THE CASE AGAINST REGIONAL LANDFILLS

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SUMMARY:

Recent investigations in the somewhat sparsely populated Mpumalanga district municipality of Gert Sibande have yielded interesting results in terms of future landfill planning. While regional landfills are undoubtedly the way to go for large centres, towns and cities, in remote rural areas however, transport and distance, as well as limitations in economy of scale also become relevant. The author and colleagues have found for areas of low population density, and scattered small towns that small local landfills may be less expensive overall. Recycling, composting and other forms of waste minimisation and separation at source, tend to reduce the case for regional landfills even further.

1 INTRODUCTION

A team from Felehetsa Environmental in joint venture with BKS were appointed in 1995 to prepare an Integrated Waste Management Plan for the Gert Sibande District Municipality in the southern most third part of the province of Mpumalanga, which encloses seven local municipalities. This project was reported on in general by Muavha and Boswell (2006). The map shown below shows the extent and locality of the district municipality.

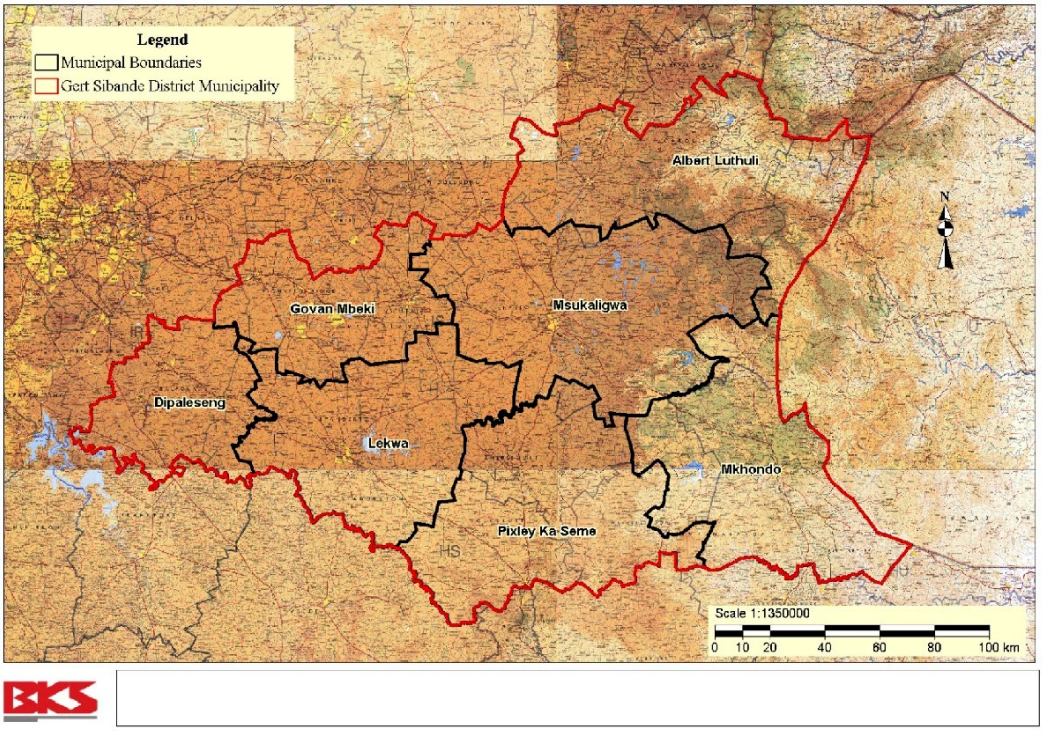

Fig 1: Gert Sibande District Municipality comprising seven local municipalities

2 BACKGROUND IN BRIEF FROM SELECTED LITERATURE

A number of authors of papers over the past fifteen years have espoused the many benefits of regional landfills. It is not the purpose of this paper to review this literature, nor to advance counter arguments to those presented. The advantages include economics and improved economies of scale, improved supervision, environmental controls and reduced overall environmental impact. As an example, Boswell (1997) at the Landfill Special Interest Group seminar in 1997 in Cape Town presented a graph showing the advantages of economy of scale of regional landfills. This graph is reproduced below. The graph was produced from actual contracts for third party operation of municipal solid waste landfills in the Highveld regions of South Africa in the early 1990's.

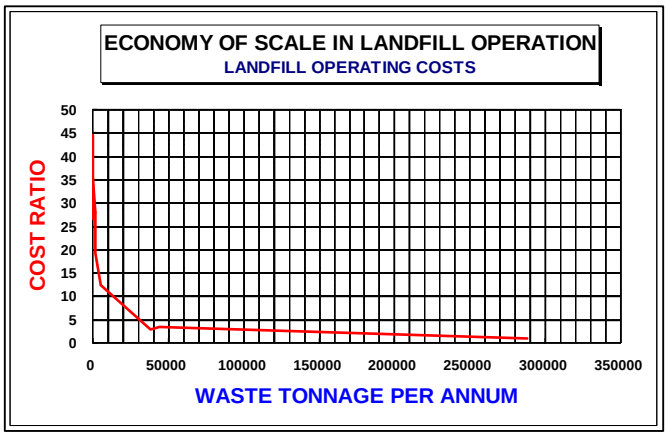

Fig 2. Economy of scale in regional landfills, from Boswell (1997)

3 ASPECTS OF METHODOLOGY

The primary objective of compiling an Economic Analysis and Feasibility Study as part of an Integrated Waste Management Plan is to integrate and optimise waste management so that the efficiency of the waste management system is maximised and the impacts and financial costs associated with waste management are minimised.

The report addressed the seven local municipal areas of which the Gert Sibande District Municipality is comprised. They are:

- Albert Luthuli Municipality;
- Dipaleseng Municipality;
- Govan Mbeki Municipality;
- Lekwa Municipality;
- Mkhondo Municipality;
- Msukaligwa Municipality; and
- Pixley ka Seme Municipality.

This document was intended to provide an economic overview of the seven local municipalities to aid in the decision making process. The economic analysis utilised key indicators such as population, waste production, levies, staff members and services offered within each municipality. The indicators were important to analyse the current situation and to develop an efficient waste management plan.

The data was obtained through earlier phases of the study, as well as through questionnaires and interviews with each municipality.

Orderly planning processes require identification and comparison of options as well as identification of the most feasible option. The following options were identified for waste disposal in the Gert Sibande District Municipality: firstly, the scenario of developing and maintaining a landfill site at each of the 22 towns and secondly, for the development of four regional sites and transporting all waste to these sites from transfer stations developed at the other towns.

After determining the initial capital cost to render each of the existing sites up to permit standards, further finances were calculated for the EIA and permitting processes at each of the landfills. Furthermore, cost was included in year 4 (2010) for further development and then a cost for capping and closure of the landfill sites after 20 years (2026).

The second option entailed the construction of four regional landfill sites spread over the Gert Sibande District Municipality. The existing landfill sites in all of the towns would then be closed down and converted to transfer stations to transport the waste to the regional site. The four regional sites were positioned in such a manner to accommodate the towns closest to it and to minimise the distances to be travelled between towns. It was found that because the Gert Sibande District Municipality comprised such a large area and the towns were not all connected by good roads, some of the resulting distances from towns to the regional site in the modelling exercise were found to be vast.

In order to dispose of the waste on the four regional landfill sites, it was required to transport all waste from source at each of 22 towns to the nearest planned regional landfill site. The resulting transport distances are shown in Table 1 below.

During the status quo assessment of the towns in the Gert Sibande District Municipality, a fleet evaluation was also done. As documented in the report by the project team's fleet specialist, the towns in the district owned and controlled only fleet sufficient to service their own specific town and many of the waste collection and disposal duties were performed by tractor and trailer. It was therefore necessary for each local municipality to acquire new vehicles which could handle the collection of waste from transfer stations and dispose of it a fair distance away at the regional landfill site.

The cost for transporting the waste was estimated using the waste tonnages determined during the status quo assessment. It was calculated how many trips needed to be made from the origin (town) to the regional landfill site to dispose of the waste. It must be noted that the calculations were done for transporting waste directly from the various towns to the relevant regional landfill site and that it could be a better option for towns that are furthest away from the regional site to transport their waste to a town that is closer to the regional site from where it can be transported to the disposal point. The routes of waste transport from the towns to the regional sites can be seen in Figure numbers 3 and 4, two pages below. Note how various towns transport their waste to other, closer, towns from where the waste is again transported to the regional site.

Table 1: Approximate Distances to Regional Landfill sites (km)

	Distance to site (km)
Regional Site 1 : Between Govan Mbeki & Lekwa	
Grootvlei	70
Balfour	50
Greylingstad	40
Leandra	40
Evander	20
Secunda	30
Bethal	60
Regional Site 2 : Between Lekwa & Pixley ka Seme	
Standerton	30
Morgenzon	40
Amersfoort	40
Perdekop	35
Volksrust	70
Wakkerstroom	80
Regional Site 3: Between Msukaligwa & Albert Luthuli	
Davel	65
Ermelo	40
Breyten	23
Lothaire	24
Warburton	20
Carolina	30
Badplaas	55
Elukwatini	70
Regional Site 4: Mkhondo	
Amsterdam	50

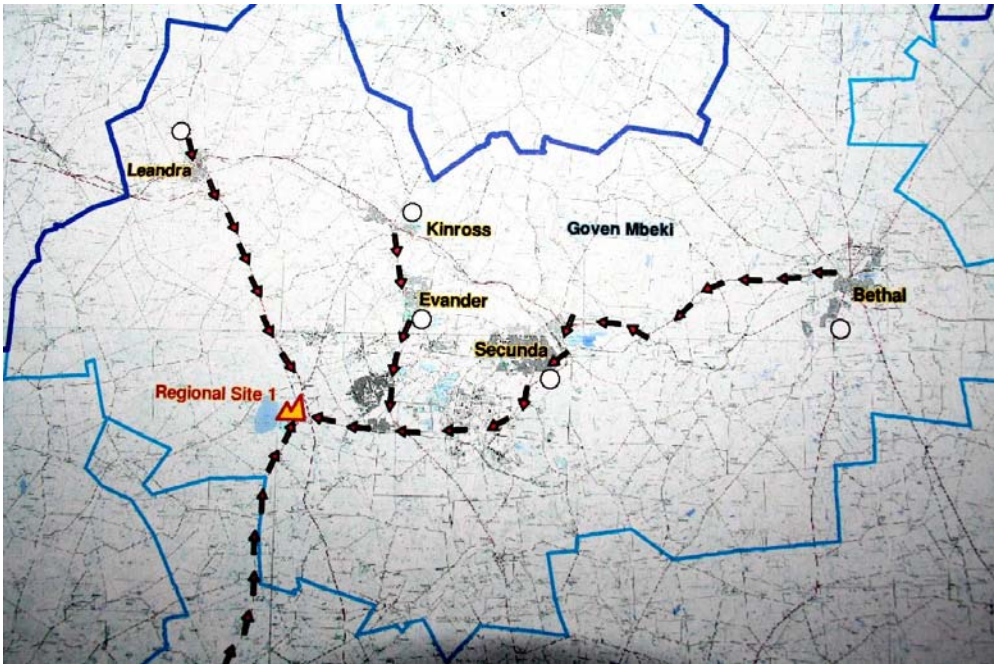

Fig 3: An economic regional landfill site: sufficiently concentrated tonnages of waste

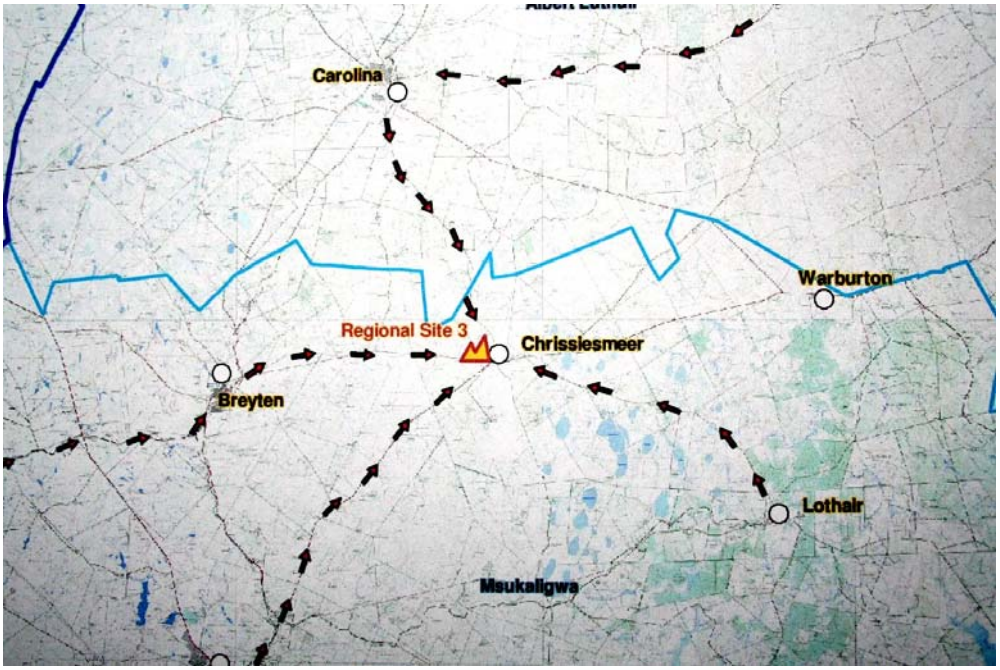

Fig 4: An uneconomic regional landfill site: distances too great for waste tonnages produced

4. PROPOSED COSTING FOR WASTE MANAGEMENT

4.1 Background

In order to maximise the potential for waste disposal in the Gert Sibande District Municipality it was decided to analyse the cost of various landfill options to determine the most feasible option. Attention was given to the scenario of developing and maintaining a landfill site at each of the 22 towns and then for the development of four regional sites and transporting all waste to those sites from transfer stations developed at the other towns. Table 2 below sets out the tonnages of MSW on which the waste management systems have been based.

4.2 Assumptions: site at each town

The landfill sites at each of the small towns throughout the Gert Sibande district were in a bad state and therefore required initial capital cost to ensure that they achieved a required standard. The amount for this initial cost was derived from the development of previous landfill sites, taking into account the size of the site in question.

After the initial capital cost, further finances were allocated for the EIA and permitting process at each of the landfills. Furthermore, cost was included in year 4 (2010) for further development and then a cost for capping and closure of the landfill sites in 2026.

It was assumed, in these calculations, that the cost for development and permitting processes were in the same range as previous projects and that all the landfill sites are closed and capped in 2026. The cost was reckoned to be directly proportional to the size of the landfill site in question and the waste disposal quantities gathered throughout the project.

The operating costs of the sites were extrapolated from existing municipal sites elsewhere. The cost of transporting the waste to the landfill was considered a common cost to the cost of transporting waste to a transfer station under the regional sites scenario and this cost was thus excluded from both scenarios, as the marginal cost impact was nil.

4.3 Assumptions: Regional Sites & Transfer Stations

Costs for the initial development and permitting of regional sites of this size were derived from the work that the authors had done elsewhere on the Highveld, for towns and landfills of similar size, nature and design. Costs of transfer stations were related to the costs of developing similar transfer stations elsewhere, and included the cost of the containers needed. These costs were then scaled up or down to represent the size of the landfill or transfer station in question.

The costs of transporting the waste to the transfer stations was again considered to be a common cost to the cost of transporting waste to a local landfill and this cost has been excluded from both scenarios.

Table 2: The mass on which the waste management systems have been based.

TOWN / DISTRICT	MASS – 2006 (Tons)	MASS – 2026 (Tons)	AIR SPACE
Carolina	2,244	2,736	69,597
Badplaas	360	444	11,624
Lukwatini	312	384	13,264
ALBERT LUTHULI	**2,916**	**3,564**	**94,485**
Balfour	240	288	13,264
Grootvlei	240	288	14,928
Greylingstad	108	132	8,001
DIPALESENG	**588**	**708**	**36,193**
Bethal	54,744	87,972	1,259,582
Evander	26,892	38,453	615,787
Leandra	26,892	38,453	419,861
Secunda	126,876	203,880	3,414,003
GOVAN MBEKI	**234,024**	**371,297**	**5,709,233**
Standerton	37,800	56,172	430,080
Morgenzon	1,080	1,608	45,312
LEKWA	**38,880**	**57,780**	**475,392**
Piet Retief	49,056	312,480	3,256,933
Amsterdam	2,508	15,972	65,171
MKHONDO	**51,564**	**328,452**	**3,322,104**
Chrissiesmeer	1,476	2,832	67,688
Davel	960	1,848	45,112
Breyten	1,248	2,400	90,265
Ermelo	11,052	21,240	507,683
Lothaire	648	1,248	28,200
Warburton	0	0	0
MSUKALIGWA	**15,384**	**29,568**	**738,948**
Amersfoort	1,536	4,992	118,503
Perdekop	744	2,412	71,111
Volksrust	10,356	33,660	474,056
Wakkerstroom	1,044	3,396	88,921
PIXLEY KA SEME	**13,680**	**44,460**	**752,591**

The cost of transporting the waste from the transfer stations to the regional sites was determined as follows:

- **Distance** Based on actual distances from the town to the regional landfill;
- **Average Mass** Based on average mass for each municipal entity as shown in table 2;
- **Average volume** Calculated at 2 m^3 per ton of waste;
- **Container volume** Based on 25 m^3 per container
- **Number of trips** Calculated based on volumes and container size
- **Tariff** Assumed at R15.00 per kilometre

5. COMPARISON OF PROPOSED SOLUTIONS

The identified options were compared on the basis of nett present value costs, cashflow and other aspects in this section. The activities and assumptions made are described in section 4.2. above.

The 2006 nett present value costs were determined based on the following assumptions:

- Study period – 20 years
- Discount interest rate = 8% per annum

A summary is shown in Table 3 below.

Table 3: 2006 Nett Present Value Costs at annual 8% discount rate

Option	2006 Nett Present Value Cost (R)
1. Landfill site at each town	76 942 523
2. Regional sites and Transfer stations	382 699 451

The annual cash flow comparison is shown in Table 4 below.

Table 4: 2006 Cash flow and annual cost

Option	2006 Cost (R)	2010 Cost (R)*	Annual Cash Flow (R)
1. Landfill site at each town	35 214 000	5 550 000	3 521 400
2. Regional sites and Transfer stations	115 706 446	28 572 213	25 622 213**

* This cost was included for upgrading after 4 years, new cells, new equipment, new infrastructure etc.

** Varies according to number of extra containers needed per year, difference per year very small and tabulated value the highest possible

From Tables 3 and 4 above it is clear that option 1 of a landfill at each town, provides the least nett present value cost. Developing four regional sites and transporting waste to them from the towns is very expensive.

In order to further compare the regional site option with the local landfill options, use is made of the "Net Present Value" ("NPV") technique. Accordingly all costs over various periods are brought to a common date, typically the start date at an agreed discount rate. In this analysis the rate of 8% per annum has been used as the real discount rate for all future cash flows. By using the real rate the impact of future inflation, and more importantly the difficulties in estimating future inflation, are alleviated.

On the basis of the costs shown in the previous sections, table 5 shows the results of the analysis on an NPV basis.

Table 5 comparison of the regional site option with the local landfill options using the "Net Present Value" ("NPV") technique

	LOCAL LANDFILLS R'million NPV	**REGIONAL LANDFILLS** R'million NPV
Initial Capital Costs	35.2	109.9
Future Capital Costs	4.4	2.0
Transport Costs	-	149.0
Operating Costs	126.5	127.0
NET PRESENT VALUE	**166.1**	**387.9**

As is apparent from the above comparison, the option of establishing regional landfills is significantly more expensive, both to establish due to the high initial capital costs and to run due to the high transport costs.

6. CONCLUSIONS AND RECOMMENDATIONS

After completion of the study it was concluded that:

- Waste management in Gert Sibande was critically underfinanced at both capital and operational level
- Staffing levels and costs varied from insufficient to just adequate
- Fleet costs and financing were critically short funded
- Existing landfills required major expenditure
- New airspace was urgently required in order to provide economically accessible landfills

Due to the above costs and the general layout of the area it is recommended that the final layout of the landfills in the Gert Sibande District be a combination of the above scenarios. Regional landfill sites should be developed to serve areas within economical driving distance, like regional site 1 between Govan Mbeki and Lekwa. Together with transfer stations this could be managed properly. In some other areas like Albert Luthuli and Msukaligwa the development of a regional site could create problems in terms of distance and vehicle time and therefore it would be advisable to upgrade the current landfill sites to permitted sites and operating them accordingly. Consideration was also given to the condition of some of the current landfills and choosing those that would be most easily and cost effectively upgraded to permitted status.

In terms of scenarios and recommended strategies, it was recommended that funds be deployed with the following factors in mind:

- Subsidised waste collection and disposal for the poorest communities
- Flagship waste avoidance, recycling and awareness campaigns be launched as new initiatives:
    - Composting
    - Buy-back centres in the major towns
    - Recycling of paper, glass, metal and plastic
    - Competitions
- The recycling activities in evidence in Balfour be highlighted and used to promote awareness and education regarding the activities and benefits of recycling
- New, additional and purpose designed mobile plant required to significantly upgrade the landfill fleet
- New, additional and purpose designed waste collection vehicles required to significantly upgrade the collection fleet
- Outsourcing of fleet maintenance
- New landfills were required for most of the 22 towns in the region
- In Govan Mbeki local municipality, a regional landfill was found to be the most economically feasible
- In the remaining six municipalities, regional landfills were not recommended, as a result of remoteness
- Instead, small landfills to serve each primary town were recommended as preferable, in order to avoid exorbitant waste transportation costs.

After consideration of the results obtained it can be seen that the development of regional sites and transfer stations is far more expensive than the alternative of developing a site at each of the towns. Administrative issues and travel time etc. also play a role in the ultimate decision.

7. ACKNOWLEDGEMENTS

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8. SELECTED REFERENCES

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