Analysis of the Full Costs of Solid Waste Management for North Carolina Local Governments

A study conducted by the Division of Pollution Prevention and Environmental Assistance to gather benchmark data on the cost of solid waste collection, disposal, and recycling services for North Carolina local governments

NC Department of Environment, Health, and Natural Resources

James B. Hunt Jr., Governor

Jonathan B. Howes, Secretary, DEHNR

Gary E. Hunt, Director, DPPEA

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About the Division of Pollution Prevention and Environmental Assistance

The North Carolina Division of Pollution Prevention and Environmental Assistance (DPPEA) of the Department of Environment, Health, and Natural Resources (DEHNR) provides free, non-regulatory technical assistance and training on methods to eliminate, reduce, or recycle wastes before they become pollutants or require disposal. DPPEA addresses solid and hazardous waste and air and water pollution for government agencies, industries, businesses, institutions, residences, and institutions.

North Carolina Division of Pollution Prevention and Environmental Assistance

Department of Environment, Health, and Natural Resources

PO Box 29569, Raleigh, NC 27626-9569

Telephone: (800) 763-0136 or (919) 715-6500

E-Mail: nowaste@owr.ehnr.state.nc.us

WWW home page: http://owr.ehnr.state.nc.us/

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Abstract

This study presents the results of full cost analyses of solid waste management for a sample of North Carolina local governments. The budgets of 15 local government programs were examined to gather benchmark data on the cost of solid waste collection, disposal, and recycling services. These data show that the cost-effectiveness of a recycling program (compared to solid waste collection and disposal) correlates with local government recycling rates; i.e., local governments that achieve high recycling rates are more likely to operate recycling programs that are less expensive per ton than solid waste collection and disposal.

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1. Background

1.1 Introduction

North Carolina local governments are required by law to determine the full cost of solid waste management. * In 1996, the North Carolina General Assembly reaffirmed this statutory requirement with the view that an understanding of full cost is a fundamental component of sound public solid waste management.

The process of full cost analysis' (FCA) helps local governments understand expenditures associated with collection, disposal, and recycling so that the true costs and benefits of each service are understood. Through FCA, recycling costs can be directly and fairly compared to solid waste collection and disposal. This approach helps local governments identify all current costs associated with solid waste management as well as account for past and future expenses for which benefits are realized in the current budget year.

Only through an understanding of the full costs of their programs can local governments make the best possible decisions regarding solid waste management. For this reason, the North Carolina Division of Pollution Prevention and Environmental Assistance (DPPEA) developed a worksheet to help local governments perform full cost analyses.' In a pilot use of the work sheet, 15 North Carolina local governments completed full cost analyses of their solid waste management budgets. Although the main purpose of the pilot project was to promote the use of FCA by local governments, the scant research on solid waste management costs completed to date underscored the need to provide local governments with benchmark data on costs for solid waste collection, disposal, and recycling.

This study presents and analyzes the quantitative data from the completed full cost analysis work sheets. The methodology used to conduct this study is reviewed in Section 2. Results and analysis are presented in Section 3, and Section 4 presents conclusions. This study found that there is a strong positive correlation between the cost effectiveness of a recycling program (compared to solid waste collection and disposal) and local government recycling rates for the 15 local governments that participated in the study. Local governments that achieve high recycling rates are more likely to operate recycling programs that are less expensive per ton than solid waste collection and disposal.

1.2 Definition of Full Cost Analysis

Full cost analysis helps local governments better understand the cost of doing business for each service they offer. This analysis is best summarized by a National Recycling Coalition fact sheet:

> *FCA provides a systematic approach for identifying and determining, in an on-going fashion, the fill cost of local solid waste management systems over a @en time period. It involves the identification and inclusion of all direct and indirect costs associated with providing a particular service or program. It identifies and incorporates, up front, current and expected future outlays, oversight, and support service (overhead) costs, and operating costs.'*

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[1] *Each [local government solid waste] plan shall include a description and assessment of the full cost of solid waste management, including the costs of collection, disposal, waste reduction, and other programs, and the methods offinancing those costs [NC HB 859-GS 13OA-309.09A(b) (7)].*

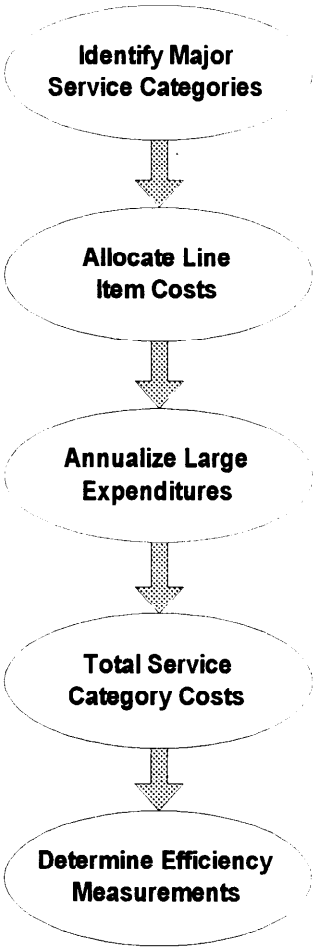
[2] Full cost accounting is another accepted title for this methodology. As this methodology is not what is commonly thought of as *accounting* (i.e. debits and credits are not compared), the DPPEA USEs the term *analysis.*

[3] *Full Cost Analysis Worksheet-for Local Government Solid Waste Programs,* NC Division of Pollution Prevention and Environmental Assistance, 1996. The main section of this worksheet is included in Appendix A.

[4] *Full Cost Accounting,* National Recycling Coalition, 1996.

Figure 1 presents the major steps of a full cost analysis. This procedure is described in more detail in Section 2.2. Although it has not always been labeled as such, many local governments have been doing full cost analysis for years. It is a common sense approach that accounts for all costs associated with managing solid waste. Through a full cost analysis, a local government can both understand its total program costs and learn the relative efficiency of its various solid waste services.

Figure 1. Steps to Conduct an FCA



1.3 Benefits of Full Cost Analysis

The most important advantage of FCA is that it provides accurate and complete information on the real costs of managing solid waste. It uncovers hidden and overlooked costs and allocates all costs to the specific program for which they are incurred. As a result, managers are able to compare current and proposed services accurately, predict future costs reliably, and evaluate privatization options thoroughly. In short, full-cost analysis allows elected officials and solid waste managers to make informed decisions regarding the types and levels of solid waste services.

In addition to the general advantages that come with understanding program costs, FCA provides the following specific benefits to local governments:

- With FCA, local governments have a valuable planning tool for preparing budgets and determining a program's direction.
- FCA exposes hidden costs so that refuse management costs and recycling costs can be fairly compared.
- FCA helps local governments better recognize and correct program inefficiencies, especially if FCA is performed annually.
- FCA can help local governments examine various financial scenarios and their resulting impacts upon solid waste rates.
- Through FCA, local governments can better understand and explore the incorporation of financial incentives (such as pay-as-you-throw user fees) into solid waste management programs.
- FCA helps local governments to consider long-term horizons in analyzing costs.

The public can also benefit from full cost analysis information. Full cost results can be presented to the public through the newspaper, tax forms, or other avenues to make solid waste cost and fees more transparent. With such information, citizens can better evaluate their own actions and the choices of their public officials. FCA does not address non-monetary costs and benefits such as environmental considerations and pubic expectations. Results from an FCA should be considered in conjunction with such non-monetary costs to help local governments make solid waste decisions.

1.4 History of FCA in North Carolina

The first time most North Carolina local governments were confronted with the term "full cost" was after the passage of the Solid Waste Management Act of 1989, which required that "each county and each local municipality . . . determine the full cost for solid waste management within the service area of the county or municipality." In 1992, the North Carolina Department of Environment, Health, and Natural Resources (DEHNR) published a Full Cost Determination Guidance Document to assist local governments. This booklet guides local governments through each calculation necessary to determine the full cost associated with a solid waste program. Because of the difficulty of performing an FCA and the intimidating nature of the subject matter, the booklet was not widely used.

The importance of understanding solid waste costs received increasing attention both nationally and locally, especially as local government recycling programs matured. By 1995, at least four other states' had developed programs and/or booklets to promote FCA at the local government level. Also, many local governments sought to better understand their solid waste costs so that cost information could be used to design variable rate programs. With these trends at both the national and local levels, the North Carolina DPPEA initiated a project to promote FCA. The results of that effort include (1) a worksheet to help local governments conduct a full cost analysis and (2) this study on the full costs of solid waste management.

2. Methodology

2.1 Scope of Study

This study presents and analyzes the cost-per-ton figures for 15 North Carolina local governments which, as part of this study, completed a FCA of their solid waste budgets. All local governments used the DPPEA Full Cost Analysis Worksheet (included in Appendix A) as a standard format. The methodology of the DPPEA work sheet is similar to other FCA guidance documents available.[6]

2.2 Full Cost Analysis Procedure

Although the procedure for performing a FCA depends on the structure of a local government solid waste budget, an FCA can generally be divided into five steps.

- **Step 1: Understand the Major Cost Centers of the Solid Waste Budget**

  Generally a solid waste budget is divided into the following three cost centers or service categories:

  - Solid Waste Collection - Solid Waste Disposal - Recycling

  Other possible service categories include yard waste, household hazardous waste, commercial waste, tires, and white goods.

- **Step 2: Allocate Line Item Costs to Appropriate Service Categories**

  A detailed assessment of costs within each service category is performed. Costs include these common budget line items:

  - Wages and Fringe Benefits
  - Contracted Services
  - Equipment Operations and Maintenance
  - Large Capital Expenditures
  - Educational Materials

  When staff, equipment, and other resources fall into two or more categories, costs can be allocated between service categories by at least two methods: (1) the percentage of time dedicated to each use or (2) the percentage of tons managed by each program.

- **Step 3: Annualize Large Capital Expenditures**

  Items such as equipment and fixed assets often have many years of useful life; therefore, their costs should be apportioned ("annualized" or "depreciated") over those years. This approach includes annualizing landfill start-up and closure costs. The annualized costs should be allocated to relevant service categories identified in Step 2.

- **Step 4: Aggregate Detailed Costs Into Total Program Costs**

  Line item costs are totaled for each service category.

- **Step 5: Determine Metrics to Measure Program Efficiency**

  Cost per ton or cost per household are two commonly used metrics; this study analyzes budgets according to both per-ton and per-household metrics.

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[5] Indiana, Georgia, Texas, Florida.

[6] *See A Solid Waste Management Full Cost Determination Guidance Document for North Carolina Local Governments* and *Texas Municipal Solid Waste Services Full Cost Accounting* Workbook.

2.3 Sample

The best way to obtain statistically accurate data on costs of local government solid waste services is to survey hundreds of local governments. In the absence of such data, this study examines a sample of solid waste budgets of 15 local governments to identify possible. benchmark cost profiles. Although the small data set is highly variable, conclusions drawn from this study help identify potential tendencies in solid waste management costs.

The sample population consists of local governments that either volunteered to participate in the study or were recruited to conduct an FCA. Specific participants were recruited to ensure a mix of large and small local governments. Thus, the sample for this study was not random and may be biased. For example, local governments that completed an FCA may have common characteristics that are distinct from those local governments that were unwilling or unable to conduct the analysis.

2.4 Average vs. Incremental Costs

Average Costs

Local government solid waste budgets can be analyzed by either average cost or incremental cost methods. Average cost requires that the cost of a service be divided by some metric, usually tons or household. For example, average cost analysis may show that a local government's solid waste collection program costs $80 dollars per ton and its yard waste cornposting program costs $60 per ton. An average cost analysis can be very beneficial to local governments for the following reasons:

- **Internal Comparison.** A comparison of costs of existing programs can help local governments make strategic decisions. For example, a local government may determine that a cornposting program is less expensive per ton than solid waste disposal and, thus, augment its cornposting efforts.
- **External Comparison.** A local government can compare its program to others. For example, a local government may find that its recycling program is costing $150 per ton while similar programs elsewhere are performed for $70 per ton.
- **Tracking Costs Over Time.** Most importantly, local governments can monitor their own costs over time. Through such monitoring, a local government can identify ineffiencies and set goals for productivity improvements.

Incremental Costs

Once a local government understands the average costs of it solid waste management program, it can, if needed, perform an incremental costs analysis to determine the impact of each service category on the program as a whole. With incremental analysis, the additional costs to the overall program attributed to each service are identified by evaluating fixed and variable costs separately.

Although incremental cost analysis is less exact than evaluation of a previous budget, it can be invaluable for making program decisions. For example, through an incremental cost analysis during a budgeting process, a local government can evaluate the benefits and costs of adding a cornposting program or recycling materials to its solid waste services. Also, incremental costs analysis may show that although one program's average cost may be lower than another's, its incremental cost may be higher. For example, although the average cost of adding a recycling program may be $80 per ton while collection and disposal of garbage costs $100 per ton, the creation of a recycling program may still increase the overall solid waste budget. Such an increase would result from fixed costs (such as landfill overhead) in a solid waste program that cannot be reduced despite waste reduction activities. Thus, a problem with incremental cost analysis is that it heavily favors existing programs for which fixed costs are already imbedded in a budget.

Average and incremental cost analyses complement each other. Average cost analysis identifies possible inefficiencies and allows for comparison between programs, while incremental cost analysis helps with decisions about adding new services and the effect on the overall budget. As described in Section 2.2, this study used average cost analysis to analyze local government solid waste budgets.

3. Results and Analysis

This section reviews the direct results of the full cost research such as average costs for each of the solid waste services offered by local governments. The study examines average cost per ton and cost per household and also compares solid waste costs to population. As mentioned in the Introduction, Section 3.3 compares recycling costs to those of solid waste collection and disposal. Finally, costs are correlated to recycling rates to see how recovery rates may affect the cost effectiveness of recycling compared to solid waste collection and disposal.

3.1 Average Cost Results for Cities and Counties

Of the 24 local governments that volunteered or were asked to complete a full costs analysis of their budgets, 15 returned completed forms, a response of 63 percent. Eleven of the local governments provided budget analyses from FY 1995-96, while four provided data from fiscal year 1994-1995.[7] All cities participating in the study operated door-to-door (curbside) solid waste and recycling programs while all counties operated staffed solid waste and recycling (drop-off) centers. The average costs of the service categories for cities and counties are presented in Table 1. (Sample sizes for each data set are remarked in the first column of Table 1 by the letter *n.*)

The study concentrated on costs of residential solid waste collection, solid waste disposal, and recycling. For purposes of analysis in this study, recycling costs are defined as all costs borne by the local government for recycling materials such as paper, metal, glass, and plastic. These costs include collection, internal processing, and marketing of materials. In a few cases, cities broke out costs in their analysis for yard waste management and commercial solid waste collection; the statistics for these two services are also included in Table 1 as they provide a benchmark, but it should be noted that the sample sizes are extremely small. Also, during telephone conversations to follow up on the completion of the FCA forms, 60 percent of the local governments said the process or the information from the analysis was useful to them.

Table 1. Solid Waste Management Cost Statistics for Sample North Carolina Local Governments, ($/ton) (n represents sample size)

Category	Mean, ($)	Median, ($)	Standard Deviation, ($)	Range, ($)
North Carolina Cities				
SW Collection (n=9)	83	71	33	50 - 153
SW Disposal (n=9)	30	26	10	19 - 48
Recycling[8] (n=9)	139	145	39	86 - 193
Yard Waste Management (n=3)	76	85	17	57 - 87
Commercial Solid Waste Collection (n=3)	35	31	9	28 - 45
North Carolina Counties				
SW Collection (n=6)	44	47	14	27 - 57
SW Disposal (n=6)	40	36	21	25 - 77
Recycling[8] (n=6)	106	77	73	28 - 225

[7] Although in FY 1994-95 recyclables commanded higher revenues than in FY 1995-96, the differences had little effect on overall averages and results of this study.

[8] Recycling costs include collection, processing, and marketing of materials. These costs are compared to the sum of solid waste collection and disposal later in the study.

Local governments may be interested in the data presented in Table 1 as these figures offer a benchmark for comparison with their own program costs. The data from Table 1 is presented graphically in Figure 1 for cities and in Figure 2 for counties. In these graphs, the average cost per ton for solid waste collection, disposal, and recycling is represented by a diamond (+) while the error bars represent one standard deviation both above and below the mean. In addition to providing benchmark data, the graphs provide a first comparison of service cost. For the whole sample, recycling appears to be the most costly solid waste management option per ton. This comparison is explored in more detail in Sections 3.3 and 3.4.

Figure 2. Cost for Solid Waste Services for North Carolina Cities

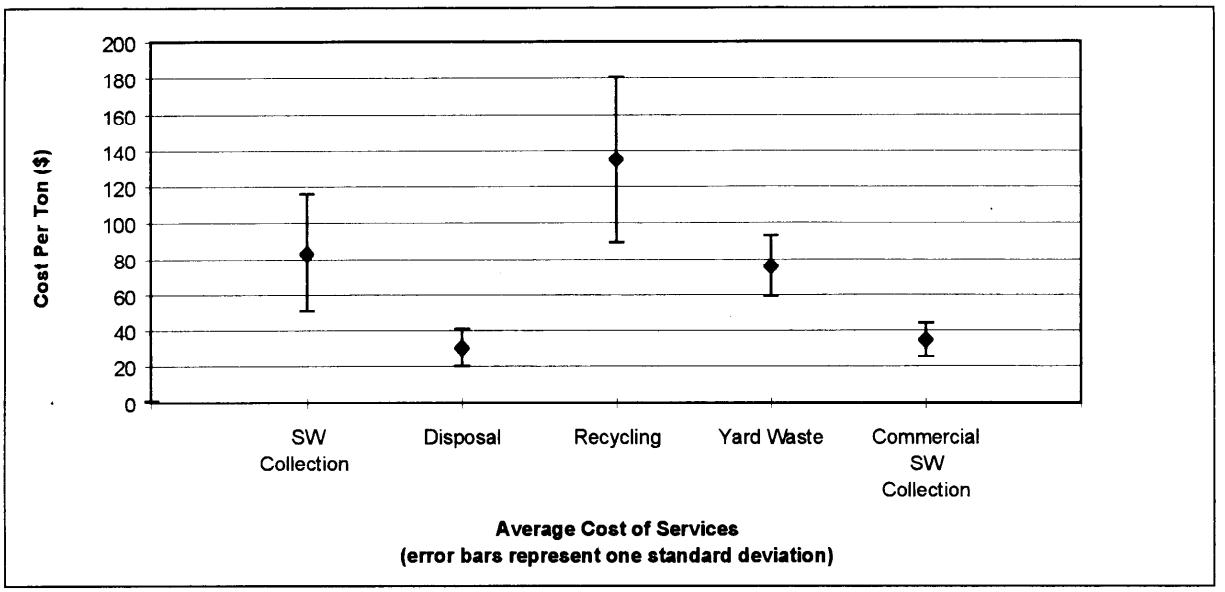
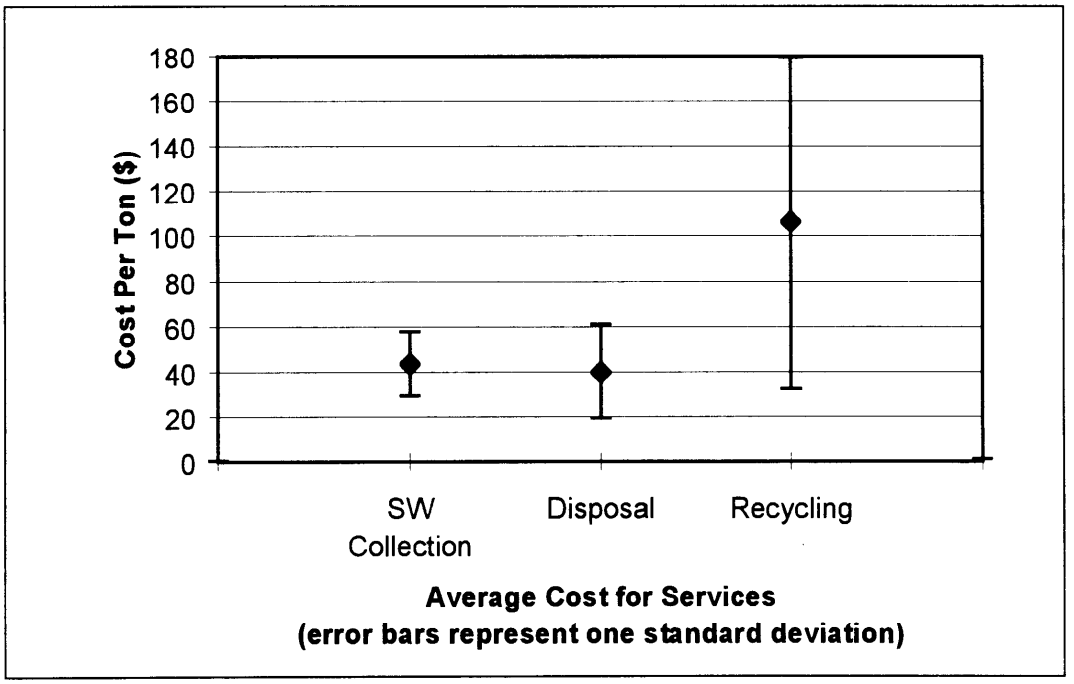


Figure 3. Cost for Solid Waste Services for North Carolina Counties

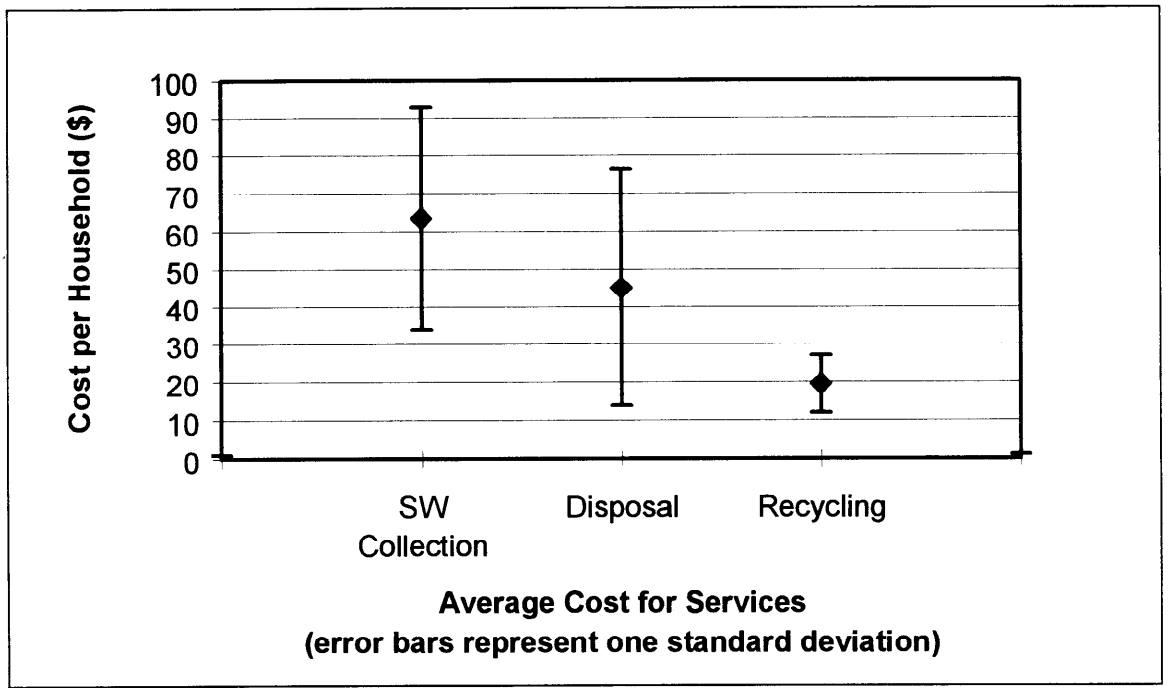


me local governments find it useful to calculate the cost per household of their services in addition to a per- cost. Average costs per household for the sample used in this study are as follows: solid waste collection - 7 per household per year; disposal - $41 per household per year; recycling - $20 per household per year.

These results are presented in Figure 4. Cost-per-household values are most useful to local governments that operate curbside collection programs for solid waste or recyclables. For example, a city may use dollars-per-household data to determine the cost of adding a new development to the curbside route.

Unlike the cost-per-ton calculations presented above, the average costs per household are significantly lower for recycling than for solid waste collection and disposal. This difference occurs because recycling and solid waste services tend to service the same number of households, although recycling in all cases in the study accounted for a smaller fraction of the budget than solid waste collection and disposal. In Section 3.3, recycling is compared to solid waste collection and disposal using cost-per-ton data; cost-per-household values do not accurately compare solid waste management options as these amounts favor recycling because of its lower costs overall.

Figure 4. Solid Waste Management Cost Per Household



Evaluation of the average results presented in Table 1 and Figures 1 through 4 should be undertaken with caution as the sample size of this study is too small to over-generalize about the cost of solid waste management services for cities and counties. However, such data give local governments a general sense of solid waste management costs in North Carolina and represent a first effort to quantify these costs. As cost data are collected from additional local governments in the future, more precise statistical information can be generated.

3.2 Costs Correlated With Population

As presented in Figure 5, the data from the entire sample show an inverse correlation between program costs and community population. Each point included in Figure 5 represents the average cost per ton for the various service categories for each local government solid waste program. The trendline that runs downward across the graph represents an estimated "average" cost per ton given a certain population, and the figure shows that as community population increases, the cost per ton decreases. This result is not surprising as one would expect that economies of scale would help larger communities achieve a lower cost-per-ton ratio. The trend is evident for most of the subsets of the sample population: county collection and city and county recycling costs decrease as population increases. However, the trend is not evident for city solid waste collection costs versus population. Figure 6 shows that as cig populations increase, the cost per ton to collect solid waste increases. The apparent inconsistency may result from the higher levels of service (such as more frequent collection or

back door pick ups) in larger municipalities, or it may only be an inaccuracy as a result of the small sample size of the study. Further research is needed to explain this unexpected trend.

Figure 5. All Solid Waste Service Costs Versus Local Government (County and City) Population

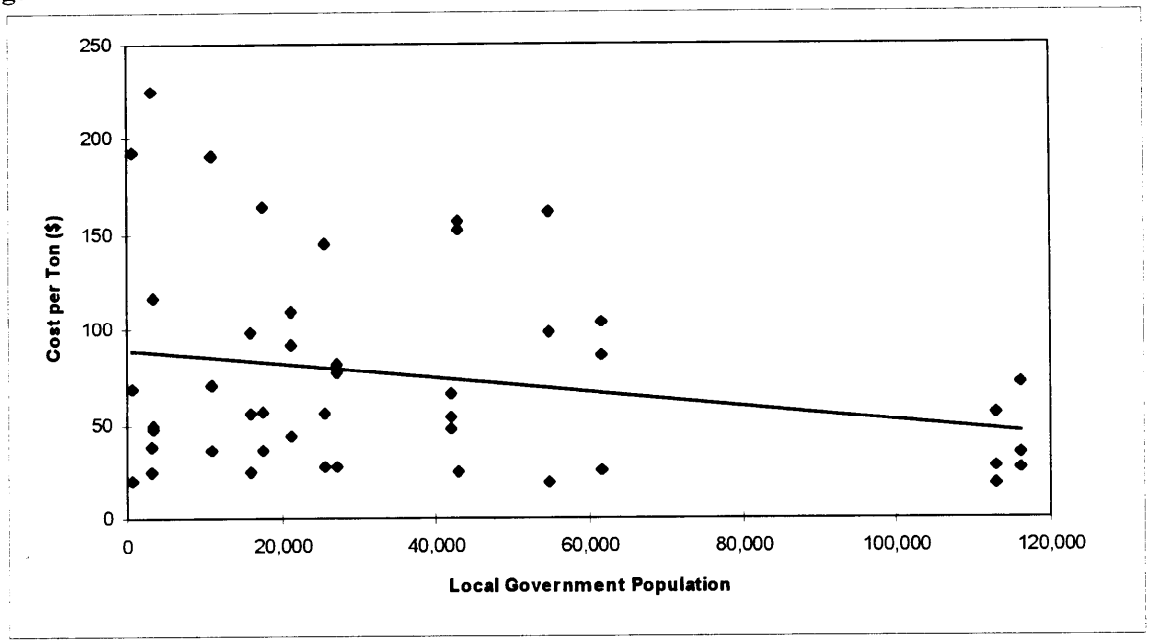
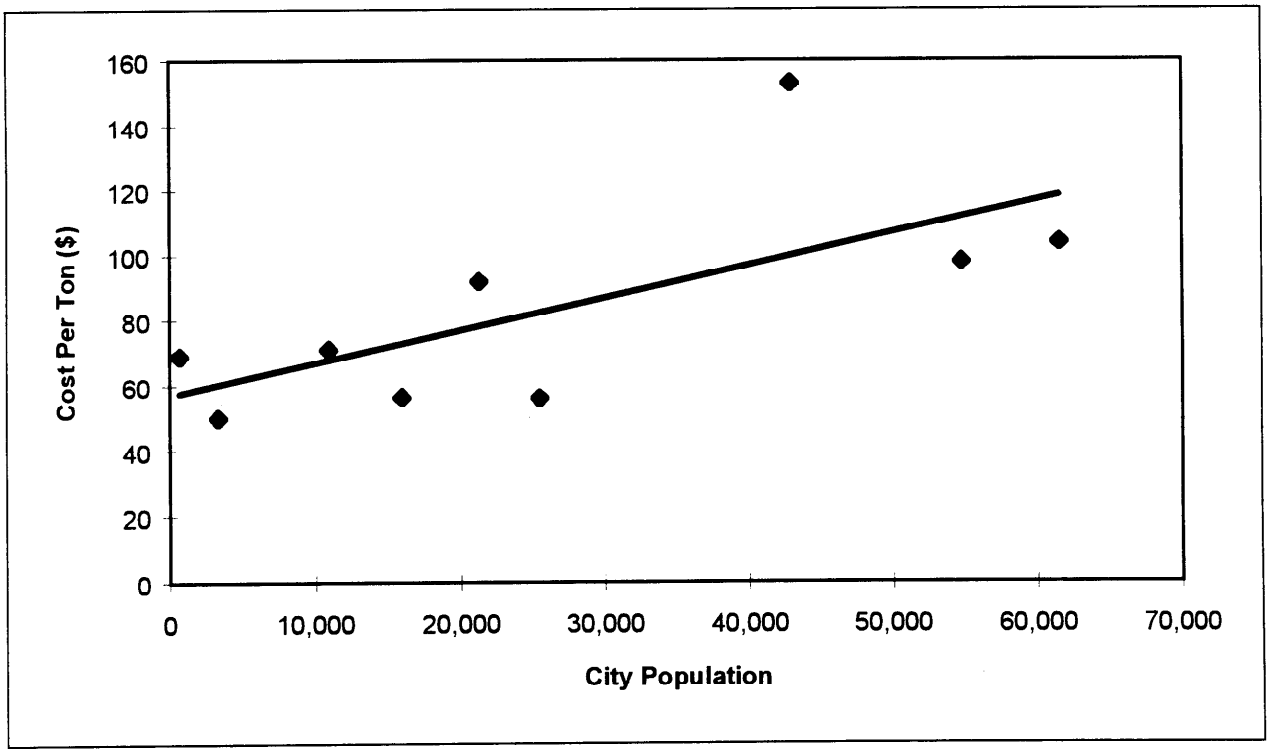


Figure 6. Solid Waste Collection Costs Versus City Population

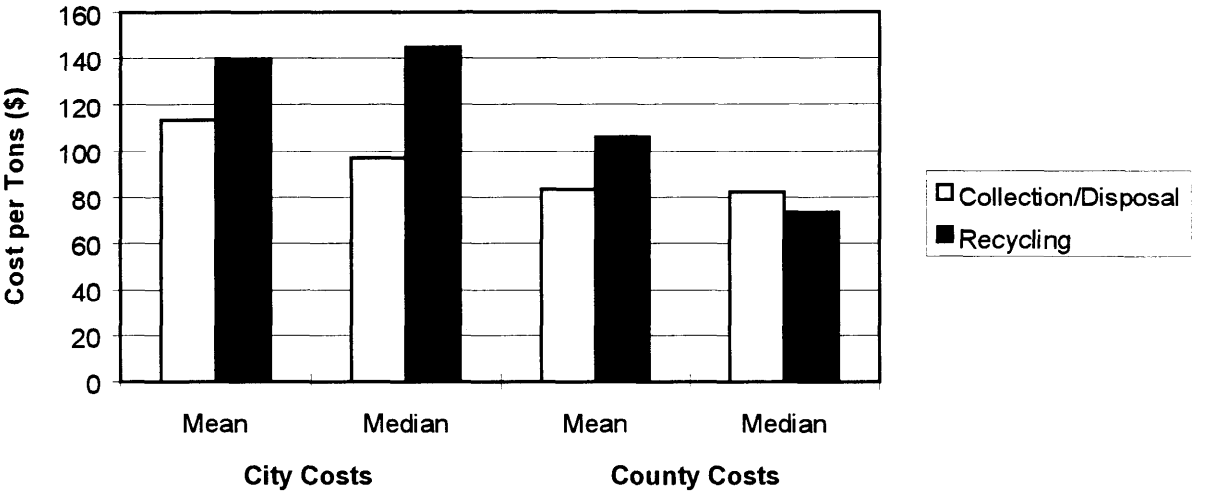


3.3 Cost Comparison of Recycling and Solid Waste Collection and Disposal

In addition to providing a benchmark by which local governments can assess the economics of their programs, the data from this study allow for the comparison between solid waste management options (i.e., the cost of collection and disposal vs. recycling). Frequently, recycling costs are evaluated only against disposal costs, but

such an evaluation does not take into account the full costs of solid waste management. To be more accurate, recycling costs should be evaluated against the sum of solid waste collection and disposal. Figure7 compares the sum of average solid waste collection and disposal costs to recycling costs. The comparison is made for both cities and counties with both mean and median averages. As can be seen from the comparisons, both mean and median average city (door-to-door programs) solid waste costs appear to be lower than recycling costs. Average county (staffed collection centers) waste costs are less conclusive, as recycling is more expensive given the mean, but less expensive given the median.

Figure 7. Average Costs of Solid Waste Collection/Disposal vs. Recycling



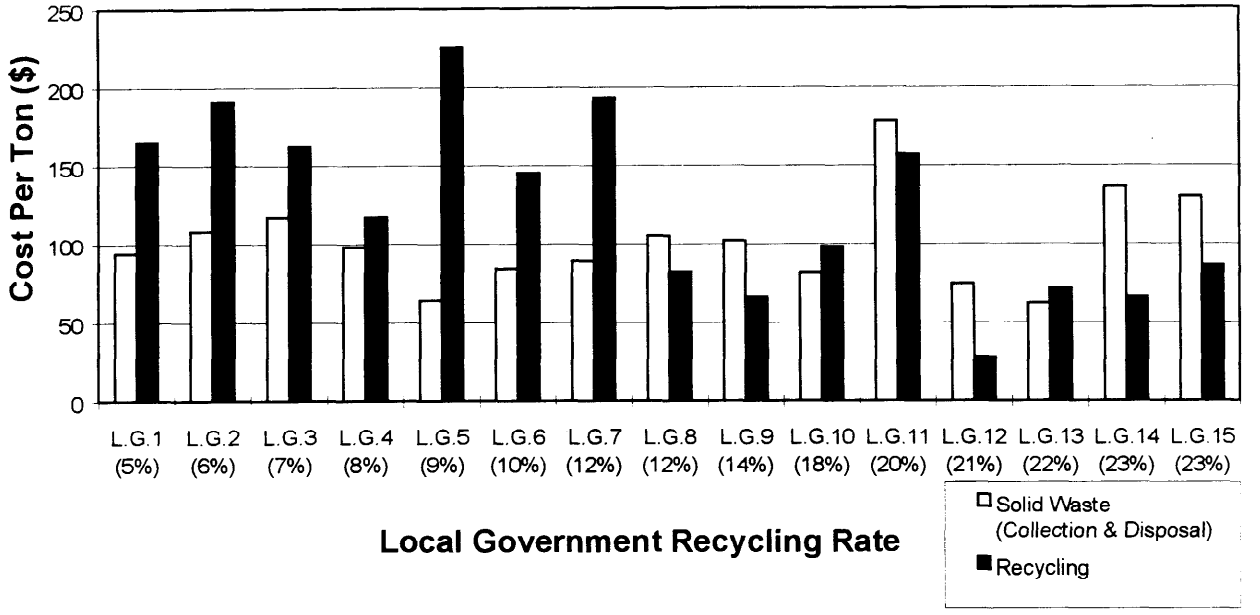
3.4 Costs Correlated With Recycling Rates

Further analysis of the data shows that averages alone may not accurately compare solid waste collection and disposal to recycling. Examination of the raw data reveals that 6 of the 15 local governments, or 40 percent, operate recycling programs in which recycling costs per ton are less than conventional solid waste collection and disposal costs.[9] Although average costs seem to favor solid waste collection and disposal over recycling, an average of the costs for the participating communities does not necessarily tell the whole story.

The shortcomings of averages can be reconciled if individual programs are compared with reference to the quality of the programs. For example, it may be assumed that, on average, a program of high quality is more cost effective than a low quality program. Figure 8 presents a side-by-side comparison of solid waste collection and disposal costs to recycling costs for each of the local governments that participated in the study. As an indicator of program quality, the local government results are presented in order of the recycling rates for their programs. [lo] As Figure 8 shows, local governments are ordered by recycling rates (which range from 5 to 23 percent) along the base of the graph. The white bars of the graph represent solid waste collection costs per ton plus disposal costs per ton. The black bars represent recycling costs per ton. For example, the first listed local government (LG 1) pays $93 per ton for solid waste collection and disposal and $163 per ton for recycling. As Figure 8 shows, solid waste programs that achieve a high recycling rate (greater than 12 percent) tend to operate recycling programs that are less costly per ton than solid waste collection and disposal; solid waste programs that have a low recycling rate (less than 12 percent) tend to operate recycling programs that are more costly per ton than collection and disposal. These same results are true even when county and city data are segregated.

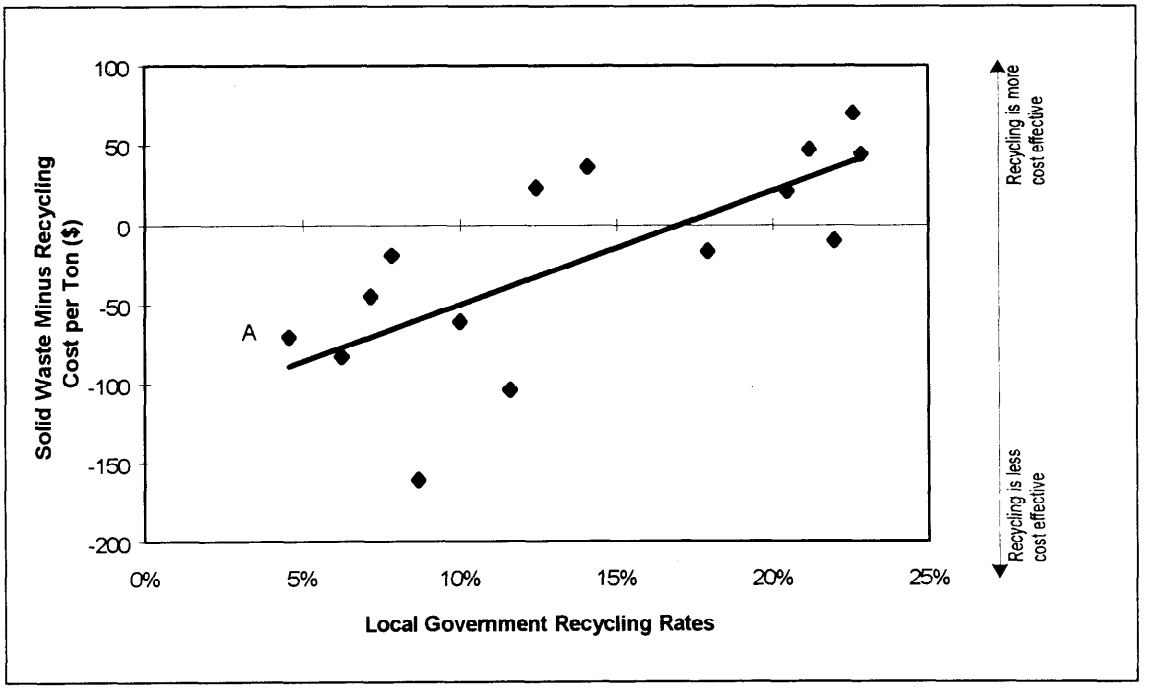
[9] This conclusion should not be cited out of context as the sample for this study was not random.
[lo] Recycling rates are determined for residential waste only and exclude yard waste mulching and cornposting.

Figure 8. Individual Local Government Waste Management Costs Versus Recycling Rates



The extent of the correlation between recycling rates and cost effectiveness can be seen through a scatter diagram of the same data presented in Figure 9 which plots local government recycling rates against the difference between solid waste management and recycling costs. For example, point A in the graph represents a local government that has a recycling rate of 5 percent and solid waste costs that are $75 less expensive per ton than recycling. The trendline of Figure 9 represents an estimated "average" difference between solid waste and recycling costs given a certain recycling rate. It clearly shows that relative cost effectiveness of recycling compared to solid waste collection and disposal costs is directly correlated to local government recycling rates. This correlation likely results in large part from the economies of scale achieved as a program increases the quantity of recyclables managed.

Figure 9. Correlation of Relative Cost Effectiveness of Recycling to Recycling Rates



This analysis does not evaluate the quality for the solid waste collection and disposal programs. It again must be noted that the sample size of the study comprises only 15 local governments. However, the apparent correlation between recycling rates and relative cost effectiveness of recycling merits continued evaluation of solid waste budgets. Also, the data clearly show that recycling programs can be less costly than solid waste collection and disposal, especially if local governments have invested the resources to achieve high recycling rates?

3.5 Limitations of Analysis

This study identified many challenges to local governments as they conduct full cost analyses. The study also underscored difficulties in aggregating data from different communities. Participants encountered the following problems while analyzing the full cost of their budgets:

- **Time and resources.** Many local governments needed 8 staff hours or more to complete the full cost analysis. Despite the utility of the information, some local governments found it difficult to dedicate time and resources required to complete the analysis
- **Structure of existing budgets.** As many local solid waste budgets are not segregated by program category, the completion of a budget analysis is inhibited.
- **Cost allocation between programs.** Some participants found it difficult to allocate costs between solid waste services. For example, it may be difficult to divide costs of individuals or equipment that are shared between programs.
- **Distribution of costs over** time. Most local governments were able to annualize their large capital expenditures as this information was generally available through the local finance office. However, other local governments encountered difficulties performing necessary calculations.
- **Calculation of overhead costs. The** calculation of overhead costs was nearly a universal problem. Many participants were able to calculate successfully the overhead of the department's time; however, local governments were less successful in estimating overhead costs of items such as buildings and office space.

In addition to these challenges, it is difficult to compare local government budgets. Level of service, demographics, community interest, political support, and many other factors make each community's program unique. The small sample size of the study hampers normalization of the data to such factors. Moreover, cost effectiveness and efficiency are relative terms that are affected not only by tangible characteristics such as a community's population, economic base, etc., but also by intangible characteristics such as its solid waste management priorities and goals.

The fluctuation of recyclable revenues could also impact results of any cost study, The average recycling markets of FY 1995-1996 (between $50 and $70) was much lower than the previous year (between $80 and $100) but a bit higher than average rates over the last 5 years (between $40 and $60) not including the 1995 spike. [12] As most of the FCAs performed for this study were for FY 1995- 1996, the results can be generalized to other years with "normal" or above average recycling markets. However, a cost comparison of a recycling program to solid waste collection and disposal is naturally affected by the strength of recycling markets.

3.6 Comparison of Data With Other Research

Although many local governments understand the costs of managing solid waste, there seem to be only a few organized studies that help set solid waste cost benchmarks. Other research in solid waste costs includes the following:

- **The Clean Washington Center** conducted a study of solid waste management costs for four large cities and found that recycling costs were $128/ton while collection and disposal costs together were significantly higher at $166 per ton.

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[11] Additional information is available from DPPEA on factors that help improve the cost effectiveness of recycling and solid waste programs.

[12] Recycling market values are extrapolated from a graph developed by Sound Resource Management, 1996.

- **The National Solid Waste Management Association** surveyed 10 MRFs (material recovery facilities) to find that the average cost of processing recyclables was about $50/ton (before recycling sales) with a range between $28 to $72 per ton.
- **The Solid Waste Association of North America** conducted a detailed study of the budgets of six major cities nationwide. The study highlights the importance of incremental analysis (discussed in Section 2.4) and shows that for most of the participating communities, curbside recycling, yard waste composting, waste-to-energy, and mixed waste cornposting increased the total cost of solid waste management.
- **The North Carolina Institute of Government** (IOG) is presently completing a study of 7 large city solid waste budgets that used a full cost determination format similar to that of the DPPEA study. The IOG undertook the study to help large cities establish benchmarks of solid waste service costs. Analysis of preliminary results of the IOG data reinforce the results of the DPPEA study presented in Figure 9. Specifically, the cities with high recycling rates (greater than 15 percent) operate recycling programs that are less costly per ton than solid waste management. The only program with a low recycling rate (less than 9 percent operates a recycling program that is more costly than solid waste collection and disposal.
- **SERA,** Inc., is conducting a benchmarking study of solid waste costs with data from hundreds of local governments. The size of this study should help further the knowledge of solid waste management costs.
- **The Environmental Protection Agency** is conducting a major life cycle assessment project to help local governments incorporate environmental factors into their solid waste decisions. Solid waste management costs are an integral part of this project, which is slated for completion in 1998.

Conclusions

Although many local governments understand their solid waste management costs, there has been very little research to evaluate solid waste costs across multiple local governments, and the number of studies presently being conducted demonstrates the need for such information. Many of the averages and trends presented in this study should be regarded as a piece of the larger puzzle of solid waste costs. However, three tangible conclusions can be drawn from this study:

- **Full cost analysis provides a foundation for budgetary decisions.**
  This study demonstrates that through a full cost analysis, local governments gain a better understanding of their solid waste management costs. A thorough knowledge of its budget helps a local government make better decisions regarding its solid waste management programs and improve program efficiencies over time.
- **Recycling can cost as little or less than solid waste collection and disposal.**
  It is commonly cited that recycling costs more than disposal. This study demonstrates that such a generalization is a myth. Many local governments can and do operate recycling programs that cost less per ton than solid waste collection and disposal.
- **Local governments that achieve high recycling rates are more likely to operate recycling programs that are less expensive per ton than solid waste collection and disposal.**
  This study shows that there is a strong positive correlation between recycling rates and low recycling costs (compared to solid waste management) for the 15 participating local governments.