicle T
CA660089	19-Apr-23	10:14:34	08:51:49		200	168.1	VHKD754946	Mix waste	VHK	MONTAGUE GAF	VHKB143	PRIVATE	PRIVATE	LDV 1t
CAA362233	04-Apr-23	11:35:57	12:03:46		500	445.4	VHKD753842	Clothing/trags	VHK	PAROW	VHKB143	PRIVATE	PRIVATE	LDV 1t
CEY43262	03-Apr-23	11:54:02	14:58:04		100	168.1	VHKD753790	Mix waste	VHK	CAPE TOWN	VHKB143	PRIVATE	PRIVATE	LDV 1t
CEY43262	11-Apr-23	11:20:17	14:50:01		100	168.1	VHKD754210	Mix waste	VHK	CAPE TOWN	VHKB143	PRIVATE	PRIVATE	LDV 1t
CF151575	25-Apr-23	09:02:03	09:30:29		360	336.2	VHKD755026	Mix waste	VHK	EPPING			PRIVATE	T/RoRo/Skip 6x4
CY14424	12-Apr-23	09:27:32	14:35:39		2780	2672.4	VHKD754290	Asbestos	VHK	CAPE TOWN	VHKB143	PRIVATE	PRIVATE	T/Tip 6.6 - 8.5t
CY201350	20-Apr-23	09:45:10	08:50:46		3840	2688.4	VHKD754948	Mix waste	VHK	MALMESBURY F	VHKB143	PRIVATE	PRIVATE	T/Flatbed 3.6 - 4.5t
CY262717	21-Apr-23	08:21:40	08:57:56		21200	14282.2	VHKD754837	Mix waste	VHK	EPPING			PRIVATE	Tractor Hauler All
CY310019	08-Apr-23	10:28:43	08:55:30		200	168.1	VHKD754149	Mix waste	VHK	MILNERTON	VHKB143	PRIVATE	PRIVATE	T/Flatbed 4.5 - 6.5t
CY367143	13-Apr-23	10:26:50	11:00:29		18880	12769.9	VHKD754343	Mix waste	VHK	EPPING	VHKB143	PRIVATE	PRIVATE	Tractor Hauler All
CY44117	28-Apr-23	09:11:01	09:44:36		20080	13610.1	VHKD755218	Mix waste	VHK	EPPING	VHKB143	PRIVATE	PRIVATE	Tractor Hauler All
CCT33093	24-Apr-23	14:07:27	14:20:28	1001053184	140	222.7	VHKD755008	Clothing/trags	VHK	MITCHELLS PLA	18060058	CITY OF CAPE TC	CITY OF CAPE T	LDV 1t
CY165619	25-Apr-23	12:29:39	12:48:07	1001053184	180	222.7	VHKD755064	Clothing/trags	VHK	KRAAIFONTEIN	18060058	CITY OF CAPE TC	CITY OF CAPE T	LDV 1t
CAA102348	07-Apr-23	12:18:36	12:40:21	132417771	340	336.2	VHKD754083	Mix waste	VHK	DELFT	1000484076	A CAMERON	A CAMERON	T/Tip 6.6 - 8.5t
CAA102348	08-Apr-23	12:49:52	13:00:58	132417771	480	336.2	VHKD754099	Mix waste	VHK	DELFT	1000484076	A CAMERON	A CAMERON	T/Tip 6.6 - 8.5t
CAA102348	10-Apr-23	08:00:07	08:10:14	132417771	560	504.3	VHKD754107	Mix waste	VHK	DELFT	1000484076	A CAMERON	A CAMERON	T/Tip 6.6 - 8.5t
CAA102348	10-Apr-23	12:41:39	13:00:20	132417771	420	336.2	VHKD754129	Mix waste	VHK	DELFT	1000484076	A CAMERON	A CAMERON	T/Tip 6.6 - 8.5t
CAA102348	22-Apr-23	12:49:35	12:59:54	132417771	420	336.2	VHKD754938	Mix waste	VHK	DELFT	1000484076	A CAMERON	A CAMERON	T/Tip 6.6 - 8.5t
CAA102348	24-Apr-23	07:10:15	07:23:27	132417771	140	168.1	VHKD754941	Mix waste	VHK	DELFT	1000484076	A CAMERON	A CAMERON	T/Tip 6.6 - 8.5t
CAA265074	13-Apr-23	09:02:50	09:36:09	132417771	13400	12025.8	VHKD754317	Premix	VHK	DOCKS	1000484076	A CAMERON	A CAMERON	T/RoRo/Skip 6x4
CAA265074	28-Apr-23	10:33:37	11:33:30	132417771	19140	17147.9	VHKD755237	Asbestos	VHK	LANGA	1000484076	A CAMERON	A CAMERON	T/RoRo/Skip 6x4
CAA265074	29-Apr-23	09:50:40	10:38:37	132417771	26460	23606.2	VHKD755302	Premix	VHK	DOCKS	1000484076	A CAMERON	A CAMERON	T/RoRo/Skip 6x4
CF202966	03-Apr-23	11:51:53	12:31:04	134861527	1200	1113.5	VHKD753752	Asbestos	VHK	HANOVER PARK	1000706602	PARADIGM CON	PARADIGM COM	LDV 1t
CA368553	27-Apr-23	10:37:25	11:16:38	181315555	24000	0	VHKD755191	Builders rubbl	VHK	ATHLONE	1000260544	MARTINUS WAST	MARTINUS WAS	T/RoRo/Skip 6x4
CA368553	27-Apr-23	13:12:17	13:45:45	181315555	26700	0	VHKD755200	Builders rubbl	VHK	ATHLONE	1000260544	MARTINUS WAST	MARTINUS WAS	T/RoRo/Skip 6x4



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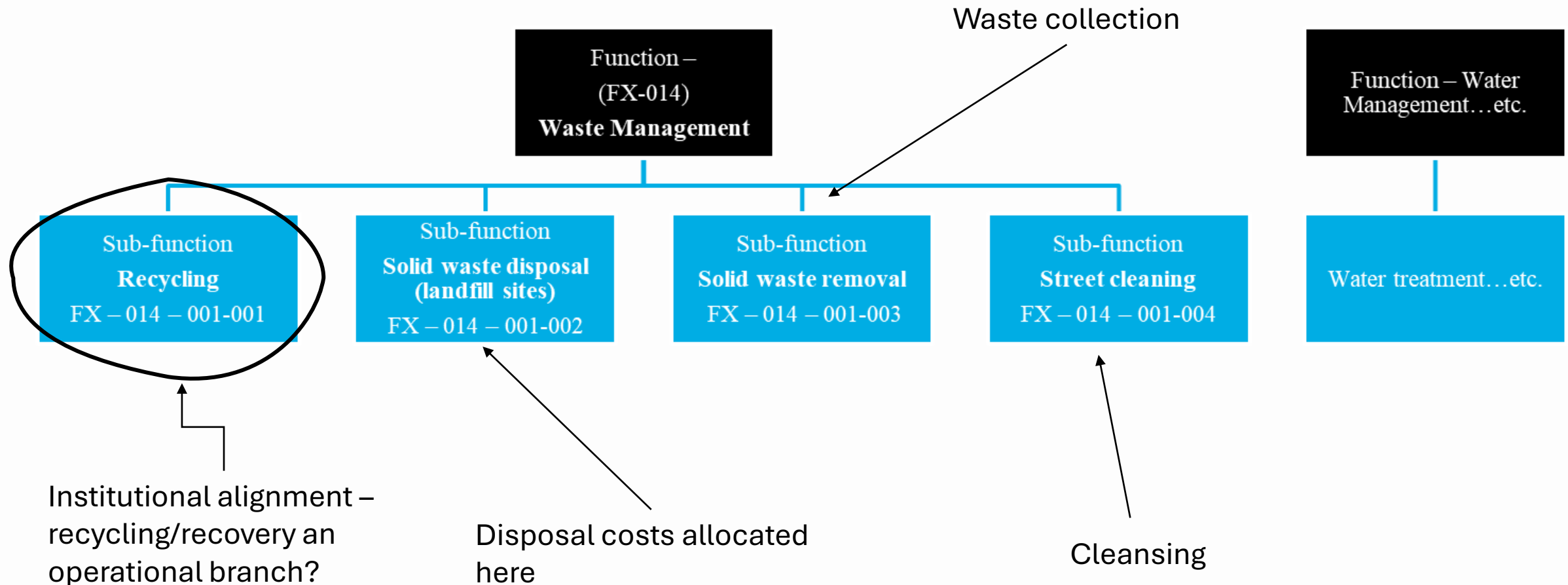
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## Understanding the system and its costs

	Scheduled lifts/week	Tons per annum	Rm/annum	R/ton
Collections (direct cost)	Formal HHs 800,000	649 487	876,6	1 403
Collections (S@S packaging)	23% of HHs 198 000	Into MRFs ???	???	???
Drop-offs	N/a*	209 269\$	129,5	619
Packaging (recovery)	23% of HHs 198 000	Diverted (out of MRF) 26 454	???	???
Greens diversion/rubble (commercial)	N/a	107 467**	54.2\$\$	505
Disposal	N/a	1 537 956***	497,7	324



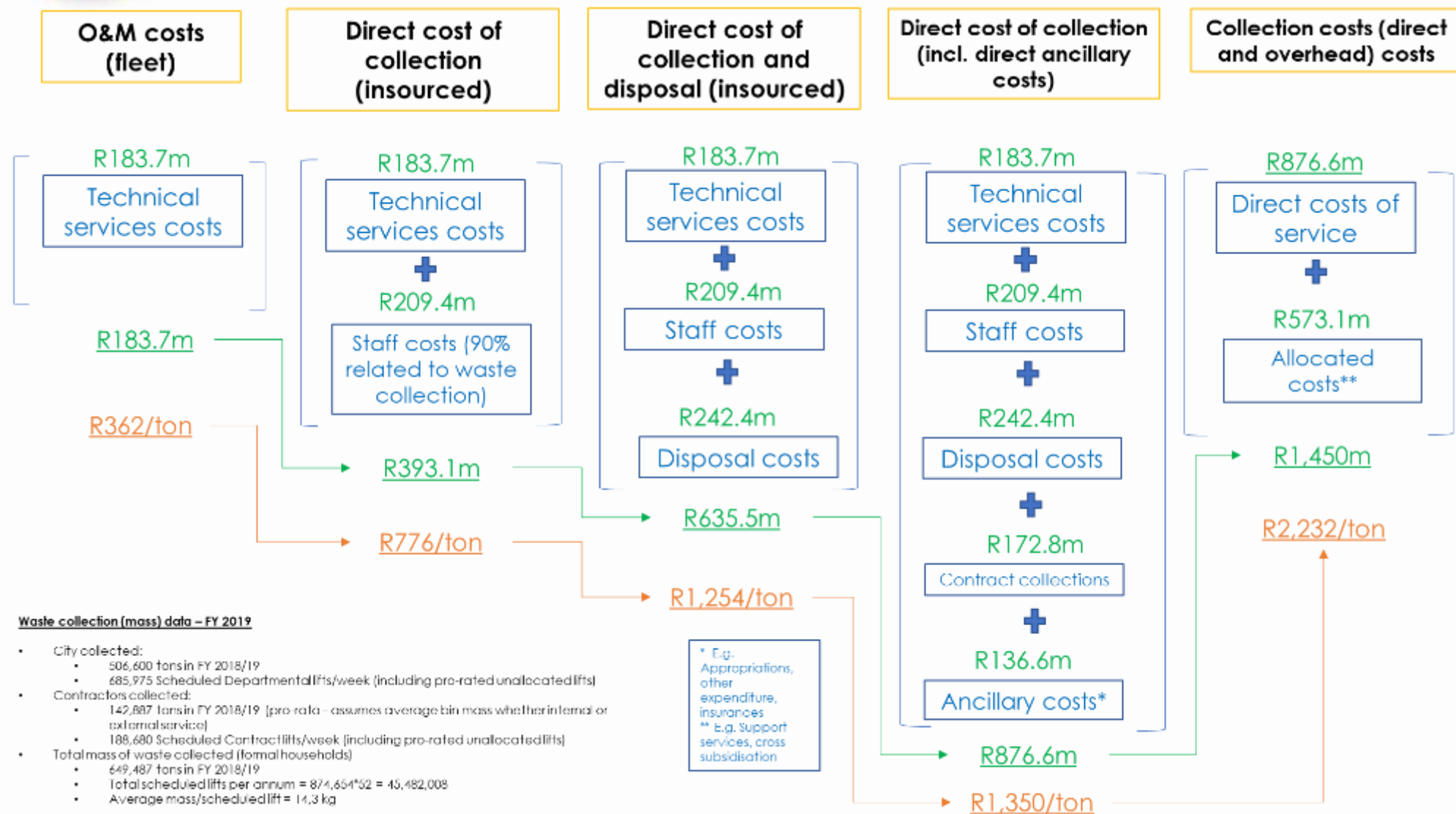
## Making a start – using existing tools better





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## Metrics for benchmarking and baseline for y/y improvements

Collections business  
cost of service

545,000 tpa

R2,383/ton

Collections cost  
(insourced)

484,000 tpa

R2,242/ton

Collections cost  
(outsourced)

121,200 tpa

R1,820/ton

Unit cost of logistics

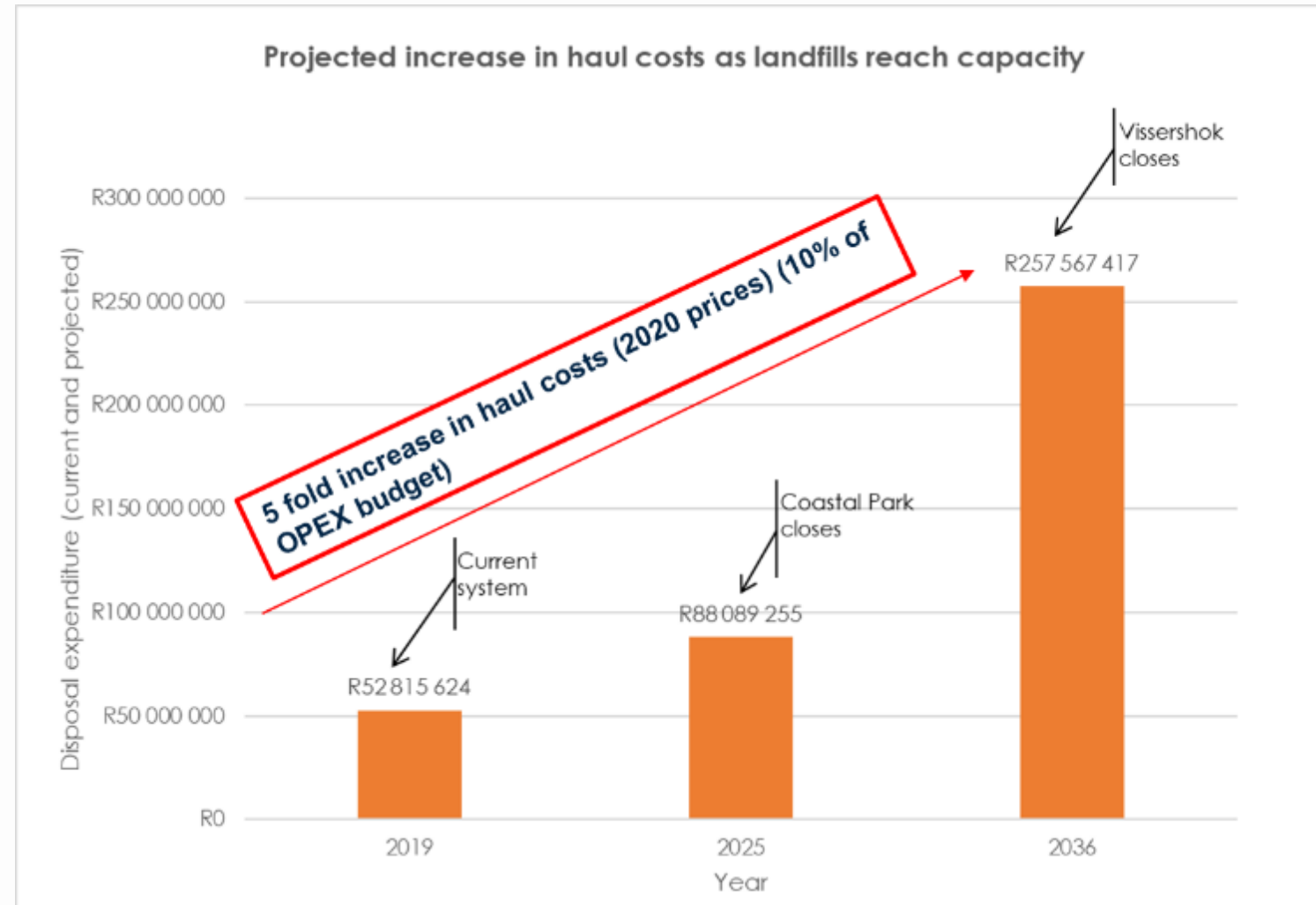
R123/km

14 tons/beat/day

R8,57 per ton-km

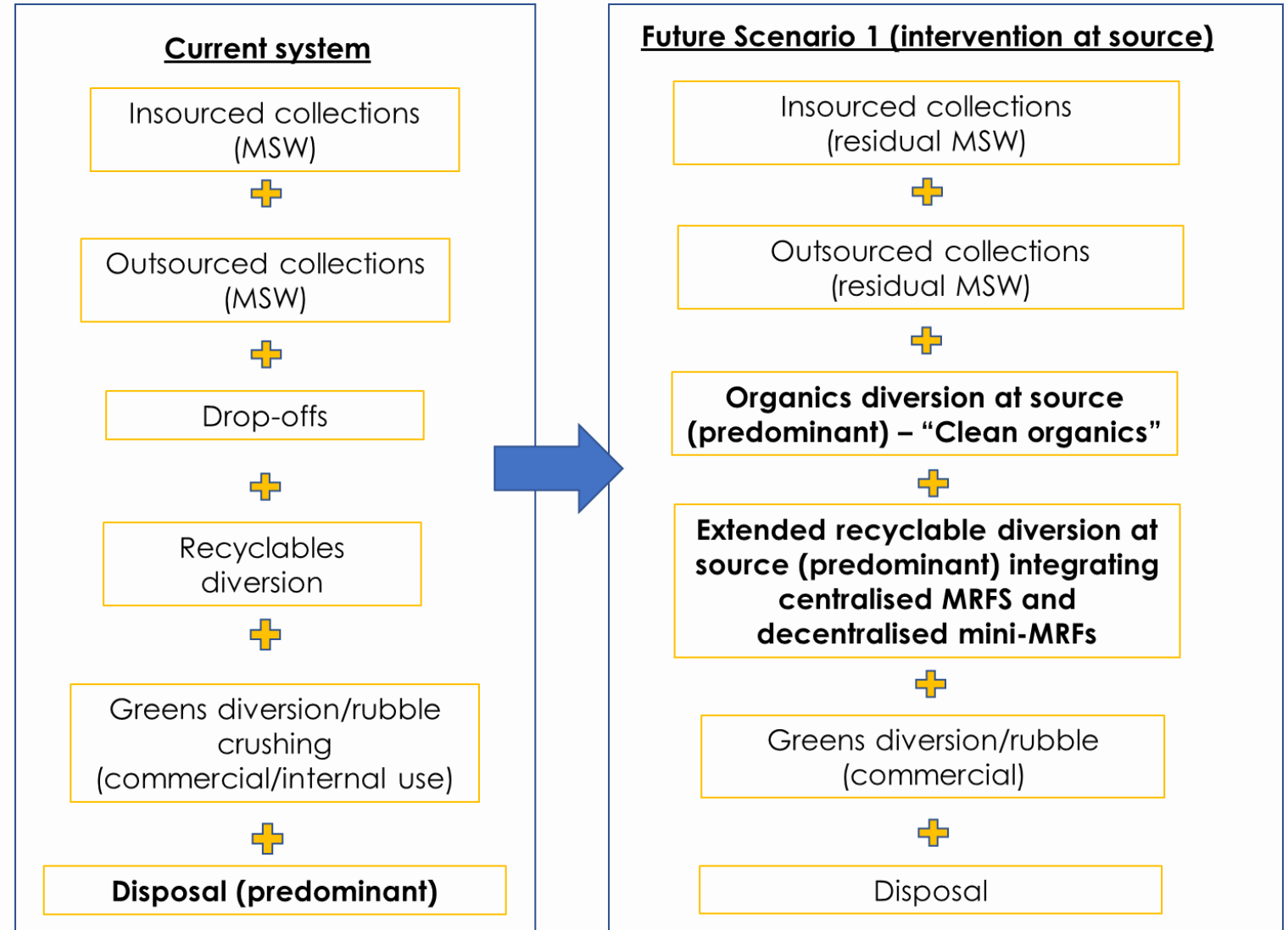


## The interplay of waste infrastructure and logistics costs





## Full cost accounting for future planning





# What is being done improve the system?

- A **compliance and enforcement committee/** forum has been conceptualized for the **TOP 40 largest, operational, public and private** sector landfills
- The **waste management sector in these metros should be investable** with little state and/or financial support should the **market failures be addressed**
- Waste flagship programme, using waste management charges, to crowd in private investors in waste infrastructure





# Reform of Metro trading services

- National Treasury is leading a programme to incentivise the turnaround in the performance of metro trading services
  - Institutional reforms
  - Finance reforms
  - Grant reforms
- Performance-based finance incentive
  - Grant value: R54bn over 6 years
  - Leverage: R54bn over 6 years (metro internally generated funds – own source revenue, borrowing)

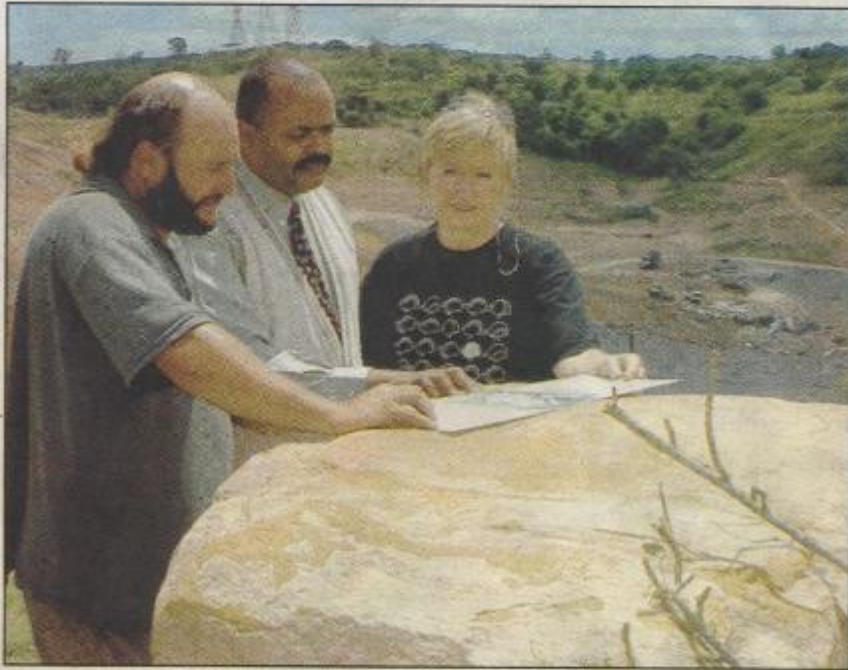


Pictures from DSW  
(Bisasar Road  
Landfill)



PAGE 8 DAILY NEWS  
FRIDAY NOVEMBER 29 2002

## NEWS



RICHARD Winn, Raymond Rampersad and Jean Lindsay review the latest plans for Durban's "green" rubbish dump  
PICTURE: GRANT ERSKINE

## From rubbish dump to nature reserve

Site gives regular educational visits to schools



With Compliments  
© Durant Civils (Pty) Ltd 2005

Pictures from DSW  
(Mariannhill  
Landfill)



## Rubbish has a tight control on odour

### DSW's team of engineers have been working with advanced technology to combat odour trails

BARBARA COLE

**J**EANINE and Michel Fanucci are used to causing a stink about the "putrid" smell that comes from the nearby Mariannhill landfill site.

But now they say they have had enough of the "gagging" stench that wafts over, into their home, whenever there is a south-westerly wind blowing.

"It's pungent, like having the worst rotten garbage inside your back door. You can't open the windows and can't even drink a cup of tea," fumed Jeanine Fanucci.

And their neighbours in the Mariannhill Park suburb near Pinetown agree.

"You have no idea. It's absolutely disgusting," said neighbour Faith Pillay.

"It's a beautiful area, but when the south-westerly wind is blowing and that overwhelming smell comes from the landfill site, you just can't go outside."

Another neighbour, Butch Duvenhage, who moved to the area recently, said he would not have bought there if he had known about the smell.



Down in the dumps... Fanucci

A Mariannhill Park resident living near the Mariannhill landfill site, Michel Fanucci, is delighted at the new odour control system which Durban Solid Waste installed on his fence in January 2005.

In recent years, DSW's team of engineers have been working with advanced technology to combat odour trails that are released from waste disposal sites.

The odour control system installed on the Fanuccis' fence comprises of a dosing pump that feeds an odour neutralising chemical to water.

The system then pumps the diluted chemical through a set of very fine nozzles. The diluted chemical is then rapidly dispersed into the air and helps neutralise bad odours.

"Associated with landfills are localized weather patterns, that if correctly understood, can be utilised to ensure the public living near a landfill never smell it," said project manager Lindsay Strachan, project manager for DSW.

A now satisfied Fanucci was once a long standing opposer to the Mariannhill landfill development.

"The landfill made living in the area almost unbearable. A south westerly wind carried with it a terribly offensive odour which wafted into my house. Having to entertain guests became unbearable as my wife, Jeanine and I had to constantly make excuses about the odour," said Michel Fanucci.

At present Fanucci has no problem with man-

ually operating the dosing pump from his home.

"I am very pleased by DSW's high-science methods that have helped make living near the landfill site pleasant for me and my family," said Michel Fanucci.

### RESPOND

According to Strachan, DSW is currently implementing the infrastructure to automate the odour control system so that it can respond to telemetrically sent weather data signals.

"Odour emissions linked to local weather patterns on the Mariannhill landfill have been so accurately modeled that DSW is now able to predict ahead of time when and where the odour will be. This advancement has enabled DSW to introduce the odour control system as a pilot project and the Fanuccis were cooperative enough to allow us to install the spraying system on their fence as a means of testing our apparatus," said Aiden Bowers, DSW landfill operations engineer.

According to Bowers, once the system is automated it will be known as the Satellite Odour Control System and it will be the first of its kind to be controlled via telemetry linked to the weather station and PC in the resident's yard.

This will allow for the prediction of an odour plume and activation of the system in the residents yard.



From left: Melvan Govender, Mariannhill Landfill site supervisor, Michel Fanucci, Jeanine Fanucci and Aiden Bowers, DSW operations engineer.

Externalities can be reduced but requires additional investment!





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