SWANA RECYCLING
TECHNICAL ASSISTANCE STUDY

FINAL REPORT

IMPROVING CURBSIDE COLLECTION METHODS AND EDUCATION FOR THE CURBSIDE RECYCLING PROGRAM

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The Borough of Conshohocken Public Works department provides waste and recycling services to its residents. The Borough can make collection and operational changes that will improve the way waste and recyclables are collected in the Borough. As part of this recycling evaluation, Gannett Fleming (GF) has made a number of observations and recommendations for improving the Borough's collection system. Importantly, these changes must be considered carefully and decided upon by Borough Council. Based on evaluating the existing waste and recyclables collection system, some key conclusions are:

- Including Act 101 and non-Act 101 materials, the Borough's recycling rate is 21 percent.
- Twice-per-week waste collection creates a disincentive for recycling because residents are provided convenient and unlimited waste disposal.
- On the second day of twice-per-week waste collection service, approximately 10-15 percent of households do not set out trash and the majority of household waste set-outs on the second day contain only a small amount of waste (e.g. a Weis grocery bag full).
- Twice-per-week waste collection services increase the Borough's collection costs by at least 15 to 30 percent, when compared to once-per-week waste collection service.
- Once-per-week waste collection service can meet residential waste disposal needs.
- Some effective recycling education methods are missing from the program (Section 6.1).
- The Borough lacks an active waste and recycling enforcement program, which is a critical component in achieving high recycling participation rates.
- The Borough's recycling ordinance could be improved and updated (Section 5.0).
- The Borough has a good recycling program and opportunity in place for small businesses.
- If the Borough continues to consider a single-stream recycling program it should review all associated collection system costs carefully. GF did not conduct an economic analysis of a single-stream collection program, but it is clear that current revenues paid to the Borough by BFI Recyclery for dual-stream recyclables are higher than current/projected revenues paid by Blue Mountain to municipalities for single-stream recyclables. However, revenues from sale of recyclables do not fully offset operational costs.

Key recommendations by GF's are:

- Transition from twice-per-week waste collection to once-per-week waste collection to: 1) improve the incentive to recycle; 2) reduce Borough waste and recyclables collection costs by 15-30 percent.
- Improve recycling convenience to the extent feasible by providing all households with curbside recycling containers no less than 22-gallons.
- Implement effective recycling education strategies (see section 6.0 – 6.2) including curbside program feedback, clearly labeled recycling containers, enforcement, refrigerator magnets, annual calendar, and business recycling education.
- Reinforce an enhanced/modified recycling program via changes to the ordinance (see recommended changes in Section 5.0.
- Regularly evaluate recycling markets and review all collection system costs.

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1.0 INTRODUCTION

Through the partnership with the Solid Waste Authority of North America (SWANA), the Pennsylvania State Association of Township Supervisors, and the Pennsylvania Department of Environmental Protection (PADEP), Conshohocken Borough (Borough) was awarded $7,500 in technical assistance to be provided by Gannett Fleming, Inc. (GF).

1.1 Scope of Work

GF worked with the Borough to confirm the following tasks for this recycling technical assistance project.

Task #1 GF will gather and review background information about the existing recycling program in order to identify methods for improving collection performance. This task will include review of the existing recyclables collection methods, contracts, ordinances, and recycling education information and education methods.

Task #2 GF will develop guidance and recommendations related to increasing the recovery of recyclables generated by the Borough. GF will identify any problem areas in the existing recyclables collection system and educational program and suggest changes that could enhance recycling performance, and improve participation and cooperation from residents. GF will provide brief guidance related to improving recycling in the private commercial sector.

Task #3 GF will prepare and provide the Borough with a project report of findings and recommendations. This task includes a review of the report by the Pennsylvania Department of Environmental Protection (PADEP) and response to PADEP comments. Additionally, an electronic file of the final report will be submitted to PADEP and SWANA. Both an electronic and hardcopy version of the report will be provided to the Borough.

2.0 BACKGROUND

Conshohocken Borough is located in southern Montgomery County, Pennsylvania. The Borough has approximately **3,300 residential households**. The Borough provides weekly curbside trash and recycling services to residential establishments. Curbside recyclables are collected commingled with paper collected separately. Residents do not pay a separate fee for recycling. The Borough also collects yard waste, tires and bulky items (e.g. white goods and metal).

Over the past five years the curbside residential recycling program has been relatively stagnant. The Borough wishes to:

- ✓ increase the quantity of materials recycled
- ✓ eliminate recyclables within the trash stream
- ✓ improve methods and timing of community notification and education
- ✓ stream-line the collection process
- ✓ develop methods to capture recyclables from the private commercial sector

3.0 EXISTING WASTE COLLECTION SERVICES

The residential service area of the Borough is primarily urban with dense housing, twin homes and row homes. The Public Works Department provides waste collection services **twice- per-week** to all residential establishments according to the following pick-up schedule:

Mondays.....	East Side (except Spring Mill Avenue and East Elm St.)
Tuesdays.....	Spring Mill Avenue, East Elm St. and West 5th Ave. down
Wednesdays.....	West 6th Avenue up
Thursdays.....	East Side
Fridays.....	West Side

Usually trash is collected on the same day as recyclables. The Borough has observed that approximately 10-15 percent of households do not set out any waste on their second collection day of the week. The majority of households that do set out on the second collection day typically put out only a small amount of trash (e.g. a Weis grocery bag). **It is very important for the Borough to recognize that twice-per-week trash collection creates a disincentive to recycle.** This disincentive results from the residential perception that trash disposal is not only more convenient than recycling, but that trash service is also unlimited.

After waste is picked up from residencies it is hauled to the Montenay Energy resource recovery facility in Plymouth Township, which is located 1/4 mile outside the Borough. The Borough pays a gate fee of **$70 per ton** for every ton of waste delivered. In 2005, the Borough reported approximately **3,700 tons** of municipal waste disposed. This waste total includes waste disposed from approximately 60 small businesses that have collection and disposal contracts with the Borough. These businesses use trash can pickup that is the same as the residential service. Commingled recyclables and office paper are collected by the Borough from these businesses for no additional fee.

3.1 Waste Collection Routes and Service

The Borough is considering changes to the routing and collection schedule at this time to increase collection efficiency and to reduce costs. It is beyond GF's current scope of work to evaluate the Borough's routing, collection schedule, or collection equipment. However, GF recommends the Borough review The Environmental Protection Agency (EPA) document, "Getting More For Less – Improving Collection Efficiency" (1999) that is attached as **Appendix A**. This document provides valuable insights on improving waste collection system efficiency. GF notes that the Borough incurs additional costs by providing twice-per-week waste collection

services as compared to once-per-week trash service. In other collection programs GF has reviewed, twice-per-week waste collection costs 15-30 percent more to provide than one-per-week service. The added cost is actually magnified since the waste recovered on the second day of collection is usually far less than the first day. In other words, the first and second day of collection require similar amounts of staffing, equipment and travel (i.e. cost), but the second day recovers much less total waste. GF has found that twice-per-week trash service is common in eastern portions of PA. Twice-per-week collection programs are often poorly justified with statements like, "that's the way it's always been done." GF experience has found that a more cost-effective waste collection system that satisfies residential disposal needs can be accomplished using once-per-week trash pick up schedule.

3.2 Bulky Item Collection

The Borough has a program called "bulk recycling". Bulk recycling items include metal items such as appliances, lawn mowers, metal fencing, and other large metal items. These items are collected at the curb April through September (3rd wed of month) by the Public Works Department. Bulk recycling items are not collected curbside the rest of the year due to concerns with weather conditions and risks for workers. Year round residents may drop-off bulk recycling items at the Public Works Department yard. There is a $10.00 charge for Freon-containing items.

There Borough also provides separate (non-recycling) collection for couches, chairs, tables and other large non-metal or furniture items. These items are collected and disposed as trash and there is a limit of one item per household on each collection day.

4.0 RECYCLING

As a "mandated" municipality, Conshohocken Borough is required to operate recycling programs in a manner consistent with the requirements of the Municipal Waste Planning, Recycling and Waste Reduction Act of 1988 (Act 101) and PADEP regulations, policies and guidelines. The Borough is required to implement a residential curbside recycling collection program. PADEP generally recognizes three basic systems that municipalities can use to provide mandated curbside collection of recyclables:

- Collection of recyclables by the municipality/municipal workers (current method)
- Collection of recyclables by a private collection company under a contract with the municipality (in some cases more than one company is used)
- Collection of recyclables by any number of private collection companies under private subscription with residents, pursuant to municipal recycling requirements established by the municipality

The Borough Public Works Department provides weekly recyclables collection services to residential establishments using a Labrie split (i.e. dual-stream) collection vehicle staffed with three workers (a driver & 2 pickers). The pick-up schedule is as follows:

Mondays..... East Side
Fridays..... West Side

Residents are required to participate in the municipal curbside recycling program according to Borough Ordinance 7-1990. Borough residents separate the following commingled (mixed) materials for recycling at the curbside:

- Glass Jars and Bottles
- Aluminum and Bimetallic Cans (including empty aerosol and paint cans)
- Plastic Containers marked "1" or "2" on the bottom

The following paper items are kept separate from commingled materials and are placed in a brown paper bag in or near the recycling container:

- Newspapers
- Magazines
- Telephone Books
- Junk Mail
- Envelopes
- Manila Folders
- Other White or Colored Paper
- Light Cardboard (e.g. Cereal Boxes)

Glass, plastics and aluminum and bi-metallic cans are collected commingled in 20 gallon curbside recycling bins. The bins were purchased through the State Cooperative Purchasing Program and paid for by the Borough. Paper is collected mixed and is placed on top of recyclables in paper bags or bundled. Although residents are permitted to recycle all the mixed paper listed above, the Borough indicates that many residents are unsure what types of paper can be recycled. The recyclables that are collected are taken to BFI Recyclery in King of Prussia, which is approximately 6 miles away.

As shown in **Table 1**, the Borough recycled **625 tons** of paper and commingled materials in 2005 from the residential establishments and 60 small businesses that are provided curbside waste and recycling service by the Borough. Counting Act 101 materials and other materials reported, the Borough recovered 961 tons of recyclables in 2005. This diversion is equivalent to a 21 percent recycling rate. The approximate weight breakdown of recyclables and revenue generated for commingled and mixed paper is shown in **Table 1**.

Table 1: Conshohocken Borough Recyclable Recovery and Revenue (2005)

Recycled Material	Tons Recovered (2005)	Revenue Per Ton (Paid by BFI)*	Revenue Generated by Recyclables (2005)
Commingled	270	$6.35	$1,745
Mixed Paper	355	$30	$10,650
Commingled/Mixed Subtotal	**625**	-	**$12,395**
Bulky Items	56	-	-
Tires	.25	-	-
Leaf Waste	280	-	-
Totals	**961**	-	**$12,395**

* Price paid for material delivered to the tipping floor of the BFI Recyclery. Other materials shown are not taken to BFI.

4.1 Current Recycling Education and Enforcement Methods

Effective recycling education has been a challenge for the Borough. The Borough encourages residents to recycle by offering recycling services at no charge to households. Recycling education takes time to coordinate and the current information and methods result in fair to moderate recycling participation. The Borough roughly estimates that 50 to 70 percent of the households participate in the curbside collection program. A portion of households that do participate do not recycle properly.

The Borough is currently working on it's website to improve the waste and recycling information (conshohocken.borough.org). The Borough Public Works Department staff that conduct the collection service have never been involved in a program to provide recycling information and feedback at the curbside to residents via stickers or door hangers. The Borough does not currently have a Codes Enforcement Officer to assist with ensuring the proper recyclables preparation by households.

4.2 Yard Waste Collection

The Borough uses a trash truck to provide weekly curbside yard waste collect services year round to effectively manage yard waste (including grass clippings). Yard waste is collected on Wednesdays. The Borough also collects leaves raked to the curbside in the fall. Based on review of August and September 2006 data, the Borough reported nearly three tons of yard waste collected curbside per week or about **12 tons per month**. The Borough collected approximately **280 tons** of yard waste, including Christmas trees, in 2005 that was diverted to recycling. This accounts for 6 percent of the Borough's total recyclable material diverted from landfill disposal. The Borough Reports that some residents are confused by the trash truck that is collecting yard waste. These residents are concerned that the material is not being recycled. Because of the housing unit types and density in the Borough, backyard composting is not the preferred option for managing yard waste. Improper backyard composting can produce odors and also draw in rodents and other vectors.

The Borough Public Works Department collects Christmas trees seasonally.

4.2.1 Compost Facility

After mixed yard waste is collected in the Borough it is delivered to the Upper Merion Township compost facility. Deliveries to the facility take approximately 40 minutes round trip. Mixed yard waste from the Borough is accepted for a nominal tip fee. Each load of yard waste is weighed on a scale at the compost facility. Leaves that are collected curbside by the Borough are taken to a small, low-tech leaf compost site located at the 300 Block of West 7th avenue. Leaves are placed in windrows and turned every three months using a loader. Residents can pick up composted leaf waste by appointment.

4.3 Commercial Recycling

The Borough provides curbside recycling service for commingled materials and office paper to approximately 60 small businesses that are under contract with the Borough for curbside waste

collection services. Recycling is offered in the same way it is offered to residential services and businesses do not pay a fee for recycling service. Businesses that are not under a collection contract with the Borough privately subscribe with one of several local private haulers for waste collection, and in some cases these businesses may have service for segregated recyclables collection. It is unknown how many commercial establishments actively recycle in the Borough.

Act 101 requires commercial, institutional and municipal establishments located in Pennsylvania's mandated municipalities to recycle the following materials (as a minimum):

- High-grade office paper
- Corrugated paper
- Aluminum
- Leaf waste

A local ordinance can require businesses to recycle more materials than are required by Act 101.

GF's experience with municipal recycling programs throughout PA reveals that many businesses do not have recycling programs that fully comply with Act 101. In many Act 101 mandated communities businesses do not recycle some or any of the materials designated by Act 101 to be recycled by commercial, municipal and institutional establishments. Non-compliance by businesses is attributed to:

- Lack of understanding by the business of the recycle requirements
- Confusion on how to recycle properly, efficiently and cost effectively
- Unwillingness to change existing disposal habits (other priorities)
- Lack of enforcement and/or penalties or recycling incentives
- A financial disincentive if segregating recyclables for separate collection costs the company more than disposing the material as waste

In Act 101 mandated communities like the Borough, establishments are responsible for arranging for collection and recycling of designated Act 101 materials, unless another arrangements or an agreement fulfills the Act 101 requirements. However, the Borough can assist businesses to improve recycling through effective education.

Act 101 requires the Borough to submit annual recycling reports to Montgomery County for PADEP record. Some Pennsylvania Counties require haulers to provide a quarterly recycling report. Via ordinance, the Borough should require commercial, institutional and municipal entities to provide written documentation to the municipality as to the type and weight of materials recycled annually.

4.4 Recycling Markets

When implementing a curbside program, it is important to identify and use favorable local recyclables outlets and to be aware of recycling market trends. Favorable recycling markets are those that offer the greatest return (or overall economic feasibility) when considering all relevant collection/operational costs and any revenues that may be generated through sale of materials. In

many cases, recyclables revenues are higher when the collector can segregate recyclables before delivery to market. As an example, the Borough currently separates fiber from commingled materials and receives **$30 per ton for fiber and $6.35 for commingled materials** that are delivered to the BFI Recyclery in King of Prussia, which is 6 miles from the Borough or 10 – 20 minutes away. The Borough uses a split collection vehicle to collect commingled materials and fiber at the curbside at the same time.

Blue Mountain Recycling is located off the Schuylkill Expressway and is approximately 20-40 minutes away depending on traffic. Blue Mountain accepts dual stream (i.e. fiber is separate from commingled materials) and single-stream recyclables. Based on conversations with this recycling facility in November 2006, the price paid to municipalities per ton for single-stream recyclables is currently **$4.00 per ton**. The single stream price paid for recyclables over the last 2 years has had an average range of $2.00 - $8.00 per ton. The price paid to municipalities is based on the average commodity revenue that is paid to Blue Mountain for recyclables.

It was not in the scope of this study for GF to complete a detailed operational or market analysis. However, GF encourages the Borough to closely review recyclables markets and operational costs as part of a transition to an enhanced recycling and waste management program. As part of this analysis the Borough should consider:

- Current operational costs
- Current market revenues
- Collection system and equipment changes for recyclables under the current dual-stream collection format
- Comparing current dual-stream operational costs with operational costs and market revenues from single-stream and other local markets. Equipment use will be a key to this analysis (e.g. single-stream recyclables may be collected using waste packers)
- Distance and time (i.e. cost) to deliver recyclables to markets because these factors will degrade the value of the material in terms of economic feasibility

If the Borough completes the economic analysis and finds single-stream to be a viable option, it may be able to transition to a single-stream program in a manner that allows the flexibility to revert back to dual stream collection. The Borough could continue the curbside practice of separating commingled materials and fiber at the curbside, but consolidate the materials together in one vehicle (e.g. waste packer) for transport to Blue Mountain. In this trial phase, the Borough could inform residents that the Borough is trying a new recycling market, but indicate residents do not have to change their curbside preparation of materials. Through the trial period (say at least one year), if the collection system is economically feasible and the market relationship works, the Borough could then transition residents to a new curbside collection method that would include combining commingled materials and fiber into a single curbside recycling container (likely new and a larger capacity than the current curbside bin).

5.0 REVIEW OF BOROUGH ORDINANCE

As part of this Study, GF conducted a preliminary review of the existing Borough recycling Ordinance 7-1990 (Part 2) to identify inconsistencies with Act 101 and to identify other areas where improvements may be needed.

5.1 Ordinance Review Comments

GF's Ordinance review comments include:

- In recent years PADEP has stepped up its efforts of encouraging, assisting, and requiring mandated municipalities to implement collection programs and ordinances that comply with Act 101 requirements for curbside "leaf waste" collection. Based on review of Ordinance 7-1990, the Ordinance language (not the actual leaf waste collection program) does not appear consistent with PADEP policies and guidelines for leaf waste collection. The inconsistencies are as follows:

  - The Ordinance does not accurately define leaf waste as it is defined by Act 101. The Ordinance currently defines leaf waste as "leaves and foliage of trees and shrubs, and foliar garden residues, but not including grass clippings or tree or shrubbery branches". This definition is different than the Act 101 definition. Act 101 and the PADEP Municipal Waste Regulations define "leaf waste" as **leaves, garden residue, <u>shrubbery and tree trimmings</u>**, and similar material, but not including grass clippings. It is suggested the ordinance be revised to define leaf waste as it is defined by act 101. If the leaf waste definition is corrected it will encompass tree limbs. The Borough could possibly eliminate the duplicative use of "tree limbs", which is used as a separate definition in several sections of the Ordinance.

    It is noted that brush and tree limbs, which fall under the leaf waste definition, are commonly limited to 6" diameter in mandated municipalities. The minimum and maximum dimensions of tree limbs, branches, etc. should be stated under the leaf waste definition and other relevant sections of the revised Ordinance.

- In accordance with PADEP policies and guidelines it is recommended the Ordinance state the leaf waste will be collected at the curbside at minimum of twice per year in accordance with Act 101. Act 101 and PADEP policies and guidelines, collection of leaf waste including brush must be conducted as follows:

  - A minimum of two curbside collections should be conducted annually for leaves, garden residue, shrubbery, tree trimmings, and similar material (i.e. brush). To meet this requirement:

    - At least one fall collection is recommended by PADEP for leaves.
    - At least one spring collection is recommended by PADEP for leaf waste including garden residue, shrubbery, tree trimmings (or "brush"), and similar material.

The changes suggested for the Ordinance are technical in nature. The Borough's actual leaf waste collection program exceeds the Act 101 collection requirements. Not only does the Borough leaf waste program provide comprehensive collection services to Borough residents, this program reduces Borough disposal cost through reduced tip fees and provides valuable material for composting at the Upper Merion compost facility. It is not recommended the Borough reduce the level of service currently provided for residential leaf waste collection to the minimums set forth by Act 101. As the Borough has experienced, the residential disposal needs for this material is greater than two collections per year.

PADEP policies and guidelines require municipalities to inform residents of a location for yard waste drop-off. The drop-off facility does not have to be in the Borough and could be a county facility, located in a neighboring municipality, or a private facility.

6.0 INCREASING RECYCLING PARTICIPATION IN CONSHOCKEN BOROUGH

The following sections outline a number of methods that the Borough may implement to increase recycling participation and the Borough's recycling rate. Currently, the Borough's recycling rate is 21 percent, including Act 101 and non-Act 101 materials reported by the Borough. This rate is based on recycling 961 tons material from 4,661 gross tons of municipal waste in 2005. The Borough's goal is to increase the recycling rate by at least five percent by implementing feasible improvements to the recycling program.

6.1 Increasing Curbside Residential Participation

The Borough can make a number of changes to the curbside residential waste collection system that can result in increased waste diversion. Realistically, the Borough could increase municipal waste diversion by **five to ten percent** by implementing a more aggressive residential curbside recycling program.

It is GF's observation that recycling education is very important at getting residents to "buy-in' to recycling. However, the implementation of an effective waste and recycling enforcement program is also recommended to achieve high participation rates. GF encourages the Borough to improve recycling participation from the **residential sector** as follows:

- **Convenience**: Make changes to the recyclables collection program that ensure participating in the recycling program is convenient for residents/households. Some of the key components of a convenient curbside residential recycling program include:

  - Consistent curbside collection schedule for all households in the municipality
  - Curbside recyclables collection frequency is not less than bi-weekly
  - Collection of a comprehensive list of recyclables is offered to all households by the municipality and/or other collectors active in the municipality
  - Adequate recycling containers (see next two bullets)

- **Curbside recycling containers should be properly sized** to ensure that residents have adequate recyclables collection capacity between scheduled collection days. 22 gallon containers should be the minimum size for weekly collection and larger containers (e.g.

32 gallon) may be feasible for bi-weekly programs that collect a comprehensive list of commingled materials.

- Provide/enforce that a **sufficient number of curbside recycling containers are being used by all households**. Do not assume residents will take the initiative to request a curbside recycling container for their household if an additional container or a replacement container is needed. The Borough will need to take an active role in determining what households need one or more recycling containers. The Borough should identify households that do not set out containers and follow up with them. The Borough staff, collection crews, or enforcement officer can conduct windshield surveys on recyclables set out days to identify non-participating residencies.

- **Effective Recycling Educational Methods**: Recycling information should be distributed to households at least twice per year in accordance with Act 101 to all residential establishments. Although websites can contain useful recycling information, many residents do not rely on municipal websites for guidance on trash disposal or recycling. Borough newsletters and flyers can also contain helpful recycling information. However, newsletters only result in improved recycling performance when they are read and the instructions are followed. Many residents will quickly discard newsletters and flyers along with other "junk mail". Based on experience and success stories from a number of municipal recycling programs throughout Pennsylvania, some of the most effective residential recycling education methods include:

  - **Curbside Program Feedback –** The Borough Public Works Staff that provide curbside waste and recyclables collection service should participate in a waste and recycling curbside program feedback program. Public Works Staff can place stickers or notices on trash cans, on recycling containers or directly on recyclable items to provide immediate feedback at the curbside to residents. These notices can be used to inform and educate residents who are not following Borough and Act 101 procedures for trash and recyclables preparation. Because residents are relayed information that relates directly to their actions/handling procedures, these programs are effective in changing behavior and improving disposal/recycling practices.

    Notices can be left on curbside containers to let the household know they are doing a good job at recycling properly. Some municipalities leave unacceptable recyclable items (e.g. glass mirrors, plastic bags, etc.) or the entire recyclables container behind with a sticker or notice indicating why the container was not emptied or why certain non-recyclables were left behind. The back of the sticker or notice can state the Borough's recycling requirements and penalties for non-compliance. An example of a Recycling Problem Notice is provided in **Appendix B**. A similar notice could be used commercial entities that are under contract with the Borough and/or the remainder not collected by the Borough. The notice has been customized by GF for the Borough residential program. It is not final, and should be revised by the Borough prior to use. The actual notice card can be printed on 8" x 5.5" heavy stock paper. This example notice has a perforated tear off section at the bottom so the address and date of the notice can be removed and tracked. The Borough could issue a final version of this notice or a notice with a similar format to Borough households as part of an improved enforcement program. For curbside program feedback to be most

effective, this program should be implemented with the assistance of the Codes Enforcement Department and a corresponding waste and recycling enforcement program.

- **Annual distribution of community event calendars** that include the waste and recycling collection schedule and list of accepted recyclable materials. The Borough should continue to issue the annual calendar containing waste and recycling information and collection schedules as long as it is economically feasible.

- **Recycling containers should be labeled** with recycling instructions (e.g. list of accepted materials) either printed directly on the container or printed on a label that adheres to the container. Pictures can be used to clarify the recycling message.

- **Distribution of refrigerator recycling magnets** to households that lists the acceptable and unacceptable recyclables and includes the recycling schedule (if the schedule will fit on the magnet). Refrigerator magnets are effective because they can be placed in the house in a visible location and referenced by household members throughout the year. Magnets are not usually discarded as quickly as newsletters or flyers.

- **Website:** Although the Borough's website may not be the first place for residents to look for waste and recycling information, the website should still be kept up-to-date. The website should clearly explain the waste and recycling program and procedures. Additionally, the website should provide information on the importance of recycling as it relates to the community, lowering disposal costs, saving energy, and preserving resources and the environment.

- **Enforcement: M**unicipalities that achieve the highest residential recycling rates have an effective waste and recycling enforcement program. The Borough has established waste and recycling goals to:

  - ✓ increase the quantity of materials recycled
  - ✓ eliminate recyclables within the trash stream
  - ✓ improve methods and timing of community notification and education

  For the Borough to achieve these goals and high participation rates, it is highly recommend that the Borough implement an active waste and recycling enforcement program. Some components of this program could include:

  - Code Enforcement Officer that performs waste and recycling enforcement as part of his/her regular work tasks.

  - The ordinance should be updated to reflect an improved enforcement program. The ordinance(s) should enable an enforceable process by which the Code Enforcement Officer(s) or other designees have the ability to issue warnings and citations or penalties/fines.

  - Periodic inspections should be conducted of waste and recyclables set-outs and feedback, warnings, and citations (for frequent offenders) should be issued to households.

- The Borough should solicit support from the local police and the local district justice to take waste and recycling violations seriously. Implementation of a quick penalty process for violators should be promoted.

6.1.1 Pay-As-You-Throw Waste Collection System Alternative

GF has recently completed recycling studies that evaluated the feasibility of implementing a Pay-As-You-Throw (PAYT) waste collection program. In PAYT programs, residents pay a fee based on the number or capacity of trash bags/containers that are used for curbside set-out of waste. Because residents are charged based on the quantity of waste disposed, PAYT creates a financial incentive for residents to divert materials to recycling. In other words, more recycling means less paid by the household for trash disposal. Based on GF's research and conclusions, PAYT waste collection systems are favorable in terms of increasing residential recycling participation, which in turn maximizes the quantity of waste that is diverted from the landfill to recycling. Since the Borough pays $70 per ton for the waste tip fee, the Borough can benefit from a similar financial incentive in the avoided disposal costs. PAYT program implementation in the Borough was not evaluated in detail as part of this study, but properly implemented PAYT programs are proven to increase recycling participation in Pennsylvania municipalities and in other states.

6.2 Increasing Commercial, Institutional and Municipal Recycling

Commercial sector establishments (i.e. commercial businesses, industries, institutions, and municipal establishments) located in the Borough are mandated to recycle by Act 101 (refer to Section 4.1). Borough businesses generate recyclable materials. Large offices typically generate recoverable quantities of paper and cardboard. Depending on the size of the company and quantity of recyclable material generated, business may lower their waste disposal costs by separating recyclables from the waste stream and then reducing the level of service that is required for waste disposal. There are several common barriers or reasons why businesses in the Borough may not implement comprehensive recycling programs:

- The commercial establishment is unaware of its recycling requirements established by Act 101 and the Borough ordinance.
- Management has not established recycling as a priority.
- Management and staff are unaware of how to implement a recycling program.
- Supplemental programs, such as local drop-off sites, have not been made available.
- Management perceives recycling as a hassle and feel it may result in extra cost to the company.
- There is little or no enforcement program or consequences for commercial establishments that do not comply with Act 101.
- Many municipalities do not wish to interfere with the activities of private businesses.

The following methods are recommended to the Borough to increase commercial sector (commercial, institutional, and municipal) recycling participation:

- Provide commercial sector recycling education/information at least once every six months (as required by Act 101). It is recommended commercial recycling information includes the following:

- **The recycling requirements** of businesses located within the Borough as specified by Act 101 and the Borough's ordinance(s).

- **A Commercial Sector Recycling Report Form**. A commercial reporting form that has been developed by PADEP is presented in **Appendix C**). This form can be used for both documenting commercial recycling efforts for reporting to Counties for the Annual Recycling Report or for collecting data for Act 101, Section 904 Recycling Performance Grants. The Borough is required to report municipal recycling data to the County for the prior calendar year, including information from commercial sector establishments, by February 15th of each year. Recycling data for Act 101, Section 904 Performance Grants is due to PADEP at the end of September. Annual report data can include recycling estimates, but data for Act 101, Section 904 Performance Grants must include weight receipts and/or signatures from the collector or processor verifying the recycling amounts.

- Effective guidance on securing collection services for segregated recyclable materials. At a minimum, larger offices should contract for segregated collection of office paper and cardboard. Dumpsters are usually provided for segregated collection of cardboard and can create an avoided cost of disposal for high paper-generating businesses. For example, waste disposal may cost $120 - $160 for each dumpster pull for an 8 cubic yard dumpster. However, cardboard that is segregated into cardboard dumpsters for recycling may cost $45 - $65 for each service or pull. For some businesses cardboard can make up more than 20 percent of the waste generated and thus results in some savings or avoid cost if the level of trash service is reduced. In some cases the collector will permit office paper to be placed in the dumpster along with cardboard provided the office paper is placed in clear bags.

- **A list of local private haulers** that offer segregated recyclables collection services, including contact information.

- **Business verification of a recyclables collector**: Establish a program that requires new and existing businesses to provide written documentation that identifies they have secured recyclable collection services through the Borough or another hauler. In some municipalities, businesses are issued a business permit before they are allowed to conduct business in the municipality. The City of Allentown has implemented a program that requires businesses to provide the City with documentation that they have secured a provider for recycling service. If the business does not identify their recyclables collector, the business permit can be withheld.

- **Commercial sector recyclables reporting requirement**: Update the Borough's recycling ordinance to require commercial establishments to report recycling totals to the Borough. Act 101 requires the Borough, as an Act 101 mandated municipality, to report residential, commercial, institutional and municipal recycling totals (from the prior year) to their host County by February 15th. Consequently, the Borough may wish to require commercial establishments to report to the Borough by January 15th or no later than January 31st.

- **Enforcement**: Implement an enforcement program that enables the Borough and Codes Enforcement Department to enforce recycling activities of Borough businesses. For

example, the Codes Enforcement Depart could issue citations to businesses that fail to comply with Act 101 and Borough ordinance recycling requirements. It is not suggested that the enforcement program be designed with the intent to issue numerous citations to local businesses. Rather, the program should be designed to cite businesses who fail to comply with recycling on an ongoing basis and after they have been fairly warned and given sufficient opportunity to implement a compliant recycling program (i.e. specified time frame).

- **Small business "Opt-in"**: The Borough should continue to offer the "Opt-in" program for small businesses to receive trash and recycling services provided by the Public Works Department. Small businesses should be added to this program as feasible. The collection services and rates provided by the Public Works Department to these businesses is the same as those provided to residential establishments. Businesses benefit from this service because it is typically less expensive than dumpster services that may be provided by another private hauling company. The Public Works Department does not charge businesses an additional fee for recycling service.

7.0 RECYCLABLES DIVERSION, REVENUES AND "AVOIDED COSTS"

It is estimated that the Borough of Conshohocken can increase the waste diversion through enhanced curbside recovery of recycles by **five to ten percent** by making modifications to its waste and recyclables collection program. GF's review of curbside recycling programs across Pennsylvania show that a 35 percent diversion rate for curbside programs is achievable in municipalities that implement aggressive and comprehensive curbside recycling programs.

Table 2 presents the potential revenues and avoided costs for five percent and 10 percent increases in waste diversion for commingled materials and mixed paper only. These materials were targeted for analysis because they represent a majority of the recyclables that will be collected curbside and impacted from the strategies recommended in this study. It is noted, however, that other recyclable materials such as yard waste comprise a significant portion of the waste stream and can contribute to waste diversion. As the Borough implements an improved recycling program, the diversion of other recyclables, in addition to commingled materials and mixed paper, may increase as a result of these overall improvements.

Assuming the Borough achieves a 10 percent increase in diversion, **Table 2** shows that the Borough could recover **1,072 tons of commingled materials and mixed paper per year**. Based on 2005 data, curbside recycling is split as follows: 43 percent commingled and 57 percent mixed paper. Using this breakdown by material, 1072 tons may produce 461 tons of commingled materials and 611 tons of mixed paper. Applying (as an assumption) the 2005 price per ton for these materials, the Borough would be paid the following amounts for recyclables given an additional 10 percent diversion for curbside recyclables:

- **$ 18,830** for mixed paper (611 tons x's $30 per ton)
- **$ 2,927** for comminged (461 x's $6.35 per ton)

  $ 21,757

The same analysis and assumptions were applied to the five percent additional diversion and revenues shown as values in **Table 2** Revenues recovered by the Borough through sale of recyclable materials will vary by market conditions. Value of recyclables can be degraded by collection and transportation costs.

Table 2: Conshohocken Borough:Avoided Costs and Potential Recyclables Revenue

	Total Municipal Waste & Recycling (Gross tons)	Commingle & Mixed Paper Recycling (tons)	Commingle & Mixed Paper Only Recyclables Diversion Rate	Estimated Avoided Disposal Cost ($70 per ton)	Estimated Recyclables Revenues ($30/ton mixed paper) ($6.35/ton commingled)
Status Quo/current recycling (2005)	4,661	625	13%	**$43,750**	**$12,395**
5 Percent Additional Diversion	4,661	839	18%	**$58,730**	**$16,632**
10 Percent Additional Diversion	4,661	1,072	23%	**$75,040**	**$21,757**

Note: The municipal waste generation (4,661 gross tons) includes waste, tires, bulky items, leaf waste, commingled, and mixed paper.

8.0 CONCLUSIONS AND RECOMMENDATIONS

By conducting this Recycling Technical Assistance Study to evaluate recycling, Conshohocken Borough has taken an important initial step toward improving the Borough's existing waste and recycling system. Because the Borough's Public Works department provides waste and recycling services to its residents, the Borough can make collection and operational changes that will improve the way waste and recyclables are collected in the Borough. Importantly, these changes must be considered carefully by Borough Council. Ultimately, it will be Council support and decisions that will determine how and if the recommended changes are implemented. Gannett Fleming encourages the Borough to view waste and recycling as integrated services that are managed as a complete system. In this report, and in the following section, GF recommends a number of changes to improve the current waste collection system and recycling program. Based on evaluating the existing waste and recyclables collection system, some key conclusions are:

- Including Act 101 and non-Act 101 materials that have been diverted from the waste stream, the Borough's recycling rate is 21 percent. Pennsylvania has established a 35 percent recycling goal.
- Twice-per-week waste collection creates a disincentive for recycling because residents are provided convenient and unlimited waste disposal.
- On the second day of twice-per-week waste collection service, approximately 10-15 percent of households do not set out trash. The majority of residents that do put trash at

the curb on the second day, only place only a small amount of waste for pick-up (e.g. a Weis grocery bag full).

- Twice-per-week waste collection services increase the Borough's collection costs by at least 15 to 30 percent, when compared to once-per-week waste collection service.
- Once-per-week waste collection service can meet residential waste disposal needs provided a convenient recycling program is also provided.
- Good recycling information is distributed (e.g. calendar), however, other effective recycling education methods are missing from the Borough's program (Section 6.1).
- The Borough lacks an active waste and recycling enforcement program, which is a critical component in achieving high recycling participation rates.
- The Borough's recycling ordinance could be improved.
- The Borough has a good recycling program for small businesses. Over 60 small businesses receive waste and recycling services by the Borough Public Works Department.
- If the Borough continues to consider a single-stream recycling program it should review all associated collection system costs carefully. GF did not conduct a detailed economic analysis to compare Borough implementation of a single-stream collection program, but it is clear that current revenues paid to the Borough by BFI Recyclery for dual-stream recyclables are higher than current and projected revenues from Blue Mountain Recycling for materials collected and delivered single-stream. However, revenues from sale of recyclables do not fully offset operational costs.

8.1 Recommendations

The recommendations included in this section are based on the following objective or goals established by Conshohocken at the outset of this Recycling Technical Assistance Project:

- ✓ **increase the quantity of materials recycled**
- ✓ **eliminate recyclables within the trash stream**
- ✓ **improve methods and timing of community notification**
- ✓ **stream-line the collection process**
- ✓ **develop methods to capture recyclables from the private commercial sector**

If implemented properly, the recommended changes can result in increased diversion of recyclables from the waste stream. Implementing these changes will require that the Public Works Department makes adjustments in the methods and schedules for residential waste and recyclables collection. Changing the collection system will also require that residents (and businesses to a lesser extent) change their behavior as it relates to overall waste management – modifying behavior is an essential part of increasing recycling participation.

Recommendations and guidance have been provided throughout the body of this report. Some of the key recommendations by GF's are:

WASTE COLLECTION AND RECYCLING SYSTEM

- Transition from twice-per-week waste collection to once-per-week waste collection to: 1) improve the incentive to recycle; 2) reduce Borough waste and recyclables collection costs by at least 15-30 percent.

- Improve recycling convenience to the extent feasible by:

  - Providing all households with curbside recycling containers no less than 22-gallons. Identify households requiring more than one recycling containers and provide these containers.

- Implement effective recycling education strategies including:

  - Curbside program feedback using stickers or notices to identify improper preparation and handling of waste and recyclables placed at the curb. Enforce this program and issue warnings followed by citations/fines as needed.
  - Label curbside recycling containers with the list of acceptable and non-acceptable recyclables.
  - Distribute refrigerator magnets to households containing recycling information.
  - Continue to distribute the Borough's annual calendar with waste and recycling information.
  - Educate businesses on their recycling requirements. Recommended methods are described in Section 6.2.
  - Educational efforts/cost should be added as a line item in the Borough's budget to ensure that education is ongoing and effective. Actual costs for education should be documented and these costs should be offset by collection service fees.

- Reinforce an enhanced/modified recycling program via changes to the ordinance. Recommended changes, as verified by the Borough Solicitor, could include:

  - Revising the "leaf waste" definition to be consistent with Act 101's definition for leaf waste.
  - Adding provisions that require commercial, institutional and municipal establishments to report annual recycling data to the Borough.
  - Adding provisions that establish a clear waste and recycling enforcement mechanism that permits a Code Enforcement Officer or other designee the ability to issue citations, fines, or penalties for specified waste and recycling violations.

- Evaluate recycling markets and review all collection system costs regularly in order to maximize program efficiency and sustainability.

FUNDING

Recycling grant funding is not a guaranteed source of funding. The Borough should not rely on grant funding as the support mechanism for its public recycling programs. To reduce the need for supplemental funding, the Borough should continual evaluate its waste collection system operations and recycling programs. The Borough can increase the sustainability of its waste and recycling program by analyzing costs and making necessary changes to collection schedules, staff utilization (labor), and equipment utilization. Some revenues from sale of recyclables can be generated, but these revenues will only partially offset collection costs. Improving the safety of Public Works Department staff that conduct day-to-day waste collection can pay big dividends through reduction in workers compensation claims.

ACT 101 SECTION 902 RECYCLING PROGRAM GRANT

- The Borough should continue to apply for Section 902 grant funding for up to 90 percent reimbursement for costs associated with purchasing recycling equipment and recycling containers, and for educational outreach. It is recommended the Borough submit a grant application for new curbside recycling containers that are at least 22-gallon capacity and are clearly labeled with acceptable and unacceptable recyclable materials.

ACT 101 SECTION 904 PERFORMANCE GRANT

- It is recommended the Borough apply annually for the Act 101, Section 904 Performance Grant award. The Section 904 grant program provides funding based on the amount of eligible Act 101 recyclable materials that are collected and documented (documentation must meet PADEP requirements) for a given year. Information on recycling Performance Grants is available on the PADEP website (www.dep.state.pa.us). Providing accurate documentation of recycling efforts by commercial establishments can increase the Borough's total Act 101, Section 904 Performance Grant Award.

APPENDIX A

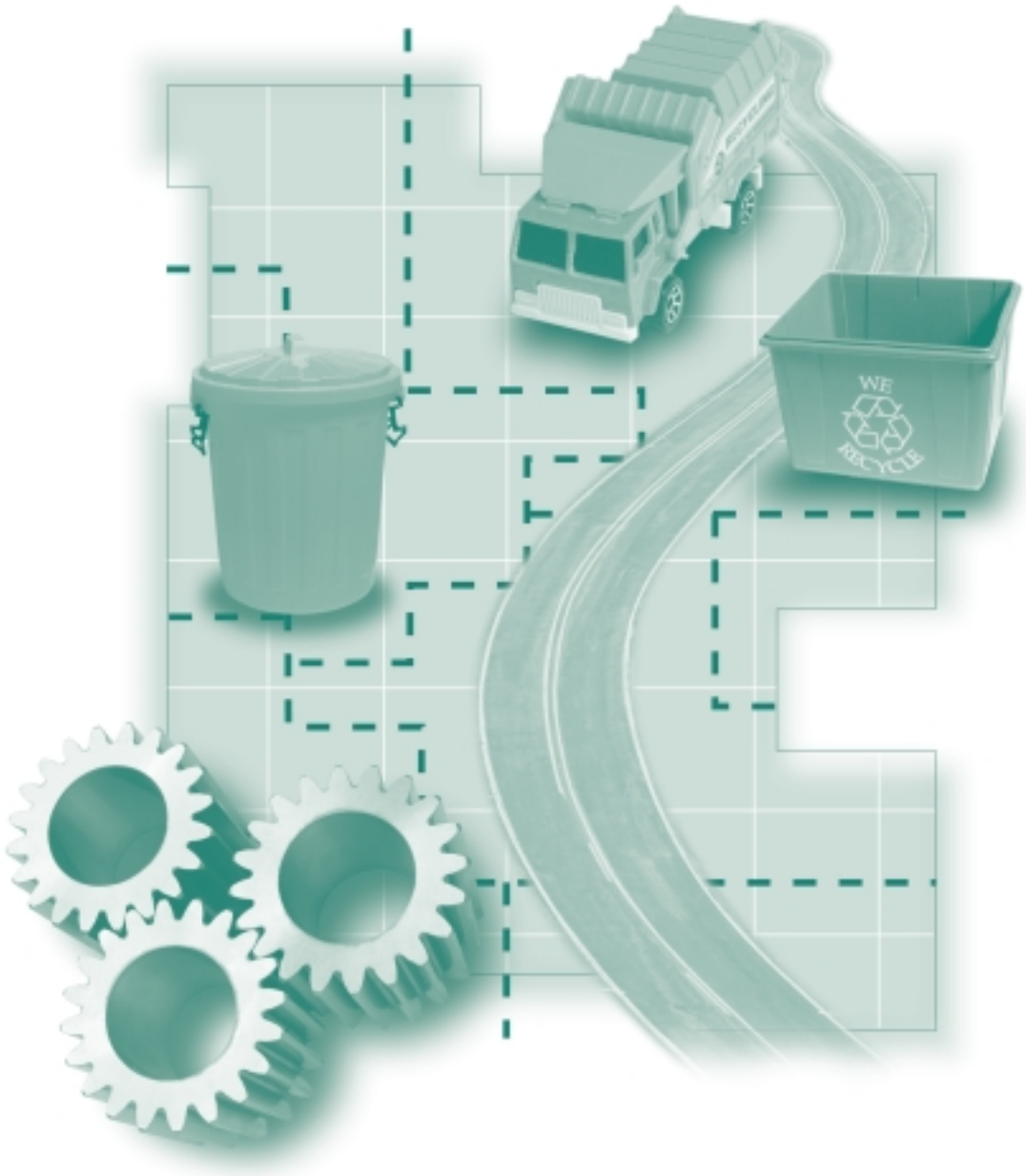
EPA: “Getting More for Less – Improving Collection Efficiency” (1999)

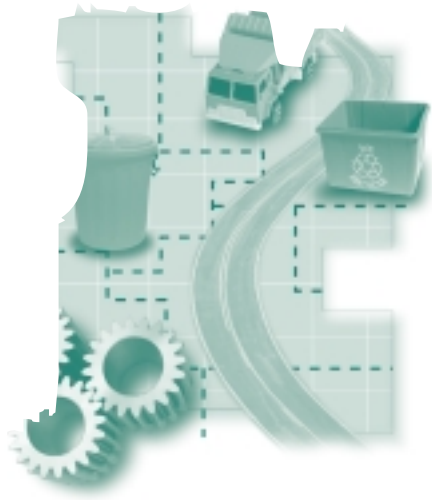
United States
Environmental Protection
Agency

Solid Waste
and Emergency Response
(5306W)

EPA530-R-99-038
November 1999
www.epa.gov

Getting More for Less
Improving Collection Efficiency





Contents

Acknowledgements

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Wayman Pearson, City of Charlotte, NC
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Foreword

The Collection Efficiency Study was undertaken to provide a more detailed understanding of cost-saving methods for collecting residential solid waste (RSW) and recyclables. The study included the following major tasks:

- Conducting meetings and discussions with project sponsors, funding sources, and Peer Advisory Committee members (i.e., representatives from local governments who provide RSW or recyclables collection services) to determine those approaches to improved collection efficiency that would have the most potential interest and utility to solid waste managers and elected officials.
- Selecting case study sites to illustrate each targeted collection efficiency strategy.
- Researching collection system improvements in the case study locations and producing four case study reports.
- Performing telephone surveys of other local governments and service providers who implemented the targeted strategies for improving RSW or recyclables collection efficiencies.
- Producing a workbook for solid waste managers and elected officials that synthesizes key lessons learned from the case study research and the telephone surveys.
- Conducting a series of workshops.

Getting More for Less: Improving Collection Efficiency reproduces information presented to participants at a series of national workshops on collection efficiency. The workshops were conducted by the Solid Waste Association of North America (SWANA) as part of the collection efficiency study. This workbook summarizes and synthesizes the results of the study. This report is not intended to be a comprehensive review of all options for increasing collection efficiency, nor does it discuss other programs or mechanisms that could improve the efficiency of the entire solid waste management system. Tools such as full cost accounting; pay-as-you-throw fee structures (through which generators are charged based on the amount of waste they produce); and comprehensive evaluations of alternatives for a fully integrated waste management system are beyond the scope of this report.

The U.S. Environmental Protection Agency (EPA) is making this document available in order to increase the dissemination of these data within the solid waste management community and to elected officials. This wider distribution will help promote a better understanding of cost-savings methods for collecting RSW and recyclables.

The information in this document has not been verified, and no guarantee, expressed or implied, is made as to the accuracy or completeness of the information. Inclusion in this document does not express or imply endorsement by EPA.

Why Collection Efficiency?

Simply put, collection efficiency means getting more for less—picking up more solid waste or recyclables using fewer trucks or fewer people or less time.

Sound impossible?

Dozens of local governments and haulers across the continent have demonstrated that residential solid waste (RSW) collection cost-cutting strategies work. Some of these strategies require a major shift in paradigm—new equipment, new approaches to staffing, new set-out behaviors from residents. Other strategies are based on using existing resources more imaginatively. All of the collection efficiency strategies described in this workbook can have dramatic impacts on the cost-effectiveness and quality of service delivery.

Why Improve Collection System Cost-Effectiveness?

Industry wisdom has presumed that collection is the most expensive part of a solid waste management system.

A recent study undertaken by the Solid Waste Association of North America (SWANA) substantiates this belief. A close look at municipal solid waste (MSW) management system costs for six local governmental units (LGUs) revealed remarkable consistency in at least one area. Collection of solid waste and recyclables typically represented the single largest percentage of MSW management budgets—from 39 percent to 62 percent of total system costs.

As shown in Figure 1, on average, the study found that collection represented

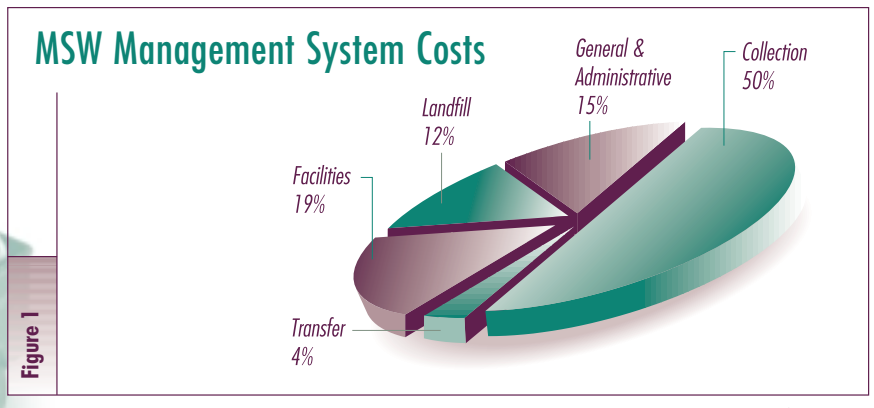


Figure 1

Source: Integrated Municipal Solid Waste Management: Six Case Studies of System, Cost and Energy Use: Summary Report, SWANA, 1995, 50 pp, GR-G 2700.

50 percent of MSW management system costs. Clearly, improvements in collection efficiency can have a big impact on total costs.

Want more detail? Figure 2 (included at the end of this chapter) shows a summary of functional costs for the MSW management systems studied, including a summary of the key characteristics of each system.

If You Are Trying To Cut Costs

If you need to reduce costs, it makes sense to:

- Target a larger component of your budget—"get more bang for your buck."
- Target the element of the system over which you have the most control.
- Look at labor-drains. Labor is typically the largest component of RSW and recyclables collection budgets.

Which Cost-Cutting Strategy Will Work For You?

The list of strategies to potentially help control or cut solid waste or recyclables collection costs is limited only by the imagination of solid waste managers, equipment and vehicle manufacturers, and technology vendors and the desires/needs of their customers.

This workbook focuses on four specific cost-cutting strategies:

- Changing collection frequency.
- Improving routing.
- Using automated collection equipment.
- Implementing a dual collection system (i.e., collecting RSW and recyclables in separate compartments on one vehicle).

Case Study

The Bottom Line
Savings Across The Country

Rochester, New York, replaced its manual RSW collection system with semi-automated collection.

- Reduced crew size per vehicle.
- Increased average crew productivity by 14 percent.
- Saved $900,000 in the first year.
- Expects to save almost $9 million over a 10-year period.

Mesa, Arizona, reduced RSW collection frequency and replaced the traditional second day of RSW collection with a curbside pickup of recyclables.

- Added a separate collection for recyclables with no additional vehicles and only three new crew positions.
- Reduced overtime demands.
- Expects to save nearly $700,000 per year in direct costs (a savings of approximately $1.50 per household served per year).

Charlotte, North Carolina, improved routing systems, changed collection frequency, eliminated backyard collection, and switched to fully automated RSW collection.

- Eliminated 43 routes.
- Reduced staffing levels by more than 30 percent.
- Expects to save $40 million over a 10-year period.

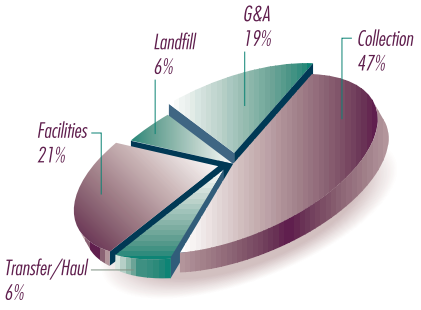
Cost-Cutting Strategy	You Might Benefit If...
Changing Collection Frequency	• You are collecting RSW twice per week now. • You need or want to add a new collection service (and could replace an RSW collection with a new service). • You want to implement a pay-as-you-throw (PAYT) fee structure. • You have low set-out rates or weights. • Your vehicle payload is not being maximized. • You operate with crews of two or more people.
Improving Routing	• You have not examined route design or balance recently. • Crews are working uneven workdays. • You are changing service levels, vehicle type, crew size, or frequency of collection. • Your service area is growing (e.g., new development or annexation). • Your service population is shrinking (e.g., competition or egress). • You have Graphical Information System or mapping software.
Increasing Degree of Automated Collection	• You are using manual or semi-automated collection vehicles now. • You want to implement a PAYT fee structure. • Lifting-related injuries have plagued your system. • You operate with crews of two or more people. • You have a cooperative relationship with employees. • You have high staff attrition rates or absenteeism. • You have unobstructed curb access. • You have the ability to replace your RSW collection fleet and purchase new containers.
Implementing a Dual Collection System	• You want or need to add collection services (e.g., separate recyclables or yard trimmings pickup). • You have low participation rates. • Distances between stops are great. • Recyclables processing and RSW disposal facilities are located within geographic proximity. • You have the ability to replace your RSW collection fleet.

Figure 2

Source: SWANA, 1996.

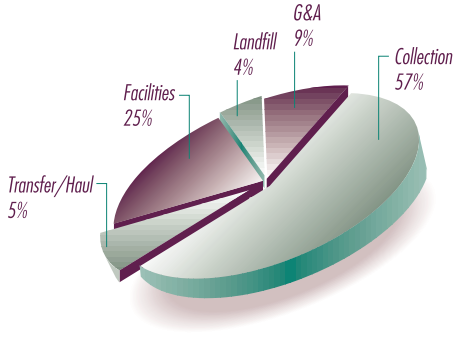
Where Did The Money Go?

Summary Of Solid Waste Management System Costs For Six U.S. Cities*



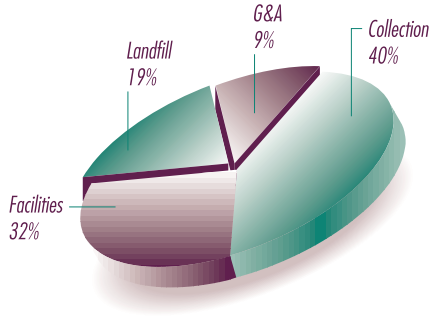
Minneapolis, Minnesota

- Half of city's households served by private crews; the other half served by public crews.
- 116,500 total households served.
- Weekly collection.
- 80 percent of households receive alley collection.
- Semi-automated collection for RSW.
- Recyclables collected weekly.
- Yard trimmings collected (April to November).
- RSW delivered to waste-to-energy (WTE) facility (county).



Palm Beach County, Florida

- Combination of municipal collection and franchise collection (unincorporated area).
- In unincorporated area:
  —Twice-per-week curbside collection of RSW.
  —Weekly collection of recyclables, yard trimmings, and bulky waste.
- RSW delivered to WTE facility or transfer station.
- County Solid Waste Authority uses a private processor, owns a materials recovery facility (MRF), and owns and operates a yard trimmings processing facility.



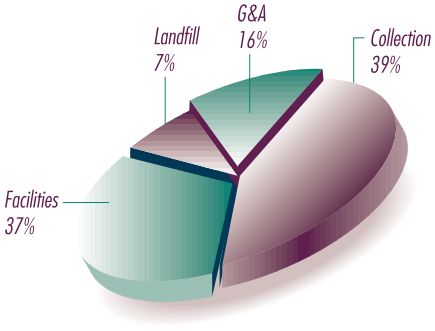
Scottsdale, Arizona

- 41,750 single-family households served.
- RSW collected weekly with fully automated vehicles.
- Customers set out RSW in 80-gallon wheeled carts.
- Recyclables collected through dropoff only.
- Brush and bulky waste collected once every 4 weeks.
- At time of analysis, city delivered RSW to a landfill that did not meet Subtitle D requirements.

* At the time of the analysis.

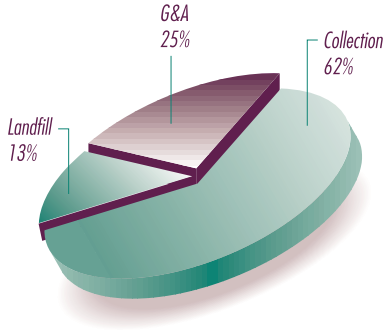
Figure 2

Summary Of Solid Waste Management System Costs For Six U.S. Cities (Continued)



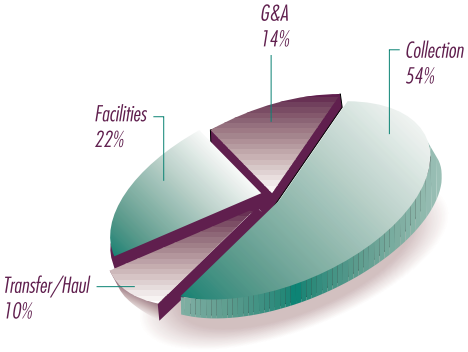
Seattle, Washington

- RSW and recyclables collection provided by contract haulers.
- RSW collected using:
  - —Sideloaders with one-person crews.
  - —Rearloaders with two-person crews.
- Variable rate pricing system in place.
- Recyclables collected by:
  - —Source separation approach (residents set out in three bins) weekly.
  - —Commingling in 90-gallon wheeled carts (monthly).
- Yard trimmings collected through curbside pickup and dropoff; backyard composting and onsite management promoted.



Sevierville, Tennessee

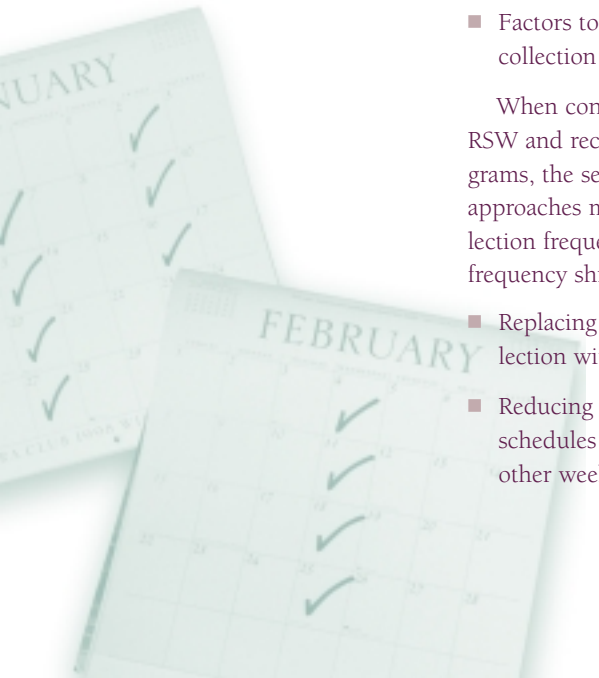
- Combination of curbside collection (incorporated areas) and residential self-haul to convenience centers (unincorporated areas).
- 1,950 households receive curbside RSW collection service with weekly pickup.
- Recyclables collected through dropoff centers at convenience stations (collected by private hauler/processor).
- RSW delivered to MSW composting facility.



Springfield, Massachusetts

- 44,500 households served with mandatory RSW collection.
- Once-per-week RSW collection.
- RSW pickup with manual rearloaders and three-person crews.
- Recyclables collected every other week.
- Mandatory ordinance requires residents to separate recyclables.
- RSW delivered to WTE facility.

Changing Collection Frequency



Many solid waste managers and elected officials fear that reducing RSW or recyclables collection frequency will be unpopular with residents or cause them to stop recycling.

This chapter addresses:

- Options for changing collection frequency.
- Benefits of reducing collection frequency.
- Strategies to overcome barriers to changing frequency.
- Examples of local governments or haulers that have successfully changed collection frequency.
- Factors to consider when evaluating collection frequency changes.

When considering improvements to RSW and recyclables collection programs, the search for cost-cutting approaches may lead to changing collection frequency. The most common frequency shifts include:

- Replacing twice-per-week RSW collection with weekly service.
- Reducing recyclables collection schedules from weekly to every other week or twice per month.

Reducing RSW Collection Frequency

Tradition, public health concerns, and, in some cases, state or local legislation have resulted in two RSW collections per week in some parts of the nation. This trend is particularly prevalent in the South, where the hot, humid climate has created fears about pest and odor problems from less frequent RSW collection.

Studies have demonstrated, however, that the second collection day is traditionally under-utilized, both in terms of set-out rates (which typically drop off sharply on the second collection day each week) and weights collected per stop. These factors drive up the cost per ton of collecting RSW on the second day each week. In addition, if residents have the opportunity to separate recyclables and yard trimmings for diversion, and/or are offered a PAYT fee structure, the need for a second RSW collection day is decreased even further.

When RSW collection frequency is decreased, average weekly set-out rates tend to rise. Most communities contacted for this study indicated that RSW set-out rates are estimated to be 95 to 100 percent when collection services are offered

once per week. Vacancy rates and seasonal occupancy factors affect this estimate. PAYT fee systems can also affect set-out rates.

How are weights collected per stop affected when programs switch from twice-per-week to weekly collection? The answer varies depending on the availability of diversion programs and the fee system in place. New or expanded collection programs for recyclables or yard trimmings may lower total pounds of RSW collected per household per week; however, average set-out weights typically increase when a second RSW collection day is eliminated.

The typical increase in set-out rates and corresponding increases in weight collected per stop mean that route sizes might have to decrease; crews will be picking up more material per stop, loading their vehicles faster, and driving off-route to unload more often. The balance of weight collected per day, however, improves and hours worked per day are typically better balanced as well.

What About Flies?

The Tucson, Arizona, pilot program showed no increase in flies as a result of the switch to once-per-week collection. The highest occurrence of flies associated with RSW set-outs typically occurs in

Field Observations

Location	First Collection Day Of The Week	Second Collection Day Of The Week
Waco, Texas	95 percent set-out rate.	60 percent set-out rate.
Memphis, Tennessee	85 percent set-out rate. (56 percent of the total RSW collected per week is picked up on first collection day.)	65 percent set-out rate. (44 percent of the total RSW collected per week is picked up on second collection day.)
Escambia County, Florida	90 percent set-out rate. (60 percent of the total RSW collected per week is picked up on first collection day.)	65 percent set-out rate. (40 percent of the total RSW collected per week is picked up on second collection day.)
Austin, Texas	Close to 100 percent set-out rate.	60 to 65 percent set-out rate.
Ocala, Florida	24 pounds RSW per household per day. (60 percent of average pounds per household per week of RSW collected.)	16 pounds RSW per household per day. (40 percent of average pounds per household per week of RSW collected.)
Tucson, Arizona (pilot study)	Containers were 51 percent full on average.	Containers were 30 percent full on average.

What Do Residents Say?

Surveys of RSW customers in Waco, Texas, and Ocala, Florida, revealed the following self-reported behaviors. Both of these cities offer drop-off recyclables collection only. Ocala residents receive weekly curbside collection of yard trimmings. In Waco, separate yard trimmings collection is not offered.

Waco, Texas	First collection day per week: respondents reported setting out two to three bags of RSW.	Second collection day per week: respondents reported setting out one bag of RSW.
Ocala, Florida	First collection day per week: respondents reported containers were 85 percent full.	Second collection day per week: respondents reported containers were 78 percent full.

Incidence of Flies in RSW Cans

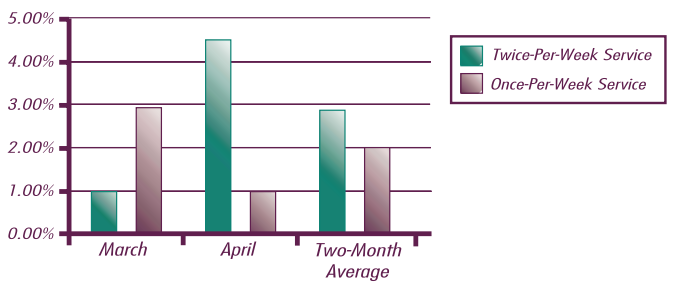


Figure 3

Source: *BioCycle*, July 1996 (based on study completed for Tucson by The Garbage Project, University of Arizona).

March, April, and October (i.e., optimum climate conditions for fly breeding). Comparative data about the percentage of RSW cans with flies were available for March and April 1995 (during the once-per-week pilot) and March and April 1996 (after service returned to twice-per-week collection).

Switching Services

Local governments contacted as part of this study often reduced RSW frequency in tandem with the addition or expansion of a new service such as curbside collection of recyclables, or separate collection of yard trimmings, for example. This practice often allowed new services to be added, or expansions for new services to be accelerated while minimizing fleet and staffing increases. It also offset potential negative public response to loss of a traditional RSW collection day.

In some places, adding a new service was mandatory. In Arizona, a law passed in the 1950s as a public health measure to control potential transmission of disease through flies, rodents, and other pests requires that twice-per-week collection be offered. The cities of Mesa, Tucson, and Phoenix have each applied for variances from the state that will enable these local governmental units to offer a second collection of recyclables or yard trimmings in place of the second RSW pickup.

Is Once-Per-Week RSW Collection Enough?

Surveys, focus groups, and field observation reveal the following:

- Focus groups conducted in **Norfolk, Virginia**, identified concerns about pests, odors, and the need for additional collection during summer months before the city converted to a "1-1-1" collection system (once-per-week pickup of RSW, recyclables, and yard trimmings). Residents who were already receiving once-per-week RSW collection reported general satisfaction with the frequency of collection.
- Eighty-five percent of residents in **Tucson, Arizona**, surveyed by phone during a pilot program of weekly RSW collection, indicated that weekly service was adequate for their needs.
- Ninety-two percent of residents in **Plano, Texas**, responding to a mail survey after the pilot program of weekly RSW collection began, reported that once-per-week service was sufficient.
- When **Jacksonville, Florida**, switched to once-per-week RSW collection, residents were given the option to receive twice-per-week collection for an additional $5 per household per month (on average). Fewer than 1,000 of the city's 216,000 households (i.e., less than 0.5 percent of eligible homes) signed up for the increased service levels.
- In a mail survey of 1,500 residential customers in **Ocala, Florida**, 50 percent of respondents who currently receive twice-per-week service thought that weekly RSW collection would be satisfactory if additional recyclables or yard trim-

mings collection opportunities were available.

- Phone surveys conducted with residents in **Waco, Texas**, prior to the initiation of a pilot weekly RSW collection program indicated that more than 55 percent of households with twice-per-week service could manage with weekly pickup if recyclables and yard trimmings diversion programs were more convenient.

Changing Collection Frequency For Recyclables

The jury is out on recyclables collection frequency. Some communities contacted as part of this study reported significant reductions in operational costs and only marginal impacts on participation and diversion when collection frequency for recyclables was changed from weekly to biweekly or semi-monthly. Other jurisdictions reported customer dissatisfaction, increases in contamination, and drops in diversion that cast a shadow over potential cost savings.

Benefits Of Collection Frequency Change:

- Makes each stop count more: maximizes weights collected per stop.
- Minimizes nonproductive time: increase average set-out rates.

Case Study

Experience In The Old Dominion

Two regional public service authorities in Virginia that provide recyclables collection services to their member jurisdictions have made the switch to biweekly collection of recyclables.

Central Virginia Waste Management Authority (CVWMA)

- A study conducted by CVWMA and its contractor revealed that most households participating in the curbside recyclables collection program were setting out recyclables twice per month on average.
- CVWMA initiated a contract in April 1994 for the biweekly collection of recyclables.
- At the same time, residential mixed paper was added as a target material in the collection program.
- CVWMA issues a calendar each year to remind residents which week is their recycling week.
- The results:
  - 17 percent increase in average number of set-outs per route per collection day.
  - 49 percent increase in average pounds collected per set-out (includes addition of mixed waste paper).

Southeastern Public Service Authority of Virginia (SPSA)

- SPSA switched from weekly recyclables collection to biweekly to allow for the more rapid expansion of recyclables pickup to member jurisdictions.
- Concurrently, SPSA changed workday schedules from 8 hours per day, 5 days per week to 10 hours per day and a 4-day workweek.
- Total number of households served increased from approximately 150,000 to nearly 250,000.
- Average set-out rates per collection day increased approximately 1 to 2 percent.
- Pounds collected per stop increased almost 19 percent (from approximately 16 pounds per stop to nearly 19 pounds per stop).
- Pounds of recyclables collected per scheduled work hour increased by 66 percent.
- Initial confusion associated with the change to biweekly service passed quickly, according to David Horne, one of SPSA's curbside recycling managers.

Case Study

Reducing Recyclables Collection Frequency—Is It Worth It?

Etobicoke, Ontario, Canada	"There were substantial decreases in cost by going to every-other-week collection and no major drop in recyclables tonnages," according to representatives from this municipality. Set-out rates increased by 55 percent, and the number of recyclables collection routes dropped by 21 percent.
Sacramento, California	Starting in January 1994, the city decreased recyclables collection frequency from weekly to every-other-week service. According to Reina Schwartz, the number of routes was decreased by 23 percent. Gary Van Dorst, the city's acting director of technical services, reported savings of $500,000 per year in the recycling program budget (*Resource Recycling,* April 1995). Reported impacts on recyclables recovered vary. Some city reports indicate a 12 to 13 percent drop in overall recyclables recovered through the curbside program. Average pounds collected per household per month may have dropped as much as 40 percent, but the number of homes being served by the program has increased.
Hollywood, Florida	"Based on observations and calls, we felt it was not a productive way to do recycling"—Lorie Mertens, the city's public works education coordinator, after a pilot program tested biweekly recyclables collection. (Source: *BioCycle,* July 1996)

Case Study

Reverse Psychology

While most local governments considering a change in recyclables collection frequency are thinking about reductions in the number of collections offered per month, at least one local government is considering the reverse.

The Tucson Experience

A year-long pilot, started in September 1994, tested the effects of increasing recyclables collection frequency from biweekly to weekly pickup on participation, set-outs, and diversion.

Participation	Monthly participation in the pilot areas rose by nearly 44 percent, from 57 percent to 82 percent.
Set-Out Rate	Increased from 44 percent biweekly to 53 percent (weekly pickup); this surprising result may be related to the fact that RSW collections were decreased from twice-per-week to once-per-week during the same pilot program.
Diversion	Diversion from the pilot routes rose nearly 56 percent; composition studies conducted by The Garbage Project (University of Arizona) confirmed a corresponding decrease in recyclables found in RSW set-outs.
	The pilot concluded that moving from biweekly to weekly collection could improve diversion while maintaining cost-effectiveness.

Source: *BioCycle,* July 1996.

- Reduces fuel consumption and other environmental impacts.
- Reduces vehicle and labor needs: eliminate routes.
- Provides new services: switch existing collections for new services.

Based on the research conducted for this study, it is difficult to isolate the impact of collection frequency changes on costs and productivity. Most of the local governments or haulers contacted had implemented changes in RSW collection frequency in conjunction with other system changes such as adding recyclables or yard trimmings collections, implementing semi-automated or fully automated collection, reducing crew size, adding materials to recycling programs, changing RSW set-out locations, or changing workday schedules.

A study released in March 1995 about RSW collection costs in Montgomery County, Maryland (a suburb of Washington, DC), addressed the cost impact of collection frequency in the two main service areas of the county. In one part of the county, residents receive weekly RSW pickup. In another segment of the county, RSW is collected twice each week.

Note that different haulers service the two areas, which could contribute to the level of complaints received.

Customer Satisfaction
Montgomery County, Maryland

Measure	Twice-Per-Week Service Territory	Once-Per-Week Service Territory
Total Annual Cost Per Ton of RSW Collected	$92	$55
Annual Complaints Per 1,000 Households Served	118	150

Source: EcoData, Inc., March 1995.

As shown in the above table, the cost per ton to provide twice-per-week collection is estimated to be approximately 70 percent higher than the cost to collect RSW once-per-week. Customer satisfaction—as measured by the number of complaint calls received—increased by more than 27 percent in the once-per-week service area.

This study indicates that while the costs per ton are likely to drop with once-per-week service, customer complaints might increase. More time might be needed to distinguish legitimate complaints from instances where customers did not set out their containers on time.

Getting Over The Hurdles

When addressing collection frequency changes for RSW or recyclables, solid waste system planners face some common barriers. Here are strategies for overcoming them.

- **To reduce potential odor and health hazards** associated with reduced collection frequency, provide containers with lids; require residents to bag waste before containerizing; and educate residents about ways to minimize odor and vector risks.
- **To avoid increases in illegal dumping,** anticipate short-term increases; develop an education and enforcement strategy; and provide consistent collection service.
- **To reduce the physical burden associated with heavier set-outs,** provide wheeled carts and "carry out" service for physically challenged residents. PAYT fee structures also could encourage residents to recycle more and dispose of less waste.

- **To prepare for holidays on residents' collection days,** develop a holiday collection plan that could include steps such as providing next day collection, offering workers the chance to work holidays (with holiday pay rates), and suspending collection of recyclables/yard trimmings on holidays in order to divert crews for RSW collection. Be sure to promote holiday collection schedules adequately and the availability of self-haul options if appropriate.
- **To avoid raising residents' expectations for a rate cut,** promote changes as a cost containment strategy and offer other desired services to replace the second RSW collection day.
- **To reduce worker injuries associated with heavier set-outs,** increase automation to reduce lifting related injuries and knee and wrist strains (e.g., from heavy recyclables set-outs); provide separate collection for yard trimmings (which will help reduce RSW set-out weights); provide increased safety and health training; and develop safety incentives.
- **To keep residents satisfied,** if necessary, offer extra collection services at premium rates (make sure operational impacts have been anticipated and addressed).

Prove It To Me

For more information about switching collection frequency, talk to service providers who have made the switch. Some sample communities are listed on pages 17 and 18.

Ready To Make The Change?

Even when change makes sense, it is often difficult. Solid waste system changes are particularly challenging. By addressing the following questions early in your planning process, you will identify areas where additional research, education, or consensus-building are needed.

Customer Service

1. Have you adequately informed the public of collection frequency changes?
2. Do you track complaints and service request data now?
3. Have you anticipated how changing collection frequency will affect number of calls received?
4. Have you added phone lines or staff to handle short-term increased volume of calls?
5. Have all staff who might get questions or calls been notified of the change?

Social and Political Issues

1. How long has twice-per-week collection been offered?
2. Will residents see a change in rates?
3. Will new services be added?
4. Are residents likely to have difficulty handling larger set-outs of RSW?
5. Are there concerns about increased illegal dumping, litter, vectors, or odor that have to be addressed?
6. Have you involved citizens, businesses, government officials, and other stakeholders in the decision-making process?
7. Do you have data from a pilot program or similar community to support your decision?
8. Will the change in collection frequency be more acceptable if alternative twice-per-week collection services are offered? If so, how will you charge for that premium service? What will the operational impacts be?
9. Will your current or future fee structure affect how customers perceive the change in collection frequency? (A PAYT fee system, for example, might make RSW collection frequency change more acceptable because there is a more direct relationship between fees paid and amount of service received.)

Labor

1. How will changing collection frequency affect your staffing needs?
2. If you will need fewer workers, can you time the switch to match current attrition levels?
3. If workers are displaced, can

they perform other functions within the department or the organization?

4. Have workers been informed of planned changes and involved in decision-making?
5. How will changing collection frequency affect overtime demands (especially during peak waste generation periods or following holidays)?
6. Can the existing labor pool handle increased weights per set-out?
7. Have you implemented safety training, such as proper lifting classes, to help workers handle heavier set-outs?
8. Have you reviewed labor agreements and/or work rules for barriers to changing collection frequency?

Routes

1. Have you estimated the impact of frequency changes on set-out rates and pounds collected per stop?
2. Have you developed area routes that optimize vehicle utilization?
3. Have you considered the impact of changing collection frequency on number of trips required to unload per day? Are processing or disposal facilities able to adjust to the new collection schedule?
4. Have you considered Monday holiday collection needs when developing routes?

Containers

1. If containers for RSW or recyclables have previously been provided, are they still large enough for the increased volume and weight of set-outs?
2. Are alternative containers acceptable? Have customers been informed of set-out options?
3. Are local hardware stores aware of impending increased demand and are they prepared to respond (possibly with "sales" to soften the impact on homeowners)?

Case Study

Making The Change

Austin, Texas
- Switched RSW collection frequency from twice to once per week.
- Switched from manual rearload to semi-automated rearload vehicles.
- Implemented weekly collection of recyclables.

Central Virginia Waste Management Authority, Virginia
- Reduced recyclables collection frequency from weekly to every other week.
- Added residential mixed paper to list of target recyclables in curbside program.

Edmond, Oklahoma
- Reduced RSW collection from twice to once per week.
- Replaced manual rearload collection vehicles with fully automated sideload vehicles.

Greensboro, North Carolina
- Reduced RSW collection frequency from twice to once per week.
- Switched from rearload vehicles to fully automated sideloaders for RSW collection.
- Added weekly collections for recyclables and yard trimmings.

Houston, Texas
- Conducted series of pilot studies to test reduction in collection frequency for RSW, addition of recyclables and yard trimmings diversion programs, and alternative collection vehicles. Currently moving to new collection system:
  - Once-per-week RSW collection with fully automated sideloaders.
  - Biweekly collection of recyclables.
  - Weekly collection of yard trimmings in manual rearloaders.

Indianapolis, Indiana
- Reduced RSW collection frequency from twice to once per week.
- Switched from manual rearloaders to fully automated sideloaders.
- Increased yard trimmings collection frequency from once per month to once per week.

Case Study

Continued

Jacksonville, Florida
- Reduced RSW collection frequency from twice to once per week.
- Maintained weekly curbside pickup of recyclables.
- Added weekly yard trimmings collection.

Jeckyll Island State Park, Georgia
- Reduced RSW collection frequency from twice to once per week.
- Replaced manual rearload collection with automated sideloaders.
- Added weekly yard trimmings collection.

Little Rock, Arkansas
- Reduced RSW collection frequency from twice to once per week.
- Switched from manual rearloaders for RSW collection to automated sideloaders.
- Implemented weekly collection of recyclables (automated side loaders) and yard trimmings (manual rearloaders).

Los Angeles, California
- Reduced RSW collection frequency from twice to once per week.
- Replaced manual frontload collection approach with fully automated sideloaders.
- Implemented automated collection of recyclables and yard trimmings once per week.

Memphis, Tennessee
- Reduced RSW collection frequency from twice to once per week.
- Retained semi-automated rearload collection fleet.
- Implemented weekly curbside recyclables collection.

Mesa, Arizona
- Reduced RSW collection frequency from twice to once per week.
- Retained fully automated sideload collection fleet.
- Phasing out alley collection.
- Implemented fully automated weekly curbside collection of recyclables.

Phoenix, Arizona
- Reduced RSW collection frequency from twice to once per week.
- Converted from rearloaders for RSW pickup to fully automated sideloaders.
- Implemented weekly curbside collection of recyclables with fully automated vehicles.

Pittsburgh, Pennsylvania
- Reduced curbside recyclables collection from weekly to every other week.

Plano, Texas
- Reduced RSW collection frequency from twice to once per week.
- Moved from manual sideload vehicles to semi-automated sideloaders (phase 1) to fully automated sideloaders (current system).
- Implemented weekly curbside pickup for recyclables and yard trimmings.

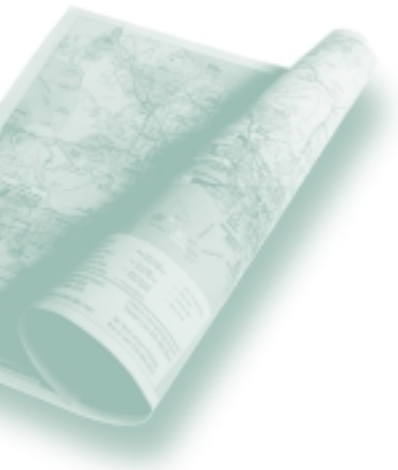
Sacramento, California
- Reduced recyclables collection frequency from weekly to every other week service.
- Added households to the program concurrently.

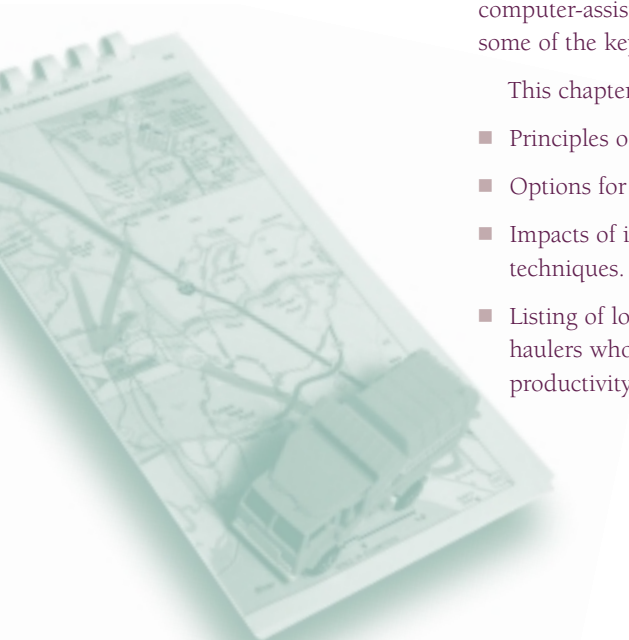
Southeastern Public Service Authority of Virginia
- Reduced recyclables collection frequency from weekly to every other week.
- Added households to the program concurrently.
- Changed workday schedule from 8 hours per day to 10 hours per day.
- Currently switching from curb-sort to commingled collection (two-stream sort).

Tempe, Arizona
- Reduced RSW collection frequency from twice to once per week.
- Retained fully automated collection fleet.
- Added weekly curbside collection for recyclables (fully automated vehicles used).

Victorville, California
- Reduced RSW collection frequency from twice to once per week.
- Switched from manual sideloaders to automated sideloaders.
- Implemented automated collection program for weekly pickup of recyclables.

Improving Routing





In jurisdictions where routing studies have not been conducted recently, collection managers often assume their drivers know the best way to pick up RSW. Indeed, driver intuition has been one of the guiding tenets of RSW routing for years. Who better to determine route configuration than the folks on the street doing the job?

As collection systems become increasingly complex, productivity issues hit the spotlight, and concerns about costs arise, and route design and management are no longer a matter of instinct alone. Improvements in data collection and analysis, increased awareness of the importance of productivity standards, and the availability of computer-assisted routing tools are some of the keys to effective routing.

This chapter addresses:

- Principles of routing.
- Options for routing.
- Impacts of improved routing techniques.
- Listing of local governments and haulers who have improved route productivity and workload balance.

Principles Of Route Design

Routing is typically accomplished in two phases:

- Macro routing: The total geographic area to be served is divided into total area to be served by all crews and vehicles in one collection day and area to be served by each individual crew and vehicle in one collection day.
- Micro routing: The specific path that each individual crew vehicle will follow to service each route is specified.

The size of each route will depend on a wide variety of factors, including geographic features of the territory, demographic considerations, vehicle design and loading features, set-out requirements, staffing patterns, types of service being provided, frequency of collection, and institutional considerations, as shown below.

Heuristic Routing Principles

According to Webster's 10th Collegiate Dictionary, "heuristic" refers to problem-solving techniques that rely on the evaluation of feedback to improve performance. Sounds a lot like "trial and error," doesn't it?

In the mid-1970s, EPA produced heuristic routing guidelines to help route managers design the most efficient collection paths. These guidelines are still applicable today. Once a route manager has designed a theoretical route path with these guidelines in mind, the "trial and error" begins, and experienced drivers and collectors should test the routes for practicality under actual field conditions.

The Guidelines*

1. Routes should not be fragmented or overlapping. Each route should be compact, consisting of street segments clustered in the same geographical area.
2. Total collection plus handling times should be reasonably constant for each route in the community (equalized workloads).
3. The collection route should be started as close to the garage or yard as possible, taking into account heavily traveled and one-way streets (see next two rules).
4. Waste on heavily traveled streets should not be collected during rush hours.
5. In neighborhoods with many one-way streets, it is best to work through it using a series of overlapping loops.

A Balancing Act

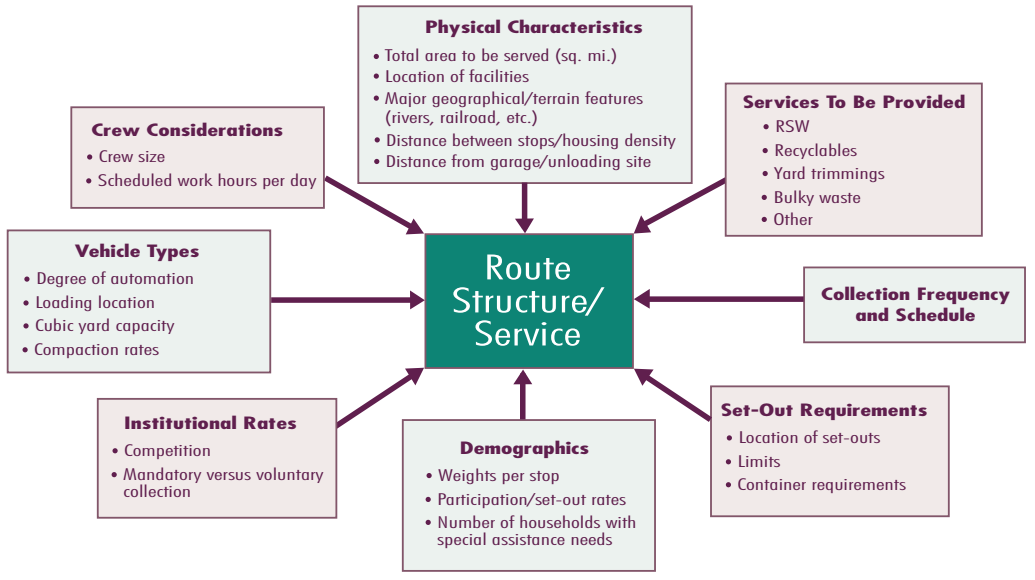


Figure 4

*Sources: *Heuristic Routing for Solid Waste Collection Vehicles,* U.S. EPA, 1974 and "Planning a High Performance Collection System," *Waste Age,* February 1993.

6. Services on dead-end streets can be considered as services on the street segment that they intersect—because they can be collected only by passing down that street segment. To keep left turns at a minimum, collect waste on dead-end streets when those streets are on the right side of the truck. Depending on the length of the street and turning restrictions, waste on dead-ends can be collected by walking down, backing down, or making a U-turn.
7. Waste on a steep hill should be collected, when practical, on both sides of the street while the vehicle is moving downhill. This practice facilitates safety, ease, and speed of collection. It also lessens wear on the vehicle and conserves oil and gas.
8. Higher elevations should be at the start of the route.
9. For collection from one side of the street at a time, it is generally best to route with many clockwise turns around blocks. (This rule and the following one emphasize the development of a series of clockwise loops in order to minimize left turns, which generally are more difficult and time-consuming than right turns. Right turns are safer, especially for right-hand-drive vehicles.)

Manual Routing

Nothing Fancy, But Nobody Said It Was Easy

Step	What You Need To Know
Define collection service areas that are well-balanced. As a starting point, consider total customers to be served, multiplied by collections per week, divided by collection days.	• Number of customers to be served in each region. • Number of collections per week. • Number of collection days per week. • Natural boundaries (e.g., major roadways, topographical features, or railways).
Divide the collection service areas into individual routes (work per truck and crew per day).	• House or customer count data on a block-by-block basis. • Vacancy and occupancy data. • Number of available collection vehicles. • Average set-out rates (and differences by region, if known). • Average weights per set-out (and differences by region, if known). • Time required per stop (including travel time between stops). • Nonproductive time (e.g., to route, to disposal/processing locations, to vehicle yard). • Maximum customers who can reasonably be served by each type of vehicle and crew combination (take into account differences in materials being collected, set-out container types, vehicle capacity, compaction ratios, vehicle age and reliability, and crew size).
Design path routes, using EPA heuristic routing guidelines.	• Location of one-way streets and dead-ends. • Location of other topographic or traffic-related features that affect heuristic route design.
Drive routes to test for practicality.	• If routing is practical under real-life conditions.

10. For collection from both sides of the street at the same time, it is generally best to route with the long, straight paths across the route before looping clockwise.

Options For Routing

The most common approach to routing continues to be the manual method—which involves maps, pencils or colored markers, and patience. Though less prevalent, computer-assisted routing also is on the rise. This approach requires computer map databases and customer databases (plus the equipment and the staff capable of running the programs).

Case Study

Norman, Oklahoma, System Comparison

Parameter	Former System	Improved Routing	Impact
Number of routes per day	13 for RSW 5 for yard trimmings	10 for RSW 5 for yard trimmings	23 percent decrease in routes
Average number of hours worked per day	5.5 for RSW 5 - 9 for yard trimmings (seasonal variation)	7 (both for RSW and yard trimmings)	27 percent increase in hours worked per crew per day
Average number of households per route per day	420 (both for RSW and yard trimmings)	500 (both for RSW and yard trimmings)	19 percent increase in households served per route per day
Number of vehicles required	18 active 7 spare	15 active 5 spare	20 percent reduction in fleet size
Crew size	3 for RSW 3 for yard trimmings	3 for RSW 2 for yard trimmings with 1 temporary helper added per route during peak generation periods	No change for RSW routes 73 percent increase in households served per crew hour for yard trimmings routes

Computer-Assisted Routing: It's Just A Matter Of Time

The arduous task of manually re-routing can be eased somewhat with computer technology. Several vendors offer systems for optimizing routes through computer-generated routing algorithms. What's required?

- Geographic Information System (GIS) street maps: Known as "center-line" maps, these maps are digitized representations of every street in a jurisdiction with line segments that reflect every block face. The map database might also indicate address ranges per block, paving surface, road weight limitations, or turning restrictions. Many larger local governments have invested in developing their own GIS systems (which could include tax mapping, election district maps, zoning and land use maps, maps of streets and water/sewer lines, etc.). Center-line map databases also are available from commercial vendors for almost every county in the United States. Firms such as E-TAK, Navigation Technologies, and Geographic Data Technologies produce these digitized map databases at costs that range from approximately $650 to $2,500 per county.
- Customer database: Sometimes available through tax assessors

offices or a utility billing system, these databases could provide complete customer lists with physical street addresses.

The computer-assisted routing works by geocoding each customer and searching the map database for the appropriate block.

The same information required for manual routing (as listed in the box on page 19) also is needed for computer-assisted routing.

Depending on the vendor, outputs of the computer-assisted routing include maps, direction lists, and customer lists.

Case Study

Hempstead, New York, System Comparison

Parameter	Former System	Improved Routing	Impact
Number of routes per day	62 for RSW 18 for recyclables	52 for RSW 16 for recyclables	16 percent decrease in RSW routes 11 percent decrease in recyclables routes
Average number of households per route per day	675 for RSW 1,200 for recyclables	800 for RSW 1,300 for recyclables	19 percent increase in households per RSW route 8 percent increase in households per recyclables route

Benefits Of Improved Routing

Efficient route management can decrease costs by reducing labor and vehicle needs, balancing workloads, decreasing overtime demands, and allowing for adjustment of workloads during periods of seasonal waste stream variation.

Here are some results from local governments that have tried traditional and computer-assisted routing improvements.

Manual Routing: Norman, Oklahoma

Late in 1992, a committee of labor and management representatives in the city of Norman, Oklahoma, initiated the task of evaluating its RSW collection system productivity. The rate of operating cost increases was projected to create a deficit for the sanitation department, and rate increases could only be authorized by public referendum. This scenario created an incentive for labor and management to work together to develop cost-cutting strategies.

Ideas from the labor and management committee were put to the following tests:

- Does it cut costs?
- Are service levels maintained?
- Are employee wages and benefits maintained?
- Can it be implemented practically?
- Does it increase productivity?

Improvements in route balance and crew productivity were the key to solving the city's fiscal crisis. By re-structuring routes and establishing minimum workdays of 7 hours per crew per day (out of a scheduled 8 hour day), the city increased productivity, reduced the number of crews and vehicles needed, and saved money. The city estimated savings from the re-routing to be approximately $452,000 per year.

Computer-Assisted Routing: Hempstead, New York

Located on Long Island, approximately 25 miles east of Manhattan, the town of Hempstead has a population of

Case Study

Improving Routing

Western Disposal Boulder, Colorado	• Implemented computer-assisted routing to balance workload and allow more customers to be served per vehicle per day.
Charlotte, North Carolina	• Improved routing with computer-assisted route design. • Implemented fully automated collection. • Reduced collection frequency. • Experimented with changes in workday schedules.
Gloucester Township, New Jersey	• Balanced workload for recyclables collection. • Improved number of households served per route per day.
Hempstead, New York	• Maintained collection frequency and crew size. • Reduced number of RSW and recyclables routes through computer-assisted route design. • Plans to adjust routes for seasonal variations in yard trimmings quantities.
Metro Dade, Florida (Miami)	• Improved routing for RSW through use of computer-assisted routing software. • Estimates average crew handles 10 to 15 percent more households per day under the new system.
Norman, Oklahoma	• Improved routing through manual routing effort and establishment of route productivity goals.
Oyster Bay, New York	• Implemented computer-assisted routing program (one of the first cities to try automated route selection). • Tried "grand tour" route concept. • Increased number of households served per truck per day by 12 to 13 percent for RSW. • Estimates annual savings of $1 million through route improvements.

800,000. The implementation period took approximately 2 years, but Hempstead now uses GIS-based technology to route RSW, recyclables, and yard trimmings collection vehicles.

Hempstead relied on state and county supplied street center-line databases as the basis for its routing application. Turn limitations, and other traffic impediments, had to be entered into the database before computer-assisted route design was feasible. This effort took time, and maintaining the database is an ongoing process. Hempstead's Commissioner of Sanitation, however, finds the investment is paying off. The town has used the route optimization program several times per year since its installation to help address the addition of phone books and magazines to the recyclables collection program and to allow for adjustments in routing because of the seasonal variability of yard trimmings quantities.

As a result of routing improvements, the town has eliminated 10 RSW collection routes, at an estimated annual savings of $200,000 per route.

Computer-Assisted Routing: Charlotte, North Carolina

The city of Charlotte, North Carolina, has been on the leading edge of cost-cutting measures for

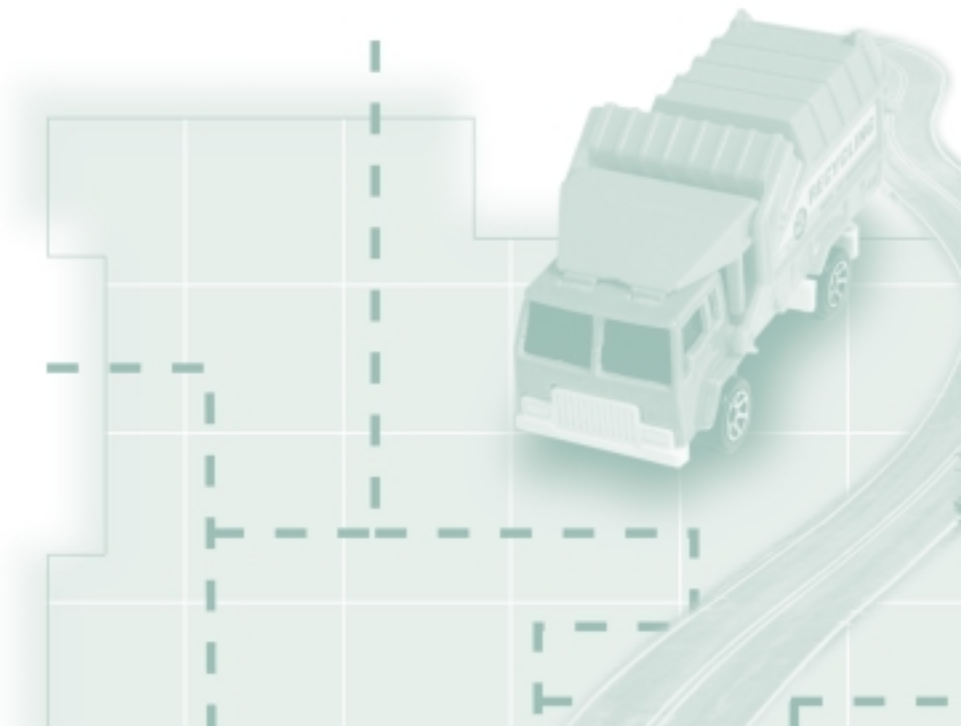
RSW collection for the past several years. The city has switched from twice-per-week RSW collection (with one collection per week picked up in the backyard) to a fully automated collection system with weekly curbside service for RSW. Yard trimmings and recyclables are collected in separate pickups on a weekly basis. In addition, the city recently privatized 25 percent of its service area to compare the performance and cost of the private hauler's services to the public crews.

Computer-assisted routing is another way that Charlotte has stayed current with trends in the industry. Using the RouteSmart™ package, Charlotte has been able to respond to changing collection schedules, service areas, and route sizes with relative ease. Installing the computer-assisted routing application required an investment equivalent to a full year of one analyst's time. In addition, the software itself cost the city approximately $37,000. All together, start-up costs were estimated to be approximately $75,000.

In the first year of its use, the RouteSmart™ system saved the city approximately $26,500 in labor costs associated with the routing exercise alone. In addition, the city expects to save through increases in route productivity through improved route management.

Improved Routing: Where Else Is It Working?

Routing is an important factor in any solid waste management system that is undergoing change, but the list of local governments or haulers (on page 24) illustrates several jurisdictions where improved routing is receiving priority attention.



Automating RSW Collection

In the past, residents put their entire waste stream, including recyclables, in their backyards or at the curb for collection.

Today, the demands for increased cost-effectiveness and diversion programs that require separation of residential recyclables or yard trimmings have caused a revolution in the solid waste industry's approach to collection.

Though manual collection of RSW has been the mainstay for decades and is still the norm, there is growing interest in automation as a way to:

- Decrease labor requirements.
- Reduce the number of vehicles required to serve a collection territory.
- Reduce injury potential associated with fatigue and lifting.
- Reduce litter and unsightly set-outs.

Many local governments and waste haulers are turning to automation as a way to reduce the labor costs of recyclables and yard trimmings pickup.

This chapter addresses:

- Options for automated collection of RSW.
- Impacts of automated collection.
- Potential barriers to the implementation of automated collection.
- List of local governments and haulers who have implemented semi- and fully automated collection programs for RSW, yard trimmings, or recyclables.
- Factors to consider when evaluating automation of the collection fleet.

Options For Automating Your Collection Fleet

There are two main approaches to reducing the demands of manual RSW collection—semi-automated collection vehicles and fully automated collection vehicles. Both systems rely on mechanical or hydraulic lifting systems to reduce the labor costs associated with collection services.

Semi-Automated Collection

Semi-automation offers a bridge between manual collection systems and fully automated collection approaches. System characteristics include:

- **Specialized collection containers:** Typically, customers are required to use special containers compatible with mechanical lifting equipment. Often,

semi-automated containers are sized in the 60- or 90-gallon range. In many communities with PAYT programs, 30-gallon semi-automated containers are common, and some communities offer even smaller "mini" cans for households that generate less waste. Containers are designed with wheels and lids to make storing and handling set-outs easier for customers and collectors.

- **Special equipment or equipment modifications:** Semi-automated "flippers" (hydraulic lifting devices) can often be mounted on existing front-load, rear-load, or side-load collection vehicles. These retrofits may be less efficient than factory-built semi-automated vehicles. Lift times should be monitored, as well as power demands, for any potential retrofit. Semi-automated vehicles direct from a vehicle body manufacturer also can be designed for rear- or side-loading.

How does semi-automated collection work?

- Customers wheel carts to the curb, typically facing them outward to facilitate crew usage.
- Crews wheel carts to the collection vehicle.
- Crews line carts up with the lifting device.
- Crews activate the lifting device, mechanically tipping contents of the carts into the hopper of the RSW collection vehicle.

Fully Automated Collection

In fully automated collection systems, containers are lifted, emptied, and returned to the collection point mechanically. Unless there are problems—overflow materials, improperly prepared materials, obstructed set-outs, or the need for roll-out assistance—the driver need not leave the cab of the collection vehicle. Crane-like arms—in some cases long

Semi-Automated Collection

What Are The Drawbacks?

- In some cases, collectors have found that semi-automated collection takes longer than collecting RSW in bags because:
  - Carts must be returned to the curb.
  - Hydraulic systems for the lifters sometimes do not have sufficient power to lift heavier set-outs.
  - Mechanical lifter timing is sometimes not adjusted sufficiently to operate quicker than a human "lifter."
- Labor needs may not decrease because crews must dismount and move containers at each stop.

On The Plus Side

- Semi-automated collection systems allow solid waste planners to utilize existing equipment (through retrofits) to test automated collection concepts.
- Semi-automated collection offers an automated collection option for geographic areas that have constraints such as tight streets, on-street parking, and one-way streets with customers on the left side of the street that would limit the use of a fully automated system.
- Dual-side collection options allow collectors to service carts from both sides of the collection hopper in some semi-automated vehicle designs.
- Manual collections can still be performed (for out-of-cart set-outs or overflow materials).
- Worker safety is enhanced:
  - Operator fatigue is minimized.
  - Manual lifting is minimized.
  - Workers' compensation costs sometimes decrease.
  - Job longevity might be increased; less turnover.

Fully Automated Collection

What Are The Drawbacks?

- Fully automated collection equipment is typically more expensive than manual or semi-automated vehicles (but fleet size is typically reduced because of increased productivity).
- Maintenance costs are often reported to be higher with fully automated equipment because of increased hydraulic system complexity (but fleet size is typically reduced, so fewer vehicles are usually being maintained).
- Fully automated systems rely on customers placing containers in accessible locations (or maximum efficiency is hindered).
- Out-of-cart set-outs are less easily handled with fully automated vehicles (hopper loading heights make manual collection impractical and maximum efficiency is limited if operators must exit the cab).
- On-street parking, low hanging wires, and narrow, one-way, or dead-end streets can present challenges for fully automated collection vehicles.
- One-way streets with left-side collections present challenges—operator time to roll-out carts for right-side pickup decreases maximum productivity.

On The Plus Side

- Labor demands can be reduced significantly—most often, fully automated vehicles are operated by one-person crews.
- Greater diversity is possible in hiring drivers (physical lifting capabilities are not a requirement).
- Worker comfort is increased—drivers rarely need to leave the cab (reduces exposure to weather).
- Worker safety is enhanced:
  - Operator fatigue is minimized.
  - Manual lifting is eliminated.
  - Potential injury risk associated with larger crews (especially collectors riding on exterior steps) is minimized.
  - Workers' compensation costs often decrease.
  - Job longevity is increased; less turnover.
- Vehicle operator job classifications are often higher than manual collection crew positions; sometimes wages are higher for automated vehicle operators as well (considered a plus by workers).

enough to reach between parked cars to reach set-outs—or claw-like grippers are hydraulically controlled from the cab.

Fully automated collection containers commonly range from 30-gallon capacity to over 400-gallon (designed to service multiple dwelling units).

Automated collection arms or grippers can be adjusted to service a variety of container sizes, depending on the manufacturer and design. Some systems can be adjusted from the cab, allowing operators to collect large containers (e.g., 300-plus gallons) at one stop and 90-gallon containers at the next without dismounting or making manual adjustments to the gripping mechanisms.

Impacts On Worker Safety

What drives local governments and haulers to consider automating collection of RSW? Often, the answer is worker injury rates and the cost of Workers' Compensation claims. While lifting injuries are the most common type of work-related injury expected to be minimized by increased automation, puncture wounds and lacerations might be avoided as well.

In Rochester, New York, an ergonomic study was conducted to document physical stresses experienced by collection crews in the city's manual RSW collection system.

At the time of the ergonomic study, backyard collection service was being offered. The average collector was walking 13 miles and lifting 6 tons of RSW per day. After implementing a semi-automated collection system and eliminating backyard collections, the average miles walked per day by collectors dropped by nearly 50 percent, to approximately 6.6 miles per day. Manual lifting of heavy set-outs was virtually eliminated. As a result, approximately 4.5 percent fewer days were lost due to injury per employee in the year following the citywide implementation of the semi-automated RSW collection system. Workers' compensation costs were reduced by 52 percent over the same period.

In addition, one year after the semi-automated RSW collection program was piloted, workers were asked to rate the semi-automated collection strategy. One hundred percent of the workers agreed that:

- Safety conditions were improved.
- Wheeled carts decreased fear of injury.
- Working conditions were improved.
- The semi-automated collection system should be expanded.
- They would prefer a semi-automated route over a manual route if they had the choice.

Thornton, Colorado, reported that work-related injuries cost $200,000 between 1988 and 1991. After implementing a fully automated collection program for RSW, the injury costs for the first year of operation dropped to zero. Workers' compensation insurance premiums dropped more than 60 percent from 1991 to 1993.

Impacts On Productivity

Local governments and haulers contacted as part of this study often implemented automation in conjunction with other system changes—a decrease in collection frequency, an increase in diversion

Automation At Work

	System Type		Crew Size		Percentage Increase in Households Served per Scheduled Crew Hour
Local Government	Before	After	Before	After	
Austin, Texas	Manual	Semi-Automated	3	2	15
Rochester, New York	Manual	Semi-Automated	2	1	100
Boca Raton, Florida	Manual	Semi-Automated	3	1	86 (projected in feasibility study)
Escambia County, Florida	Manual	Fully Automated	3	1	235
Indianapolis, Indiana	Manual	Fully Automated	3	1	260
Little Rock, Arkansas	Manual	Fully Automated	3	1	250
Pensacola, Florida	Manual	Fully Automated	3	1	300
Glendale, California	Manual	Fully Automated	2	1	309
Long Beach, California	Manual	Fully Automated	2	1	300

programs, a change in scheduled workday, or a change in set-out locations, for example. Reported increases in households served per scheduled crew hour are shown on the previous page for a sampling of systems that changed from manual to automated collection approaches.

Other Benefits

In addition to reducing the risk of work-related injuries and increasing productivity with fewer labor demands, the use of standardized wheeled carts offers several benefits:

- Using carts with lids helps to keep water, ice, and snow from set-outs, which helps to control the weight of set-outs and decreases tipping fee costs for weight of added water. Both Rochester, New York, and Minneapolis, Minnesota, reported reductions in annual RSW tonnages that the cities attributed directly to reduction in moisture content of set-outs.
- Using carts can improve neighborhood aesthetics —uniform containers often eliminate unsightly set-outs. (Community standards can vary, however, and some people might complain that carts look bad on the street. These complaints are more likely in areas where backyard or alley collection is being replaced by curbside pickup.)
- Blowing litter can be reduced because containers with lids are more resistant to being tipped over or torn apart by dogs, raccoons, crows, etc.
- Containers with lids can help control odor and vector concerns associated with keeping RSW for longer periods of time. In Evanston, Illinois, for example, the city council's concerns about the health impacts of reducing collection frequency to once per week were alleviated by the concept of wheeled carts with secure lids.
- If local governments and haulers reduce collection frequency and enforce RSW set-out limits (i.e., only RSW contained in the appropriate container will be collected), incentives can be created for participating in diversion programs.
- Providing wheeled carts in a variety of sizes can make implementation of PAYT fee structures easier.

Overcoming The Hurdles

Automation can raise concerns about reduced staffing needs and overflow waste. Here are some strategies for addressing these concerns.

When Automation Reduces Staffing Needs

"What will we do with the displaced workers?" It's a question that often accompanies an evaluation of automated collection approaches. Some local governments have had success with:

- Timing the switch to automated collection to match attrition rates.
- Retraining workers for other positions.
- Interdepartmental transfers.
- Early retirement incentives.

What About Overflow Waste?

When system planners evaluate fully automated collection, overflow waste is an important consideration. Most families find that 90 gallons of RSW capacity per week is more than sufficient—especially if recyclables and yard trimmings diversion programs are available. But there might be exceptions—after holidays, parties, or spring cleaning, for example—and some customers will place set-outs next to (or on top of) their containers because it is easier than lifting the lid and placing RSW inside the cart.

Some of the local governments and haulers contacted as part of this study tracked "overflow" percentages (the average number of out-of-cart set-outs as a percentage of total possible set-outs). Among the communities that tracked the data, overflow rates ranged from about 6 percent to 16 percent:

- Tucson, Arizona: 6 percent
- Memphis, Tennessee: 7 percent
- Plano, Texas: 11 percent
- Norfolk, Virginia: 16 percent

It should be emphasized that carts were not always full when out-of-cart set-outs were present. During field observation in Memphis, Tennessee, spot checks revealed that containers often had sufficient room to hold materials that had been left on top of or near carts. Customer misinformation or unwillingness to comply with set-out requirements might be the culprit, not excessive volume demands.

The potential productivity of fully automated systems might be seriously compromised if elected officials or staff are not willing to enforce containerized set-out requirements. Before new set-out policies were instituted in Chesapeake, Virginia, for example, manual collection equipment completed a second pass of each household each collection day to collect overflow set-outs. This system increases fleet and labor demands and undermines the intent of the fully automated collection approach.

Communities with PAYT fee structures should find overflow set-outs less problematic. In PAYT programs, the fee structure typically provides a financial disincentive for setting out excess RSW. When residents do have extra disposal needs, many PAYT systems use "extra bag" tags or stickers or some similar mechanism to recover some or all of the costs associated with handling the excess material.

Trading Headaches?

It makes sense that equipment designed to hydraulically lift heavy set-outs could cut down on labor costs and improve productivity. But what about the cost of purchasing and maintaining such equipment? Are you just trading headaches?

The key to this question rests with selecting the appropriate vehicles and equipment, providing adequate operator training, and designing an appropriate maintenance program. Pasadena, California's, solid waste planning administrator offered the following advice for local governments considering the purchase of an automated collection system:

- Buy top-of-the-line equipment; it will pay off in longer use and fewer repairs.
- Consider reducing capital costs by converting your existing fleet to automated vehicles.
- Specify vehicle performance and hold suppliers to those specifications.
- Invest in training: send representatives to the factory and provide appropriate on-the-job training.
- Design a maintenance program that addresses the needs of the specialized vehicles and equipment.
- Keep learning and adapt your program as you go.

Source: *MSW Management,* November/December 1993.

Where Is Automation Working?

The list of RSW collection service providers on pages 33 to 34 have implemented semi- or fully automated collection systems.

Ready To Make The Change?

Because resistance to change is commonplace, it is important to think strategically when evaluating significant system modifications. Answering the following questions early in your planning process will

help you to identify needs for additional research, education, and consensus building.

Customer Service

1. Have you adequately informed the public of collection changes?
2. Do you track complaint/service request data now?
3. Have you anticipated how the switch to automation will affect the number of calls received?
4. Have you added phone lines or staff to handle short-term increased volume of calls?
5. Have all staff who might get questions or calls been notified of the change?

Social and Political Issues

1. Have you involved citizens in the decision-making process?
2. Do you have data from a pilot program or similar community to support your decision?
3. How will customers respond to automated collection vehicles and containers?
4. Are residents likely to have difficulty handling the carts?
5. Will the change be more acceptable if customers have the option to use more than one container or set-out overflow waste in alternative containers? If so, how will you charge for that premium service? What will the operational impacts be?
6. Will the system be compatible with waste reduction and diversion goals?

Labor

1. How will automation affect your staffing needs?
2. Can you time the switch to automated service to match current attrition levels?
3. Can displaced workers provide other functions within the department or organization?
4. Have workers been informed of planned changes?
5. Have workers been involved in decision-making?
6. Have you trained vehicle operators and maintenance personnel?
7. Have you reviewed labor agreements and/or work rules for barriers to changing crew size?
8. Have you considered reclassification of positions for operating automated equipment (and potential impacts on wages)?

Routes

1. Have you estimated the impact of collection containers on set-out rates and pounds collected per stop?
2. Have you developed area routes that optimize vehicle utilization?
3. Have you considered the impact of automation on the number of trips required to unload per day?

Containers

1. If containers for RSW or recyclables have been provided, are containers sized appropriately?
2. Do customers have the option to utilize smaller containers or receive second containers? Will rates be adjusted (e.g., PAYT fee system)?
3. Are alternate containers acceptable? Have customers been informed of set-out options?
4. Have container distribution, maintenance, repair, and replacement needs been evaluated? Will these services be provided by your staff or contracted?
5. Have you selected carts that are compatible with collection vehicles and lifter mechanisms?
6. Have you considered potential program changes (increases in diversion opportunities, implementation of PAYT fee systems, for example) on container size and type?
7. Have you developed a container tracking system?

Implementing Automation Systems

Semi-Automation

Austin, Texas*
- Implemented semi-automated RSW collection.
- Reduced RSW collection frequency.
- Reduced crew size (three-person crews to two-person crews).
- Added yard trimmings collection.

Rochester, New York
- Switched from manual rearload collection of RSW to semi-automated sideload collection.
- Decreased crew size (two-person crews to one-person crews).
- Implemented yard trimmings and recyclables collection programs.

Full Automation

Beaumont, Texas
- Switched from semi-automated RSW collection to fully automated sideload collection.
- Reduced collection frequency.
- Reduced crew size (two-person crews to one-person crews).
- Added yard trimmings and recyclables (biweekly) collection.

Edmond, Oklahoma*
- Switched from manual to fully automated RSW collection.
- Decreased collection frequency.
- Decreased crew size (2-person crews to 1-person crews).

Escambia County, Florida
- Switched from manual to fully automated RSW collection for most households.
- Collect approximately 6,000 households with semi-automated sideloaders–which primarily serve dead-end streets and small private roads.
- Reduced crew size (three-person crews to one-person crews).
- Implemented separate yard trimmings collection.

Glendale, California*
- Switched from manual rearload to fully automated sideload RSW collection.
- Added yard trimmings collection services.

Gottstown, New Hampshire
- Switched from manual to fully automated RSW collection.

Greensboro, North Carolina
- Switched from manual rearload to fully automated sideloaders for RSW collection.
- Decreased collection frequency.
- Decreased crew size (two-person crews to one-person crews).
- Added recyclables and yard trimmings collections.

Greenville, Mississippi
- Switched from manual to fully automated sideload collection for RSW.
- Reduced crew size (two-person crews to one-person crews).

Houston, Texas
- Replacing combination of manual rear- and sideload collection vehicles with fully automated RSW collection vehicles.
- Reducing RSW collection frequency.
- Reducing crew size (two-person crews to one-person crews).
- Implementing separate yard trimmings collection.

Indianapolis, Indiana
- Switched from manual rearload vehicles to fully automated sideload vehicles for RSW collection.
- Reduced collection frequency.
- Reduced crew size (three-person crews to one-person crews).
- Increased frequency of yard trimmings collection.

Jeckyll Island State Park, Georgia
- Replaced manual RSW collection with fully automated collection.
- Decreased collection frequency.
- Decreased crew size (three-person crews to one-person crews).
- Added yard waste collection.
- Switched from manual rearloaders to fully automated sideloaders.

* This community has a PAYT rate structure.

Implementing Automation Systems (Continued)

Kill Devil Hills, North Carolina
- Switched to automated sideloaders.
- Decreased crew size (three-person crews to one-person crews).

Lake Charles, Louisiana
- Switched from manual rearload collection to fully automated sideload collection of RSW.
- Decreased crew size (two-person crews to one-person crews).
- Added yard trimmings and recyclables collection.

Little Rock, Arkansas
- Switched from manual rearload collection to fully automated sideload collection for RSW.
- Decreased collection frequency.
- Decreased crew size (three-person crews to one-person crews).
- Implemented yard trimmings and recyclables collection.

Long Beach, California
- Replaced manual rearload fleet for RSW collection with fully automated sideloaders.
- Reduced crew size (two-person crews to one-person crews).

Los Angeles, California
- Switched from manual frontloaders for RSW collection to fully automated sideloaders.
- Decreased collection frequency.
- Implemented separate yard trimmings and recyclables collections.

Pasadena, California*
- Replaced backyard collection with curbside pickup.
- Switched from manual frontloaders to fully automated sideloaders for RSW collection.
- Reduced crew size (four-person crews to one-person crews).
- Added yard trimmings collection.

Pensacola, Florida
- Switched from manual rearload RSW collection to fully automated sideload collection.
- Decreased crew size (three-person crews to one-person crews).

Plano, Texas
- Replaced combination of alley (98 percent) and curbside (2 percent) service with curbside collection for RSW.
- Switched from manual sideload collection vehicles to semi-automated fleet (interim phase).
- In process of implementing fully automated sideload collection citywide.
- In the old system, combination of one- and two-person crews were used; one-person crews now used to staff fully automated vehicles.
- Decreased RSW collection frequency.
- Implemented recyclables collection.

Richland, Washington*
- Switched from combination of manual side- and rearload vehicles to fully automated sideload collection for RSW.
- Replaced combination of one- and two-person crews with one-person crews.

Toppenish, Washington
- Switched from manual rearload collection of RSW to fully automated sideload pickup.
- Decreased crew size (two-person crews to one-person crews).

Victorville, California
- Switched from manual sideloaders for RSW collection to fully automated sideloaders.
- Reduced RSW collection frequency.
- Implemented collection of recyclables (with automated equipment).

* This community has a PAYT rate structure.

Implementing Dual Collection

To meet rising concerns about costs and productivity and minimize the number of vehicles passing customers each day, dual collection vehicles—which allow for the collection of separated waste streams with a single vehicle in a single pass—are gaining in popularity.

This chapter addresses:

- Dual collection options.
- Impacts of dual collection.
- Applicability of dual collection.
- Listings of collection service providers who are using dual collection.

Dual Collection Options—What's Available?

To get a better idea of the variety of ways in which haulers and local governments are implementing dual collection, consider the following three experiences.

By The Bag In Loveland, Colorado

Prior to the implementation of dual collection, Loveland had manual collection of RSW with two-person crews. No separate collections for recyclables or yard trimmings were offered, and residents were charged a monthly flat rate for solid waste management services.

Loveland decided to change this collection system for a variety of reasons, including rising Workers' Compensation costs, a desire to provide curbside collection for recyclables, a desire to reduce risk of injury by decreasing set-out weights, and complaints from some citizens about the inequity of the flat-fee pricing structure.

Under its new dual collection system, Loveland uses vehicles produced by May Manufacturing. Chassis are fitted with manual rearloader bodies for RSW collection, and over-the-top loading compartmentalized bodies are used for

recyclables—a two-stream curb-sort approach (paper and containers). OCC is collected in both paper and container compartments, as well as in the space between the packer and recyclables bodies.

Loveland combined flat and PAYT fees (bag and tag system for RSW set-outs) and offered separate optional curbside collection of yard trimmings using semi-automated collection vehicles. The city also promoted its yard trimmings dropoff programs.

As a result of its new system, two-person crews continue to provide manual rearload collection, but set-out weights are decreased because of yard trimmings and recyclables separation. Forty percent of residential waste is diverted (through recyclables collection and yard trimmings separation). Loveland has witnessed a 6 percent increase in operational costs compared to its old system with no separation of recyclables or yard trimmings.

The city has saved an estimated $200,000 per year in direct operational cost savings over predicted costs of operating two fleets to collect RSW and recyclables. Loveland also has a 92 percent customer satisfaction rating.

Waste Management: Making "One Pass" In Oakland, California*

In parts of Oakland, Waste Management provides RSW, yard trimmings, and recyclables collection services; in other service areas of the city, only RSW and yard trimmings collections are handled by Waste Management vehicles and crews. The "One Pass" approach gives the private hauler flexibility to collect two or three streams at one time. How does it work?

Waste Management uses Kann vehicles of front-load design with special "work buckets." Work buckets are divided into two or three compartments. Vehicles are designed to collect:

- 3.5 tons of recyclables or 4 tons of yard trimmings per load.
- 5 tons of RSW per load.

RSW and yard trimmings are collected using wheeled carts (i.e., 30-, 60-, and 90-gallon containers). Semi-automated tippers dump carts into the work bucket. The vehicle body is split horizontally in two sections:

- A top compartment is designed to accept yard trimmings or recyclables.
- The top compartment is further split into two chambers that can hold separated paper and commingled container streams.
- A bottom compartment is designed for RSW.
- Compaction is used in all compartments.

In areas of Oakland where Waste Management provides all three collection services, recyclables and yard trimmings are collected on alternate weeks. One driver serves approximately 400 to 500 households per day. RSW, recyclables, and yard trimmings are all discharged at the same location—a transfer station with separate unloading areas for each collected material stream.

Vehicle maneuverability was an issue in some of Oakland's hilly areas where streets are too narrow for the dual collection equipment. As a result, noncompartmentalized rearloaders are used to collect set-outs in areas where a dual collection truck is inappropriate.

The switch to dual collection vehicles has been a success. Mike Ropers, Waste Management's maintenance manager, reports minimal mechanical problems with the new vehicles.

Patented Success: Visalia, California

In a unique public-private partnership, the city of Visalia and Ruckstell Equipment Sales teamed up to offer a dual collection system that relies on fully automated collection equipment. System features include a patented split cart with 110 gallons of total capacity divided into two equal compartments (55 gallons each) for RSW and recycables. Fully automated side-load Heil collection vehicles are modified with split hoppers and split bodies (dual compaction). Forty percent of the packer body is

*Source: *BioCycle*, July 1996

devoted to recyclables. The commingled recyclables are collected in the top chamber, and RSW is collected in the bottom chamber (60 percent of vehicle capacity).

Since implementing the dual collection system, Visalia has not experienced a significant increase in time required to serve households. Route sizes have also remained constant (i.e., approximately 900 households per route per day). Visalia implemented a separate fully automated yard trimmings collection service concurrently with the dual collection program. The estimated incremental increase in direct costs to add recyclables and yard trimmings is 2 percent. Visalia reports a 26 percent diversion of recyclables (excluding yard trimmings) in areas of the city where the dual collection program has been phased in.

Impact Of Dual Collection: Evaluating The Potential

The Palm Beach County, Florida, Solid Waste Authority undertook a pilot program with assistance from the American Plastics Council to test the cost-effectiveness of dual collection compared to the "traditional" approach of using two separate fleets to collect RSW and recyclables, using data collected from one community in Palm Beach County (Lake Worth, Florida). Results of the pilot program are presented in the table on page 38.

Using the regression models that were developed as part of the project and field data from the pilot program, the estimated time required to service a set-out using the dual collection vehicle was calculated to be 44 seconds per stop. The total time required to collect RSW and recyclables with a two-fleet approach was estimated to be 64.6 seconds per stop. Based on the combined effect of the factors listed below, dual collection was estimated to result in a 13 percent cost savings in the Lake Worth pilot:

- Low weights per RSW set-out in the pilot area (approximately 30 pounds per set-out).
- An average time on route of just 4.9 hours for the dual collection vehicle compared to a total of 9.2 hours for the RSW and recyclables collection vehicles (approximately 4.6 hours each).
- The decrease in total time required per stop to collect RSW and recyclables with the dual collection vehicle.

Will Dual Collection Work Everywhere?

Dual collection has several limitations:

- Sizing dual collection compartments and determining the appropriate level of compaction is a challenge. Compartments need to be sized so that the recyclables compartments and RSW compartments fill up at approximately the same rate. In addition, while some communities use compaction of recyclables to improve compartment utilization, the impacts on material quality need to be considered. In Washington, DC (where dual collection was pilot tested), the City's Public Works Department reported difficulty in finding the compaction level that would maximize route productivity but still maintain material quality.
- Many dual collection vehicles have longer wheelbases requiring a larger turning radius than many typical RSW or recyclables vehicles. They might not be usable on some routes with narrow roadways and dead-end streets. (Visalia's dual collection system is a notable exception. These vehicles can access and service any area that a regular automated truck can access.)
- Once dual collection vehicles are designed, retrofits are possible but difficult; therefore upfront program planning is essential. The addition of corrugated containers to Loveland, Colorado's recycling program, for example, presented operational challenges, because the original compartment sizing was designed for newspaper only in the fiber stream.

Remember, the current generation of dual collection programs is

Comparison Of Truck Productivity (Based On Households Served)

Lake Worth, Florida, Pilot Study

	RSW Only	Recyclables Only	Dual Collection
Time required to service one set-out	28.4 seconds	36.2 seconds	44.0 seconds
Set-outs served on first load	400	492	400
Set-outs served on second load	149	NA	NA
Total set-outs	549	492	400
Set-out rate	80.0%	52.4%	80.0%
Total route size (households)	687	939	500
Total scheduled work day	**8 hours**	**8 hours**	**8 hours**
Less:			
Truck set up, paperwork, breaks	1 hour	1 hour	1 hour
Yard to route (travel)	20 minutes	20 minutes	20 minutes
Net availability	**6 hours, 40 minutes**	**6 hours, 40 minutes**	**6 hours, 40 minutes**
Less:			
Time required to fill truck	3 hours, 9 minutes	4 hours, 57 minutes	4 hours, 53 minutes
Route to unload point	20 minutes	20 minutes	20 minutes
Time to weigh and unload	30 minutes	30 minutes	60 minutes
Balance available after 1st load	**2 hours, 41 minutes**	**53 minutes**	**27 minutes**
Less:			
Unloading point to route	20 minutes	NA	NA
Time required to service second load	1 hour, 11 minutes	NA	NA
Route to unload point	20 minutes	NA	NA
Time to weigh and unload	30 minutes	NA	NA
Unloading point to yard	20 minutes	20 minutes	20 minutes
Time left over	0 minutes	33 minutes	7 minutes
TOTAL - Time on route	**4 hours, 20 minutes**	**4 hours, 57 minutes**	**4 hours, 53 minutes**
TOTAL - Time off route	**3 hours, 40 minutes**	**3 hours, 3 minutes**	**3 hours, 7 minutes**

NA = Not applicable

Source: American Plastic Council Model Cities Project, as reported in "Co-collection: Is It a Viable Technique?" J. Burgiel (R. W. Beck, Inc.) and J. Greer (Solid Waste Authority of Palm Beach), *Resource Recycling*, June 1993.

still relatively new. Despite interest on the part of many public and private RSW collection systems, fewer than 100 dual collection systems were in operation in 1995.

Vehicle vendors and solid waste system planners continue to experiment with alternatives to dual collection. May Manufacturing's President, Jim May, agrees that while dual collection vehicles have tremendous potential, they might not be appropriate everywhere.

Is Your System A Good Candidate?

Dual collection is more applicable if your community has*:

- Low RSW generation.
- Low housing density.
- High driver and crew wages.
- High offroute time.
- High mileage to unload.
- High participation in recyclables collection.
- Processing and disposal locations are close (i.e., within 10 miles, typically).

Kicking The Tires

If you are thinking of implementing a dual collection system, you might want to talk to the experts—communities or haulers that are providing (or have tested) dual collection approaches.

Case Study

Dual Collection In Practice

Who?	What Type of Dual Collection?
Beaver's Disposal, California	• Split 110-gallon carts. • Split hopper and chamber. • Fully automated collection vehicles.
Chillicothe, Missouri	• Manual rearload for RSW. • Over-the-top sideloading compartments for recyclables. • Implemented variable rate pricing system and separate yard trimmings collection program as well.
Durham, North Carolina	• Semi-automated sideloader for RSW. • Curb-sort over-the-top sideloading compartments for recyclables. Note: Significant maintenance problems have crippled dual collection productivity.
Hughes Trash Removal, Maryland	• Tested dual collection on a very rural route. • Manual rearloading style for RSW. • Sideloading compartments for recyclables.
Loveland, Colorado	• Manual rearloader for RSW. • Over-the-top sideloading compartments for recyclables. • Implemented variable rates and separate yard trimmings collection program.
Oxnard, California	• 110-gallon split carts. • Fully automated collection. • Split hopper and chamber.
Pena Disposal, California	• 110-gallon split carts. • Split hopper and chamber. • Fully automated collection.
Visalia, California	• 110-gallon split carts. • Split hopper and chamber. • Fully automated collection.

*Source: American Plastics Council, Washington, DC, 1995.

Putting It All Together: Designing For Success

Changing a collection system requires setting clear goals, designing an appropriate program, and planning for addressing unanticipated challenges. Here are some tips for making the change:*

Goals

1. Provide levels of service that will meet health, regulatory, and community requirements.
2. Provide those services for the lowest possible cost.
3. Ensure that the collection system will be compatible with processing and disposal systems.
4. Design for flexibility to meet changing demands.
5. Design a system that encourages the achievement of public policy objectives (e.g., recycling and diversion goals).

Design Framework

1. Who are the customers and how should they be served? Do service requirements vary geographically or demographically within the service territory?
2. How many types of collection services should be offered?
3. How frequently should each type of collection service be provided?
4. What set-out requirements should be established?
5. What types of vehicles and equipment will be needed?
6. Who should be the service provider?
7. What impacts will the collection system design have on staffing needs and labor relations?
8. What are the institutional, administrative, educational, and customer service support implications of the collection system design?
9. Are the resources of both public and private sectors being used appropriately?

Planning For Change

1. Involve stakeholders in the process: the community at large, the media, elected officials, planning and administrative staff, and front-line workers and supervisors.

Source: "Planning a High Performance Collection System," *Waste Age*, 1993.

2. Expect resistance.
3. Develop comprehensive and consistent public awareness campaigns (make sure to address all stakeholders).
4. Consider both the benefits and drawbacks of conducting pilot programs and phasing in change over time.
5. Be prepared to respond to changes in public policy, customer attitudes, and technology.
6. Develop a systems orientation—avoid "jumping out of the frying pan and into the fire" by carefully considering how collection systems integrate with each other and other elements of the MSW management system (e.g., transferring, processing, and disposal).

Resources

Numerous communities across the country have used the strategies described in this workbook to improve the efficiency of their collection programs. For more information about implementing a particular strategy, contact the following communities:

Changing Collection Frequency

City of Greensboro, NC
P.O. Box 3136
Greensboro, NC 27402
Contact: Elizabeth Treadway
Phone: 336 373-2867

City of Indianapolis, IN
200 East Washington Street
City/Cty Building, Suite 2460
Indianapolis, IN 46204-3357
Contact: Charles Bardonner
Phone: 317 327-7866

City of Jacksonville, FL
1031 Superior Street
Jacksonville, FL 32254
Contact: Fred Forbes
Phone: 904 387-8922

City of Little Rock, AR
701 West Markham
Little Rock, AR 72201
Contact: Chandra Russell
Phone: 501 371-4475

City of Memphis, TN
125 North Main Street
Room 628
Memphis, TN 38103
Contact: Eddie Yaun
Phone: 901 576-6851

City of Mesa, AZ
Solid Waste and Facilities
Box 1466 or 300 East Sixth Street
Mesa, AZ 85211-1466
Contact: Jack Friedline
Phone: 602 644-4567

Improving Routing

City of Charlotte, NC
SWS /Admin-7th Floor
600 East Fourth Street
Charlotte, NC 28202
Contact: Wayman Pearson
Phone: 704 336-2176

Miami-Dade County, FL
8675 NW. 53rd Street, Suite 201
Miami, FL 33166
Contact: Deborah Higer
Phone: 305 594-1567

Town of Hempstead, NY
1600 Merrick Road
Merrick, NY 11566
Contact: Richard T. Ronan, PE
Phone: 516 378-4210, Ext. 306

City of Norman, OK
P.O. Box 370
Norman, OK 73070
Contact: Tommy McCarrell
Phone: 405 329-1023

Automating RSW Collection

City of Chesapeake, VA
912 Hollowell Lane
Chesapeake, VA 23320
Contact: Mike Spears
Phone: 759 382-6136

City of Greensboro, NC
P.O. Box 3136
Greensboro, NC 27402
Contact: Elizabeth Treadway
Phone: 336 373-2867

City of Indianapolis, IN
200 East Washington Street
City/Cty Building, Suite 2460
Indianapolis, IN 46204-3357
Contact: Charles Bardonner
Phone: 317 327-7866

City of Little Rock, AR
701 West Markham
Little Rock, AR 72201
Contact: Chandra Russell
Phone: 501 371-4475

City of Rochester, NY
210 Colfax Street
Rochester, NY 14006
Contact: Lou Guilmette
Phone: 716 428-6512

Dual Collection

City of Loveland, CO
200 North Wilson
Loveland, CO 80537
Contact: Mick Mercer
Phone: 970 962-2530

City of Visalia
Solid Waste Fleet Services
366 North Ben Maddox Way
Visalia, CA 93292
Contact: Tom Baffa
Phone: 209 738-3569

A Computerized Worksheet That Helps MSW Managers Estimate the Benefits and Costs of Collection System Changes

Having trouble determining the impact of collection system changes? Help is just a few keystrokes away!

SWANA developed a free, user-friendly computerized collection worksheet that will generate route requirements for any given system. The Windows-based program includes pop-up help boxes and guides users step-by-step through data gathering and all necessary calculations. The program allows MSW managers to estimate the cost and labor savings of making almost any system change (e.g., increasing levels of automation, changing vehicle size, changing collection frequency, or redesigning curbside collection routes). The automated worksheet is available on two 3-1/2 inch computer disks along with instructions for installing the software and running the worksheet program.

To order the free software, or for more information, please contact SWANA, Technical Services, P.O. Box 7219, Silver Spring, MD, 20907-7219. Phone: 301 585-2898. Fax: 301 589-7068. E-mail: <technical@swana.org>. You also can order the automated worksheet via mail by returning this form to the address printed on the reverse. Simply fill in your mailing address below, fold the page where indicted, seal, affix proper first-class postage, and drop it in the mail.

Mailing Address:

Name: _____

Title: _____

Organization: _____

Street Address: _____

_____

City: _____ State: _____ Zip: _____

Place
Stamp
Here

SWANA, Technical Services
SWANA
P.O. Box 7219
Silver Spring, MD 20907-7219

APPENDIX B

Example (draft) Recycling Problem Notice

FRONT

DRAFT

CONSHOHOCKEN BOROUGH

RECYCLING PROBLEM NOTICE

Service Address: _____

Inspector's Signature: _____ Date: _____

Your recycling container was not emptied because:

____ Trash is in the container.

____ Newspapers mixed in container with bottles and cans.

____ Newspaper needs to be bundled or bagged.

____ Wrong items in recycling container.

____ Other: _____

_____

_____

The recycling container is to be used for bottles and cans (rinsed out) only.

THANK YOU FOR YOUR COOPERATION.

Service Address: _____

Inspector Initials: _____ **Date:** _____

BACK

DRAFT SAMPLE ORDINANCE INFORMATION
(Information must be customized and finalized by Borough)

§205. SEPARATION

All persons who occupy residences in the Borough shall separate from municipal waste generated by the use and occupancy of said residences, the following source separated recyclable materials:

A. Newspaper. Such newspaper shall be tied or otherwise secured in bundles, e.g. paper shopping bags, which shall not exceed 25 pounds in weight.

B. Clear, Colorless Glass. Such glass shall be free of food waste and placed in a designated recycling container issued by the Borough.

C. Aluminum Cans. Such cans shall be free of food waste and placed in a designated recycling container issued by the Borough.

D. Leaf Waste. Such leaf waste shall be stored on the property upon which a residence is located until the Borough schedules a leaf waste collection. This subsection shall not prevent the composting of leaf waste on said property for personal use. (Include leaf waste definition as recommended in report)

§206. COLLECTION

A. Public notice shall include, but not be limited to, notification to persons occupying residences within the Borough of the designated days when each of the source separated recyclable materials shall be collected in the Borough.

B. Nonseparated Municipal Waste. Any municipal waste containing source-separated recyclable materials shall not be collected by the Borough.

Violators can be sentenced to pay up to a $1,000.00 fine.

APPENDIX C

Draft Commercial Report Form

DRAFT

2500-FM-LRWM0013.3 Rev. 6/2005

ANNUAL COMMERCIAL RECYCLING REPORT

CALENDAR YEAR _____

Businesses, schools, colleges, universities and other commercial and institutional establishments in _____ are required by State law and the Borough Ordinance to recycle. This form has been provided by the _____ to obtain recycling totals from your establishment so that recycling information can be reported to _____ County. **Please complete this form and return to _____ (Attn: _____) on or before _____.**

NAME OF BUSINESS/ESTABLISHMENT _____ **CONTACT PERSON** _____

ADDRESS _____

MUNICIPALITY _____ **COUNTY** _____ **PHONE #** _____

1. What type of business do you operate?

   ☐ Manufacturing

   ☐ Wholesale/Retail

   ☐ Other: _____

2. Where was the material you recycled generated? (Check all that apply)

   ☐ Food service ☐ Maintenance ☐ Retail Operations

   ☐ Lunchroom ☐ Offices ☐ Shipping/Receiving

   ☐ Mail Room ☐ Print Shop ☐ Warehouse

   ☐ Other: _____

3. Who collects/markets your recyclables?

   Name of Business _____

   Contact: _____ Phone # _____

On the reverse side of this report, please record by category the amount(s) of **Post Consumer Materials** that your business separated for recycling. Please list the amount in **TONS**. These weights should be available to you from your recyclable collector or market. Attach to this form any weight receipts or collection report(s) you received as verification of the amount of material you recycled **OR** have your recycling collector/market sign this form to verify its accuracy. Submit this form to your local municipality's recycling office.

I hereby certify that the amount(s) of recyclable materials listed in this report are to the best of my knowledge complete and accurate.

_____ _____

Signature of Recycling Collector Date

Please list the amount of Post-Consumer recyclable materials generated from your business for the calendar year which has just passed.

		Tons
1.	Old Newsprint	
2.	High Grade Office Paper	
3.	Corrugated	
4.	Other Marketable Grades of Paper:	
	Magazines	
	Telephone Directories	
	Other: _____	
	Other: _____	
5.	Aluminum Cans	
6.	Steel/Bimetal Cans	
7.	Amber Glass	
8.	Clear Glass	
9.	Green Glass	
10.	PET Plastics	
11.	HDPE Plastics	
12.	Other Plastics:	
	LDPE	
	PVC	
	PP	
	PS	
	Other: _____	
13.	Commingled (Any of the above)	
14	Single Stream	

		Tons
15.	Food Wastes	
16.	Other Glass	
17.	Major Appliances	
18.	Other Ferrous	
19.	Other Non-Ferrous	
20.	Textiles	
21.	Mattresses	
22.	Tires	
21.	Wood	
	Wood Packaging	
	Other: _____	
23.	Yard Trimmings	
	Brush & Branches	
	Grass	
	Leaves	
	Tree Stumps	
24.	Automotive	
	Antifreeze	
	Lead Acid Batteries	
	Oil Filters	
	Tires	
	Used Motor Oil	
25.	Electronics	
	Circuit Boards	
	Computer Monitors & TVs	
	Consumer Electronics	
	Flourescent Tubes	
26.	Household Hazardous Waste	
27.	Other Recyclables:	

_____

_____

Comments:

Pre-Consumer Materials refer to materials generated in manufacturing and converting processes such as manufacturing process scrap and trimmings/cuttings. Also, print overruns, overissue publications, and obsolete inventories that did not leave the generating facility would be classified as pre-consumer materials. These materials should not be included in the above totals.

Post-Consumer Materials refer to recovered materials that have been used as a consumer item and are diverted from municipal solid waste for the purpose of collection and recycling. The term excludes materials from industrial processes that have not reached the consumer, such as overissues of newspapers or magazines and industrial process scrap.