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In-Depth Studies of Recycling and Composting Programs:

Designs, Costs, Results

Volume I: Rural Communities

This work was performed for USEPA by the Institute for Local Self-Reliance. The Institute for Local Self-Reliance (ILSR), a nonprofit research and educational organization, provides technical information and assistance to city and state government, citizen and neighborhood organizations, and industry.

In-Depth Studies of Recycling and Composting Programs: Designs, Costs, Results; Volume I - Rural Communities, Volume II - Suburbs and Small Cities, and Volume III - Urban Areas is part of an ongoing series of technical reports prepared by the ILSR staff. For more information on the Institute's philosophy, publications, and practice, write:

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ILSR made dozens of phone calls to state and local recycling coordinators, solid waste professionals, recyclers, and local decision makers in order to identify communities to document. The assistance of these individuals was invaluable in getting this project off the ground. Approximately 100 surveys were sent to key contact people.

Although most information for the report came from municipal recycling coordinators and Superintendents of Public Works, ILSR also made calls to local landfills, private refuse haulers, processing centers, composting facilities, county and state solid waste officials, and local political leaders to fill in our knowledge about various communities' recycling and composting programs.

In addition to the contacts listed in the case studies included in this report, people in the following communities provided information on their materials recovery programs: San Diego, California; Longmont, Colorado; Hartford and Manchester, Connecticut; Dade County and Orlando, Florida; Barrington, Princeton, Urbana, and Woodstock, Illinois; Chelmsford, Hilltown Cooperative, Longmeadow, and Springfield, Massachusetts; Ann Arbor, Michigan; Lexington, Durham and Wilmington, North Carolina; Haddonfield, Park Ridge, Cherry Hill, and Woodbury, New Jersey; Hamburg, Ithaca, and Ulster County, New York; Barrington, Rhode Island; and Burlington, Vermont.

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Abbreviations

ANJR — Association of New Jersey Recyclers
BFI — Browning Ferris Industries
CCA — Container Corporation of America
C&D — construction and demolition
C-E — Combustion Engineering
CEI — Citizens for Environmental Improvement
CFC's — chlorofluorocarbons
CMCMUA — Cape May County Municipal Utilities Authority
comm — commercial
CRC — Community Rehabilitation Center
CSWMB — California Solid Waste Management Board
CSWMP — Comprehensive Solid Waste Management Plan
cy — cubic yard
DEM — Department of Environmental Management
DEQ — Department of Environmental Quality
DO — drop-off
DPW — Department of Public Works
EDF — Environmental Defense Fund
ENCORE — Environmental Container Reuse
EPA — Environmental Protection Agency
F — Fahrenheit
FY — fiscal year
HDPE — high density polyethylene
ILSR — Institute for Local Self-Reliance
instit/inst — institutional
IPC — intermediate processing center
IPF — intermediate processing facility
lb — pound
LDPE — low density polyethylene
MARC — Monroe Area Recycling Committee
MRF — materials recovery facility
MSW — municipal solid waste
NA — not available
NHRRA — New Hampshire Resource Recovery Association
NoCAL — Northern California
O&M — operating and maintenance
PCB — polychlorinated biphenyl
PET — polyethylene terephthalate
PP —polypropylene
PS — polystyrene
PSE&G — Public Service Electric and Gas
PVC — polyvinyl chloride

REA — Richmond Environmental Action
RFP — request for proposal
RRT — Resource Recycling Technologies
SRMG — Sound Resource Management Group
SWA — Solid Waste Authority
SWAC — Solid Waste Advisory Commission
SWMA — Solid Waste Management Authority
SWMP — Solid Waste Management Plan
TURF — Total Urban Recycling Facility
UC — University of California
WMI — Waste Management, Inc.

Sample Conversion Factors

Waste generation rates used in this report are based on tonnage figures provided by recycling coordinators and other local officials, who may have estimated the data or relied on other sources, such as private haulers. In a few instances, ILSR staff obtained tonnage data directly from the private sector. Communities, in several cases, measure materials in cubic yards and use conversion factors to calculate tonnage figures. When local conversion factors were unavailable, ILSR staff estimated tonnage recovered using commonly accepted conversion factors. Sample conversion factors utilized in this report are listed below.

MIXED MSW (compacted)

Conversions Used By Communities:

785 lbs/cy (0.39 tons/cy) or 2.55 cy/ton
Source: *Solid Waste Management Plan Revision,* Sonoma Co., CA, May 1990.

667 lbs/cy (0.33 ton/cy)
Source: Naperville, IL

Conversions Found in the Literature:

500 - 700 lbs/cy (0.25 - 0.35 tons/cy) or 2.8 - 4 cy/ton
Source: *Solid Waste Data: A Compilation of Statistics on Solid Waste Management Within the United States,* US EPA, August, 1981.

600 lbs/cy (0.3 tons/cy) or 3.3 cy/ton
Source: *Association of New Jersey Recyclers (ANJR), Directory,* 1987.

MIXED MSW (uncompacted)

200 lbs/cy
Source: *Solid Waste Data: A Compilation of Statistics on Solid Waste Management Within the United States,* US EPA, August 1981.

MIXED YARD WASTE (average compaction)

Conversions Found in the Literature:

600 lbs/cy
Source: *Yard Waste Composting,* US EPA, April 1989.

Conversions Used By Communities:

620 lbs/cy
Source: Recycled Wood Products, Berkeley, CA

650-750 lbs/cy
Source: Portland, OR

660 lbs/cy
Source: West Palm Beach, FL

MIXED YARD WASTE (loose)

200-250 lbs/cy or 9 cy/ton
Source: Portland, OR

LEAVES (average compaction)

500 lbs/cy (320 - 500 lbs/cy)
Source: *Yard Waste Composting -- A Study of Eight Programs*, US EPA, April 1989.

450 lbs/cy
Source: *ANJR Directory*, 1987.

1,000 lbs/cy
Source: New Jersey Department of Environmental Protection

LEAVES (vacuumed)

700 lbs
Source: New Jersey Department of Environmental Protection

LEAVES (loose)

250 - 350 lbs/cy
Source: *ANJR Directory*, 1987.

CHIPPED BRUSH

500 lbs/cy
Source: National Recycling Coalition, 1989

COMPOST (finished)

1,500 lbs/cy
Source: *Yard Waste Composting*, US EPA, April, 1989.

CHRISTMAS TREES

20 lbs/tree
Source: *Summary of County-Wide Christmas Tree Recycling Project 1990-1991*, Garbage Reincarnation, Inc., Sonoma Co., CA.

15.1 lbs/tree
Source: Dakota County, MN

FOOD WASTE

500 lbs/cy (residential)
800 - 1000 lbs/cy (commercial)
Source: Suhr, J.L., Higgins, A.J. and Derr, D.A., *Feasibility of Food Waste Recycling in New Jersey: Fourth Quarterly Report to the Office of Recycling*, 1984.

900 lbs/cy (commercial)
Source: *Asheville/Buncombe County Solid Waste Alternatives: Planning Workbook*, ILSR, March 1985.

WATER

8.345 lbs/gal
Source: Lindeburg, Michael R., *Engineering Unit Conversions, 2nd ed.*, 1990.

USED MOTOR OIL

7 lbs/gal (6.5 - 7.5 lbs/gal)
Source: *ANJR Directory*, 1987. Range was arrived at by converting API gravity for 25-50% crude oil to specific gravity (*Perry's Chemical Engineers' Handbook, 6th ed.*).

CONCRETE/ASPHALT (broken)

1.5 tons/cy
Source: American Rock and Asphalt, Richmond, CA.

Introduction

The Institute for Local Self-Reliance (ILSR) prepared this report of 30 U.S. recycling and composting programs under a grant from the U.S. Environmental Protection Agency (U.S. EPA). Under Phase I of this project, the ILSR gathered data on source-separation recycling and composting programs of 30 communities. This included program characteristics, waste generation and recovery tonnages, materials recovery rates, and equipment and operating and maintenance costs.

As the performance of established recycling and composting programs improves, and as newer programs benefit from their experience, the country's learning curve on materials recovery is accelerating. Nevertheless, communities continue to need detailed information about the quantities of waste they generate, how much of this they can recover, and the costs this entails. Such data are useful not only to evaluate one's own performance and progress, but also as a way to compare oneself to others.

The Institute has been working to fill this information gap. Our reports *Beyond 25 Percent: Materials Recovery Comes of Age* (1989) and *Beyond 40 Percent: Record-Setting Recycling and Composting Programs* (1990) detail how 24 communities are recovering between 24 and 57 percent of their waste streams. We produced these reports for two reasons: (1) to share the experience of the pioneers with those just starting up programs, and (2) to encourage communities to refine our methodology and improve their own data gathering. This report, *In-Depth Studies of Recycling and Composting Programs: Designs, Costs, Results,* continues to meet these objectives, while expanding our data base of outstanding recycling programs.

During fall 1990, Institute staff surveyed hundreds of recycling coordinators and solid waste managers by telephone and mailed nearly 100 written questionnaires. Based on the responses we received, the ILSR and EPA staff selected 26 municipalities and 4 counties to document for this study. Seven of these localities had been included in *Beyond 40 Percent.*

Almost half of the communities in this compendium were chosen because of their high recovery levels (either in the residential, commercial, or construction and demolition debris sector). Other communities were selected on the basis of location, population density, or model program characteristics such as source reduction initiatives, food waste recovery, or salvage/reuse operations. To facilitate comparisons and discussion of the factors that have led to successful programs, we also included several communities whose recovery levels had remained low over a number of years . Communities selected for study represent a balance of program characteristics: public and private collection, segregated and

commingled set-out, sorting en route and sorting at an intermediate processing center, curbside and drop-off, bottle bill locales, mandatory and voluntary participation, volume-based and flat refuse rates.

The table on the following page lists the 30 communities documented in this report, their populations, and their residential, commercial/institutional, municipal solid waste, and total waste recovery levels. We gathered and documented data using a uniform methodology so as to facilitate comparison and make the information accessible. (See section on Data Definitions and Case Study Format.) This report presents detailed data in case study format in three volumes: *I: Rural Communities; II: Suburbs and Small Cities;* and *III: Urban Areas.*

Volume I: Rural Communities details the characteristics of eight rural recycling and composting programs, including one county program. It presents information for planning and evaluating rural programs such as descriptions of model drop-off centers, salvage/re-use operations, co-collection (collecting refuse and recyclables together), small-scale/low technology processing centers, food waste recovery programs, and collective marketing techniques.

Volume II: Suburbs and Small Cities documents 12 programs in suburbs and cities with populations under 100,000, including two county programs. It describes successful residential curbside recycling programs, comprehensive composting programs (including backyard composting), commercial and institutional recycling initiatives, and multi-unit collection programs.

Volume III: Urban Areas covers 10 urban locales, including one county program. It provides information for designing successful recycling and composting programs in high-density urban areas. These include residential curbside collection programs that target multi-unit and apartment buildings, commercial and institutional recycling and composting, food waste collection, construction and demolition debris recovery, and materials processing and marketing.

Under Phase II of this project, the ILSR is producing a report summarizing and analyzing the data gathered and documented under Phase I. This accompanying report will detail how communities can maximize recovery rates by integrating the best features of the best programs.

Selected Recycling and Composting Programs

Community	Population	Year Data Collected	Residential Recovery Rate	Commercial Recovery Rate	MSW Recovery Rate	Total Recovery Rate
Volume I: Rural Communities						
Bowdoinham, ME	2,189	FY90	NA	NA	54%	53%
Fennimore, WI	2,378	1990	51%	25%	38%	NA
La Crescent, MN	4,305	1990	41%	9%	29%	41%
Monroe, WI	10,220	1989	32%	27%	28%	50%
Peterborough, NH	5,239	1990	42%	4%	19%	18%
Sonoma County, CA	388,222	1990	15%	10%	11%	11%
Upper Township, NJ	10,861	1990	50% *	34% †	NA	43%
Wapakoneta, OH	9,214	9/89-8/90	NA	NA	20%	NA
Volume II: Suburbs/Small Cities						
Berlin Twnshp, NJ	5,620	1990	56%	61%	57%	NA
Boulder, CO	88,000	1990	33%	12%	22%	16%
Columbia, MO	69,101	FY90	11%	NA	NA	13%
Dakota County, MN	274,016	1990	29%	24%	28%	NA
King County, WA	991,060	1990	19%	36%	30%	NA
Lafayette, LA	90,000	FY90	13%	8%	11%	NA
Lincoln Park, NJ	10,978	1990	49%	70%	62%	NA
Naperville, IL	85,351	1990	32%	NA	NA	NA
Perkasie, PA	7,878	1990	52%	NA	NA	NA
Takoma Park, MD	16,900	1990	36%	NA	NA	NA
West Linn, OR	16,557	1990	NA	NA	50%	46%
West Palm Beach, FL	62,530	4/90-3/91	22%	0%	13%	12%
Volume III: Urban Areas						
Austin, TX	465,622	FY89	7%	NA	NA	15%
Berkeley, CA	102,724	FY91	NA	NA	22%	38%
Lincoln, NE	191,972	1990	3%	25%	12%	52% ‡
Mecklenburg Co., NC	511,433	1990	7%	22%	16%	NA
Newark, NJ	275,221	1989	10%*	46% †	NA	30%
Philadelphia, PA	1,633,826	FY90	6% *	16% †	12%	11%
Portland, OR	440,000	1990	NA	NA	33%	NA
Providence, RI	160,728	1990	10%	13%	11%	NA
San Francisco, CA	723,959	1990	37%	18%	26%	27%
Seattle, WA	516,259	1990	45%	40%	40%	NA

Key: FY = fiscal year MSW = municipal solid waste NA = not available

Notes: Total waste is the sum of municipal solid waste and construction and demolition (C&D) debris. Recovery rate include material recycled and composted. MSW Recovery Rate may take into account tonnages that cannot be broken down into commercial and residential, such as bottle bill tonnages or landscapers' waste. All recovery rates represent proportions by weight.

* Publicly collected waste.

† Privately collected waste.

‡ Based on 133,167 tons of C&D utilized as landfill cover. If this tonnage is excluded from waste recovered and disposed, recovery rate drops to 30%.

Case Study Format and Data Definitions

Each case study in this report is divided into several parts: Demographics, Solid Waste Generation and Recovery, Materials Recovery Overview, Recycling Activities, Composting Activities, Amount and Breakdown of Materials Recovered, Education and Publicity, Economics, and Future Solid Waste Management Plans. While tonnage and economic data are generally based on 1990, descriptions of program characteristics may reflect changes made since. This section's figures explain the data that we have gathered and documented, and how we define certain terms. The first part of this section defines terms used throughout these case studies. These definitions apply to this report only. The second part of this section explains what information is contained in each section of the case studies.

Data Definitions

Collection Capital Costs — costs of acquiring equipment used to collect recyclable or compostable materials.

Commercial/Institutional Waste Recovered, Disposed, and Generated — the annual tonnage of waste recovered, disposed, and generated by the commercial and institutional sectors (excluding medical wastes). The commercial sector includes theaters, retail establishments, hotels, and restaurants. The institutional sector includes hospitals and schools.

Composted Waste — discarded organic materials processed into a soil amendment, fertilizer, and/or mulch.

Composting — recovering discarded organic materials for processing into a soil amendment, fertilizer, and/or mulch.

Construction and Demolition (C&D) Debris Recovered, Disposed, and Generated — the annual tonnage of waste recovered, disposed, and generated as a result of construction and demolition activities. This waste may include concrete, asphalt, tree stumps and other wood wastes, metal, and bricks. (While C&D waste often burdens municipal solid waste collection and disposal systems, the U.S. EPA and the National Recycling Coalition and this report exclude C&D debris from the definition of municipal solid waste.)

Deposit Containers Recycled — the annual tonnage of beverage containers recycled as a result of state or local bottle bills.

Disposed Waste — waste landfilled or incinerated.

Generated Waste — sum of waste recovered and waste disposed.

Intermediate Processing — preparing collected recyclable materials for end-use manufacturing. Processing typically includes sorting, contaminant removal, and crushing or baling.

Mandatory — whether citizens are required to source-separate materials for recycling. In several communities, citizens may be required to set out certain materials at curbside for recycling. In others it may simply be illegal to set these out with refuse. Not all materials collected are designated as mandatory.

Municipal Solid Waste (MSW) Recovered, Disposed, and Generated — sum of residential and commercial/institutional wastes recovered, disposed, and generated. In some cases, MSW also includes deposit containers recovered, yard waste composted from landscapers, and waste self-hauled to disposal and recovery facilities. MSW excludes construction and demolition debris.

Participation Rate (%) — the portion of households served that take part in the curbside collection program for recyclable materials. Refer to the case studies for an explanation of the specific method of calculation.

Private Sector Waste — waste collected by private haulers independent of the public sector.

Processing Capital Costs (Composting) — costs of acquiring equipment used to process—compost, chip, or mulch—organic materials. Processing or composting equipment typically includes shredders or chippers and front-end loaders.

Processing Capital Costs (Recycling) — costs of acquiring equipment used to process recyclable materials in preparation for marketing to end users. Processing typically includes sorting, contaminant removal, and crushing or baling.

Public Sector Waste — waste collected by public crews or by private haulers under public contract.

Recovered Waste — sum of waste recycled and waste composted.

Recycled Waste — discarded products and packaging materials recovered for reuse and/or processing into new products.

Recycling — recovering discarded products and packaging materials for reuse and/or processing into new products. In this report, recycling does not include composting.

Refuse — waste destined for disposal facilities (incinerators or landfills).

Residential Waste Recovered, Disposed, and Generated — the annual tonnage of waste recovered, disposed, and generated from single-family and multi-unit residences and their yards. In Bowdoinham and Wapakoneta, residential waste cannot be separated from commercial/institutional waste. The definition of residential waste generated differs for Wapakoneta.

Self-hauled Waste — waste brought to recovery or disposal sites by residents or business/institutional establishments. This waste cannot be divided into residential and commercial/institutional.

Source Reduction — waste prevention; that is, avoiding waste generation.

Source Separation — segregation of recyclable materials or yard waste from mixed waste to facilitate recycling and composting of these materials.

Tipping Fees — the fees charged to haulers for delivering materials at recovery or disposal facilities.

Total Waste Recovered, Disposed, and Generated — the sum of MSW and C&D recovered, disposed, and generated.

Information in Case Studies

Demographics

The first page of each case study contains basic demographic information on the community: 1990 population, area, number of households, and number of businesses and institutions. Also included is a brief description of each community detailing, when information is available, its location; whether it is urban, rural, or suburban; per capita income; median household income; and major industries.

Solid Waste Generation and Recovery

This section provides tonnage data on waste recycled, waste composted, and waste generated; tipping fees at disposal facilities; and a description of how waste destined for disposal (refuse) is collected and disposed, and the costs of doing so.

Tonnage data, reported in table format, generally represent 1990 annual figures, unless noted otherwise, and are usually broken down into three sectors: residential, commercial/institutional, and construction and demolition (C&D) debris. In some cases, tonnage figures cannot be broken down by these sectors, and data are presented in a modified format.

In Bowdoinham and Wapakoneta, municipal solid waste is presented as a single sum because it cannot be broken down into residential and commercial.

In Sonoma County, waste self-hauled to disposal or recovery facilities is listed separately from residential and commercial wastes, since this tonnage cannot be broken down by sector. In several case studies, deposit containers recovered as a result of bottle bills and landscapers' waste composted are listed separately, since these wastes cannot be divided into residential and commercial tonnages.

C&D tonnage figures are not tracked and thus not available in Fennimore and Wapakoneta. Footnotes accompanying tables clarify how numbers are calculated or estimated, where applicable, what numbers represent, and what, if any, waste may be excluded. Tonnage figures for waste recycled and composted are based on those reported in the Amount and Breakdown of Materials Recovered section.

Materials Recovery Overview

This section provides an overview of the community's recycling and composting activities, including history and development of programs, and state and local legislative requirements.

Recycling Activities

This section details curbside and drop-off collection programs for recyclable materials for both the residential and commercial/institutional sectors, and details how these materials are set out, processed, and marketed. Where applicable, information on salvage/reuse activities, construction and demolition debris recovery, market development, and recycled product procurement initiatives are also included.

Composting Activities

This section details curbside and drop-off collection programs for yard waste and other organic materials, and how these collected materials are composted, chipped, mulched, or otherwise processed into a soil amendment. Where applicable, information on backyard composting programs is also included.

Amount and Breakdown of Materials Recovered

This section lists, in table format, a tonnage breakdown of residential, commercial/institutional, and construction and demolition materials recycled and composted by type. The tables list subtotals for MSW recycled and composted, totals for MSW recovered and C&D debris recovered, and finally total materials recycled, composted, and recovered. Where available, several years' worth of data are provided.

Footnotes accompanying tables clarify, where applicable, how numbers are calculated or estimated, what numbers represent, and what, if any, waste may be excluded.

Source Reduction Activities

This section describes, where applicable, any initiatives undertaken to reduce the amount of waste generated. Generally, initiatives include volume-based refuse rates, "environmental shopping" programs, and backyard composting.

Publicity and Education

This section details what programs are in place to educate citizens and/or commercial/institutional establishments about recycling services—how and where to recycle—and to motivate them to do so.

Economics

This section primarily provides information on capital equipment and operating and maintenance costs. The **Costs Cover** subsection explains what costs are provided, who incurs these costs, and the programs and tonnages these costs cover. Materials revenues, source of funding, and the number of full- and part-time employees working on recycling and composting activities are also detailed.

Capital costs are generally listed in two tables: one lists equipment used for collection, and the other lists equipment used for processing. (Processing recyclables typically includes sorting, contaminant removal, and crushing or baling. Processing yard waste and other organic materials consists of composting, chipping, or mulching; equipment for this purpose typically includes shredders or chippers and front-end loaders.) Both these tables indicate the year equipment costs were incurred and the purpose for which equipment is used—whether recycling or composting. If equipment is used for several purposes, an estimated percentage of its time spent on recycling or composting is indicated; costs listed represent the total cost of this equipment. Footnotes accompanying tables clarify who owns equipment, whether equipment has been paid off, whether it was amortized, and/or whether it was owned prior to implementation of recovery programs.

Operating and maintenance (O&M) costs represent annual costs as provided by each community and are broken down into recycling costs and composting costs. These costs generally represent the costs incurred by the local government of the community documented, and do not always reflect all the costs spent for recycling and composting activities. For example, the State of Rhode Island, not the City of Providence, pays for processing costs in Providence. Additional costs are often listed in table footnotes. In some of the county case studies, we cannot calculate per ton costs for recycling or composting because these counties incur costs only for certain aspects of the program, such as planning and education/publicity.

Communities were asked to provide total O&M costs for their recycling and composting operations, including collection, processing, administration and overhead, all labor, and education and publicity costs. Where available, these breakdowns are provided. In many instances, curbside collection costs are separated from drop-off costs, so these two can be compared. The costs for curbside collection, drop-off collection, and processing often cover different tonnages. The tons covered by the costs are listed in the operating and maintenance cost table, and are used to calculate per ton O&M costs. Because costs for different activities cover different tonnages, the provided breakdowns of per ton costs cannot necessarily be added together. Footnotes accompanying O&M cost tables clarify who incurs costs, on

what cost figures are based, what costs, if any, are excluded, and, where applicable, how costs are calculated.

Future Solid Waste Management Plans

This section describes solid waste management initiatives that each community plans to undertake in the future.

Contacts, References, and Endnotes

The names, titles, organizations, addresses, and phone/fax numbers are listed for those people who were the primary sources of information on the community's recycling and composting activities. Under References, we list any written materials that we used as general sources of information. Endnotes give sources of information or clarifications for a particular statement.

Bowdoinham, Maine

Demographics

Jurisdiction:	Town of Bowdoinham
Population:	2,189 in 1990
Area:	23 square miles
Total Households:	Approximately 880 (850 single-family residences and one 30-unit building)
Total Businesses and Institutions:	15 businesses (there are no institutions)
Brief Description:	Bowdoinham is a small rural, residential community located in Sagadahoc County, 30 miles north of Portland. Per capita income was $10,809 in 1987 (the most recent year for which figures are available).

Solid Waste Generation and Recovery

Annual Tonnages (July 1989 to June 1990)

	Total MSW*	Construction & Demolition†	Total Waste
Recovered	**329**	‡	**329**
Recycled‡	261	0	261
Composted	68	0	68
Disposed**	**277**	**12**	**289**
Incinerated††	27	12	39
Landfilled	250	0	250
Generated	**606**	**12**	**618**

Percent by Weight Recovered

Recovered	**54%**	‡	**53%**
Recycled	43%	‡	42%
Composted	11%	0%	11%

*Total MSW includes residential and commercial waste self-hauled or delivered by local haulers to the Town landfill and Recycling Barn; the Town does not track tonnages separately.

†Bowdoinham's construction and demolition debris (C&D) is either burned at the landfill or used to heat the Recycling Barn. A small amount of C&D such as cinder blocks and bricks is salvaged by local residents at the landfill.

‡Recycled tonnage includes 43 tons of deposit containers, based on a State estimate that 7 percent of total waste generated is recovered through the State bottle bill, an estimated 2 of these tons were recovered through the Recycling Barn.

**Tonnage of municipal solid waste (MSW) disposed was estimated from cubic yards (cy) by the Town Solid Waste Manager, using a conversion factor of 250 pounds per cubic yard. This conversion factor is based on weighing a 6 cy load of refuse in the Town dump truck, three times during 1990.

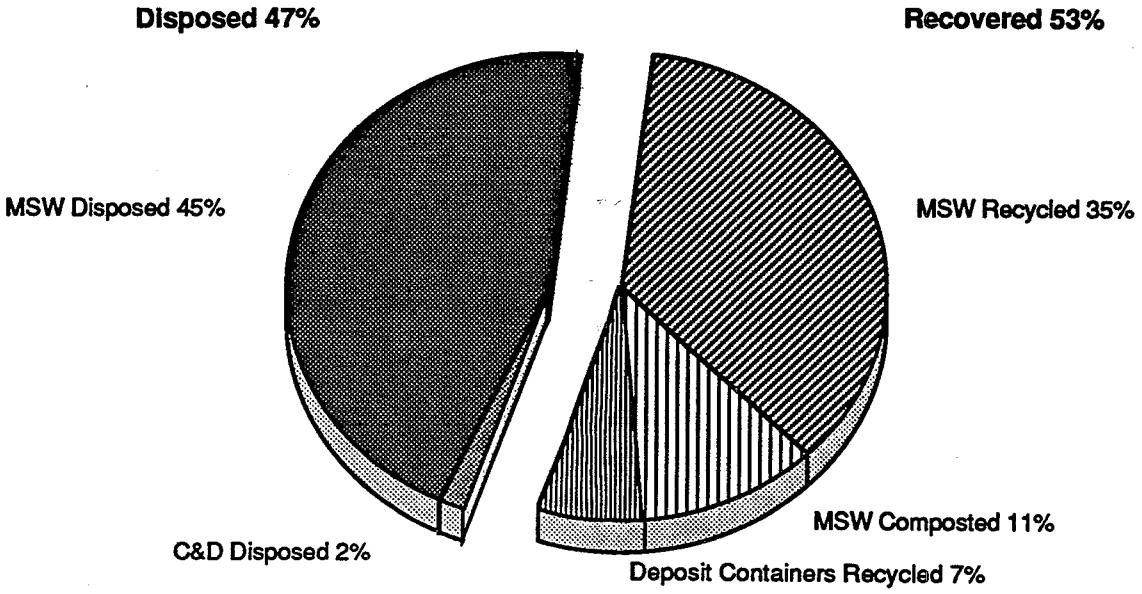
††Residential waste incinerated consists of 10 tons of brush, 1 ton of motor oil, and 16 tons of tires.

‡‡Less than 1 percent.

Landfill Tipping Fee: In 1989 residents and businesses began to pay a fee of $1 per 30-gallon bag or $8 per cubic yard at the Bowdoinham municipal landfill. This is equivalent to $65 per ton.

Refuse Collection and Disposal: The majority of Bowdoinham's residents and businesses self-haul refuse to the 5-acre Bowdoinham municipal landfill, located 6 miles outside of the Town. Two private haulers, Hollis Temple and Richard Plummer, collect refuse and recyclables weekly from approximately one-third of the Town's residents and four businesses for a $2 weekly fee. Residents and businesses must place a yellow Town refuse tag, which is sold at the Town Office for $1, on each bag of refuse. They can dispose refuse in any color plastic bag, however, recyclables must be placed in clear plastic bags. This bag-fee program began in 1989. Private haulers do not receive money generated from the Town user fees; they fund their own programs.

Total Waste Recovered and Disposed (Percent by Weight, FY 1990)



Refuse Collection and Disposal (cont'd):

Although the Town has 3 to 4 years left at the landfill at current disposal rates, the landfill is unlicensed. The Maine Department of Environmental Protection plans to close all unlicensed landfills on January 1, 1992. The Town will either incinerate its waste at the Mid-Maine Waste Action Corporation (MMWAC) incinerator in Auburn, 25 miles from Bowdoinham, or take the waste to a landfill outside the Town.

Materials Recovery Overview

Goals and Legislative Requirements:

State: In 1990 Maine established a goal of 50 percent reduction in the waste stream through recycling by 1994. The State's "Bottle Bill," enacted in January 1978, was expanded in 1990 to include all non-dairy beverage containers, making it the nation's most comprehensive deposit legislation. In addition, the State passed a ban on aseptic beverage containers, flip top openers, and plastic yoke connectors. The State also requires that plastic containers be coded by resin type and that retailers use paper bags unless plastic is specifically requested. All waste must be disposed of in lined landfills by 1992.

Local: In April 1989, Bowdoinham enacted and implemented an ordinance establishing user fees at the Town landfill of $1 per 30-gallon garbage bag, $8 per cubic yard, or variable fees for bulky items.

In 1985 Bowdoinham began collection of newspaper, corrugated cardboard, glass, and aluminum cans at the Town Office on a voluntary basis. The Town opened a second drop-off site at the landfill in 1987. The volume of waste diverted from the landfill was minimal, however, and the Town's only landfill

was expected to close by 1991. In January 1989, The Sagadahoc Recycling Company, a community group spearheaded by David Berry, Town Selectman and Town Solid Waste Manager, offered to carry out a 10-week pilot curbside recycling program in order to gather information on the amount of recyclable materials in the waste stream and to demonstrate to residents the ease and convenience of recycling. The group organized the collection and processing of the recyclable materials. Each household received fliers describing the upcoming program, and grain bags to collect glass, aluminum and ferrous cans, small scrap metal, rags, and all types of plastics. Newspaper, corrugated cardboard, magazines, junk mail, and paperboard were to be separated and collected in other bags. Bowdoin College students, from the neighboring Town of Brunswick, and The Sagadahoc Recycling Company collected the materials each Saturday in a flat-bed farm truck loaded with vegetable pallet boxes. They delivered the recyclable materials to a converted chicken barn north of the Town. During the 10 weeks an estimated 380 households participated. Bowdoinham financed the entire pilot for $1,500 through a Town solid waste study account. All equipment except the baler was loaned, and volunteers provided the labor.

This pilot led to a Town decision to establish a landfill user fee in 1989. Bowdoinham would charge no fee for recyclable materials brought to the processing center and $1 per 30-gallon bag for materials disposed at the landfill. In addition, the pilot program provided the education and support needed to continue recycling activity in the Town. After 10 weeks, The Sagadahoc Recycling Company ended its Saturday collection. In April 1989 the Town's two local haulers entered the program and collected both recyclable materials and refuse from their customers, one-third of all Town households. Most residents continued to use the two drop-off sites for recyclable collection.

Residents and businesses currently purchase clear recycling bags for $0.10 a piece, and yellow tags to place on 30-gallon refuse bags at either the Bowdoinham County Store or the Town Office. User fees are charged for bulky items other than white goods, which can be disposed free of charge. Through the pilot curbside program, the Town determined that mixed paper made up the majority of the waste it generated. The mixed paper was collected and stockpiled in the Recycling Barn, and in the fall of 1990 was incorporated into a compost mix for a research project conducted at the landfill site by Bowdoin College and the Town's Solid Waste Manager.

According to the Solid Waste Manager, David Berry, the Town cut its refuse disposed by 50 percent 6 months into the user fee program, and the life of the landfill was extended an estimated 6 years as a result of the per-bag refuse fee and the recycling program. He also estimates that because of the per bag fee, an estimated 15 percent of the Town residents currently dispose of their refuse out of town. During fiscal year 1990, Bowdoinham generated $22,000 from the sale of the user fee tags. These revenues have been set aside in a reserve account for future solid waste management expenses. Due to the Maine DEP's decision to close all unlicensed landfills by the end of 1991, waste will be hauled to an incinerator in Auburn, approximately 25 miles from Bowdoinham refuse or landfilled outside of the Town. Tipping fees will be funded through the $1 refuse bag fees.

Recycling Activities

Residential Curbside Recycling

Start-up Date:	April 1989
Service Provider:	Hollis Temple and Richard Plummer
Pick-up Frequency:	Weekly
Same Day as Refuse:	Yes

Households Served:	Approximately 290 single-family households. (The 30-unit building and other single-family households utilize the drop-off center.)
Mandatory:	No
Participation Rate:	An estimated 95 percent in 1990
Materials Collected:	Newspaper, corrugated cardboard, magazines, glossy paper, glass, aluminum and ferrous cans, small scrap metal, rags, and all plastic resins. Mixed paper (such as junk mail, high-grade paper, paperboard, paper towels, and wrapping paper) are collected for composting.
Set-out Method:	Residents must separate materials into plastic bags, which they can buy from the Town office for $0.10 a piece, in five categories: (1) corrugated cardboard, (2) newspaper, (3) glossy paper, (4) mixed recyclables including glass, cans, plastic, textiles, batteries, polystyrene packaging peanuts, and scrap metal, and (5) mixed paper.
Collection Method and Vehicles:	Both haulers collect refuse and recyclables in 1-ton, 15-cubic-yard dump trucks. Hollis Temple has a divider between the front and rear portion of the truck body. He places recyclables in the front compartment and refuse in the rear. After disposing refuse at the landfill, he brings the recyclables to the Recycling Barn. Plummer, with a smaller route, does not have a divider. He loads recyclables towards the back and refuse up front. Plummer brings the recycled materials first to the Barn.
Economic Incentives:	Residents pay volume-based fees for refuse disposal and no fee for recycling.
Enforcement:	Haulers will not pick up recyclable materials if they have been improperly separated, cleaned, or bagged.
Annual Tonnage:	Residential and commercial materials are collected together; a tonnage breakdown is not available.

Commercial & Institutional Curbside/Alley Recycling

Legislative Requirements:	None
Service Provider:	Hollis Temple and Richard Plummer
Number Served:	4
Type Served:	Grocery stores, small businesses
Materials Collected:	Newspaper, high-grade paper, corrugated cardboard, magazines, junk mail, paperboard, glass, aluminum and ferrous cans, small scrap metal, rags, and all types of plastic resins
Pick-up Frequency:	Weekly
Set-out and Collection Method:	Commercial recyclables are collected along with residential recyclables. (See under "Residential Curbside Recycling.")
Incentives:	Businesses pay volume-based refuse rates and no fee for recyclable materials.
Annual Tonnage:	Residential and commercial materials are collected together; a tonnage breakdown is not available.

In FY 1990 an estimated 93 tons were recovered through curbside collection from both residents and businesses in Bowdoinham, including mixed paper collected for composting.

Drop-off Centers

Number and Type:	2 in 1990; 1 was located at the Post Road Recycling Barn and 1 at the landfill. In spring 1991, the landfill drop-off site was closed to facilitate the collection and processing of recyclables at the Recycling Barn.
Public or Private:	Public
Sectors Served:	Residential and commercial
Number Served:	Two-thirds of all households not serviced by curbside collection
Participation Rate:	85 percent of such households in 1990 and 1991 (estimated by the Solid Waste Manager).
Materials Accepted:	Newspaper, corrugated cardboard, magazines and other glossy inserts, glass, aluminum and ferrous cans, all plastics, polystyrene, textiles, dry-cell and lead-acid batteries, motor oil, scrap metal, white goods, tires, and salvaged items such as clothing and furniture. Mixed paper including high-grade paper, junk mail and paperboard are collected for composting.
Annual Tonnage:	An estimated 187 tons from July 1989 to June 1990, including mixed paper for composting.

Only one-third of residents are served with curbside collection of recyclables; most use the drop-off center. At the Recycling Barn, open 3 days a week, residents and businesses are required to separate their materials into the same categories required in the curbside program. Beginning in April 1991 compostable materials other than mixed paper can only be brought to the Recycling Barn on Saturdays, at which time the Recyling Barn began accepting all organic materials for composting. Most residents deliver compostable materials to the Recycling Barn in plastic bags. The bags are piled into a 24-foot by 8-foot trailer for transport to the landfill, where their contents are shredded and composted.

Salvage/Reuse

Landfill attendants set aside bulky items such as usable furniture, and construction and demolition materials such as doors, windows, and usuable millwork items. These materials are stored on the first floor of the Recycling Barn, where residents can take them free of charge. In 1990 polystyrene packaging peanuts were sold to a local seafood shipper, who reused them as packaging material.

Processing and Marketing of Recyclables

Residents, some businesses, and the two private haulers bring recyclable materials free of charge to the Town's 12,000-square-foot, three-story Recycling Barn which opened in 1989. This renovated poultry barn, located 1 mile north of the Town, is owned and operated by Bowdoinham's Solid Waste Manager and leased to the Town. The center, which operates 156 days per year, accepts materials from Bowdoinham residents and businesses only. Hollis Temple and Richard Plummer deliver separated bags of recyclables to the first floor of the Barn. Three part-time employees work at the Barn. Magazines, glossy inserts, and catalogues are collected loose in 1.25-cubic-yard pallet boxes and shipped in the same boxes. Corrugated cardboard is baled and stored on the first floor. Mixed paper is baled and also stored on the first floor. Newspaper was baled until early 1991, when a local farmer began to haul it away in pallet boxes to shred for animal bedding. Commingled materials, including glass, aluminum and ferrous cans, plastics, polystyrene, and rags are brought to the third floor by freight elevator. These materials are then dumped into a hopper that feeds onto a converted hay conveyor set up on the second floor for sorting. One to three employees hand-sort approximately 5 tons of commingled recyclables each week. They drop the bulky materials such as plastic, polystyrene, and tin cans down chutes into pallet boxes on the first floor and separate the glass, aluminum and rags into drums on the second floor where they can be dumped directly into the Town's truck for delivery. An estimated 5 percent by weight of recyclable materials collected at the Recycling Barn is landfilled as residue. Because of the Recycling Barn's large size, materials can be stored until sufficient volumes are recovered for market.

The Solid Waste Manager transports recovered materials to market in a 1952 converted fire truck. All markets are within 40 miles of the facility. Corrugated cardboard is marketed at Yorktown Papermill in Gardiner, Maine, for manufacture into tubing. In early 1990 newspaper was also marketed there; however, a local farmer currently takes the paper at no charge and shreds it for animal bedding. Magazines, glossy inserts, and catalogues are sent to Scott Paper Mill in Winslow, Maine, for manufacture into tissue paper. Maine Recycling Corporation (MRC) in Lisbon Falls purchases glass and aluminum cans. Ferrous cans are sold to Maine Metal Recycling in Auburn. HDPE plastic is baled and sold to MRC. All other plastic is baled for construction of the landfill's berm walls. Local thrift stores accept some of the clothes and rags; the remainder is sold to Goodman Wiping Cloth in Lewiston, Maine. Salvaged construction and demolition debris including furniture and wood waste is burned as a heating source for the processing center. Some construction and demolition materials such as sheet rock, cinder blocks, and bricks are salvaged at the landfill; tonnages are low and not available. White goods collected at the landfill site are taken by several scrap dealers. One local scrap dealer takes lead-acid batteries and sells them to a broker in Portland, Maine; dry-cell batteries are in storage until a suitable market is found. Oil is given to a local auto repair shop and used as a heating source. Tires are shredded and burned for fuel in a Maine paper mill boiler. In 1990 polystyrene packaging peanuts were sold to a local seafood shipper; however, the company has since stopped buying the materials, and the Town is currently storing the polystyrene until another market can be found. The Town has experimented with some of the polystyrene as insulation for the center. The mixed paper collected in 1989 and 1990 is now being used in the Town composting projects.

Composting Activities

Although residents can drop off leaves, grass clippings, wood waste, and brush free of charge at the Town landfill, most residents do not use the site. The Town's two private haulers collect compostable mixed paper but do not collect and deliver yard waste to the site. Only 7.5 tons of leaves and grass clippings were collected for composting in 1990. Wood waste and brush are burned at the site, while leaves and grass clippings are composted.

In 1990 an 80-foot by 200-foot gravel-based site was prepared, at a cost of $1,000 funded through a grant, for a pilot food waste and mixed paper composting study. In Fall 1990, the Town and Bowdoin College, located in the neighboring Town of Brunswick, conducted trials comparing compost generated from mixed paper and food waste with compost generated from leaves and food waste. Employees at both of the College cafeterias collected food waste 5 days each week in 30-gallon containers. They collected an average of 110 gallons a day over the 3-month period. The college provided a pick-up truck and students in the Environmental Studies Program transported the food waste to the landfill. The Town and Bowdoin College paid $500 each. Compost Futures, a private compost management firm paid $500, and the Maine Waste Management Agency granted $3,500.

Recycling Barn employees shredded mixed paper not marketed, including junk mail, cereal boxes, and tissue paper, using a Valby shredder donated for the project. Approximately 8 tons of leaves, which had previously been stored at the Bowdoinham landfill, and 2 tons of mixed paper, which had been stored in the Recycling Barn, were used in one windrow. The bulk of the paper was mixed with food waste to extend the windrow. Students mixed food waste with shredded paper on half of the windrow, and with leaves on the second half. They added food waste to the windrow daily with pitchforks, and covered the waste with a 6- to 12-inch layer of paper or leaf waste bulking agent in a 1:1 ratio. They measured windrow temperatures daily. Windrows were turned with a Wildcat turner, loaned by Compost Futures for the study, once every 10 days to 2 weeks. There were no reported odor or vermin problems. During the study approximately 26 tons of leaves, food waste, and mixed paper were composted. Because the finished compost will be used as a landfill cover, the Town will save between $8 to $10 per cubic yard fee for final cover material when the landfill is closed.

The compost was analyzed at the Woods End Research Laboratory in Mount Vernon, Maine for pH, moisture, heavy metals, and carbon nitrogen ratio. The 3-month project, funded by Maine Waste Management Agency, Bowdoin College, Woods End Laboratory, and the Town, cost $5,000. Tests taken before and after the waste was composted showed that heavy metal concentrations were well below levels considered safe by State and Federal standards. Food scraps were high in moisture and acidity, and mixed paper/food waste compost revealed a high carbon nitrogen ratio. To reduce this ratio, materials with a lower carbon nitrogen ratio, such as leaves and other yard waste, should be added. In addition, a ratio of two parts of food waste to one part bulking agent was recommended.

In April 1991, the Town began a second composting project. This project was financed entirely by a private local foundation. The bulk of the $1,250 grant paid for leasing a tractor to operate the Valby shredder and turn the compost pile. In June 1991 the Town purchased the motor to operate the shredder. Future program costs are expected to be covered through the Town's solid waste budget. Each Saturday residents can bring food waste, disposable diapers, and other types of organic waste to a 24-foot trailer located at the Recycling Barn. (Organic materials are not accepted on other days of the week.) Organic materials and mixed paper are trucked to the landfill to be shredded. Fish waste from Stinson Seafood of Bath, Maine, a local cannery, shredded mixed paper and organic wastes are mixed in long windrows. Compost is turned once a week. After 8 to 10 weeks, the composted materials are stored for future use as final cover for the landfill, which is due to close at the end of June 1992. Although the fish waste has a strong odor, this reportedly does not create a problem, since the landfill is located 6 miles from the Town. In a joint effort with Stinson Seafood, the Town plans to test an in-vessel composting system in the spring of 1992 and continue testing throughout the summer.

Amount and Breakdown of Materials Recovered

Material	Total (Tons, July 1989-June 1990)
Newspaper	60
Corrugated Cardboard	30
Coated Paper*	25
Glass	36
HDPE Plastic	4
Mixed Plastic	4
Aluminum Cans	0.5
Ferrous Cans	2.5
Bottle Bill Containers†	41
Appliances/White Goods	38
Other Metal	14
Dry-Cell Batteries	0.25
Lead-Acid Batteries	1
Furniture	NA
Textiles	5
Polystyrene	0.25
Subtotal MSW Recycled	**261.50**
Mixed Paper‡	60
Leaves and Grass Clippings§	7.5
Subtotal MSW Composted	**67.5**
Total MSW Recovered	**329**

Notes: Materials brought to the Recycling Barn are recovered from both the residential and commercial sectors and are not tracked separately. These materials represent recovered recyclables minus any rejected materials. Due to rounding, tonnages collected through curbside, drop-off, and bottle bill collection do not add to total tonnages listed above.

Because tires (16 tons) and motor oil (1 ton) collected at the Recycling Barn are burned as a fuel source, these tonnages are not included.

*Coated paper includes glossy inserts, magazines, and catalogues.

†An estimated 43 tons of bottle bill returns were recovered from Bowdoinham; 2 of these tons were recovered through the Recycling Barn.

‡Mixed paper includes high-grade paper, junk mail, tissue, and paperboard.

§30 cubic yards of leaves and grass clippings were dropped off at Bowdoinham's landfill in fiscal year 1990. The tonnage given here (7.5 tons) is based on a conversion factor of 500 pounds per cubic yard, as reported by U.S. EPA in "Yard Waste Composting--A Study of Eight Programs."

Publicity and Education

The 1989 pilot curbside program has proven to be the best publicity for the ongoing program. The Town uses posters, direct mailings, workshops, meetings, and displays to publicize recycling activities. Bowdoinham's recycling activities have also been well publicized in local papers and through television coverage. In 1991 the Solid Waste Department awarded $50 in cash to the resident who put the largest number of flattened cans into a 5-gallon bucket at the Recycling Barn.

Economics

Costs Cover:

Collection: In 1990 the Town of Bowdoinham covered all operating and maintenance costs to collect 228 tons of recyclables and compostables at its drop-off center (93 tons of which are dropped off by private haulers). Two private haulers collect recyclable materials at curbside from approximately one-third of residential households and two-thirds of Town businesses. Bowdoinham does not reimburse haulers for collection of refuse or recyclables. Their collection costs are not available.

Processing: The Town covered all expenses to process 220 tons of material. Sixty tons of mixed paper were stored in 1990, and not processed until 1991; 7.5 tons of yard waste were placed by residents in a compost heap and the Town incurred no cost. The compost processing equipment was loaned.

Capital Costs: Processing

Item	Cost	Use	Year Incurred
Dual-Axle Trailer	$500	Recycling	1986
Vertical Baler	5,850	Recycling	1986
5 Storage Bins @ $355	1,775	Recycling	1989
Loading Ramp	994	Recycling	1989
Sorting Conveyor	500	Recycling	1989
81 1-cubic-yard Pallet Boxes*	NA	Recycling	Leased
Converted Chicken Barn*	NA	Recycling	Leased
Converted Chevy Fire Truck	NA	Recycling	1952
2 Pallet Trucks @ $3,700 & $500†	4,200	Recycling	1989
Barrel Jack for Hoisting Barrels	122	Recycling	1989
1-Ton Electric Hoist	1,200	Recycling	1989
2-Ton Chain Hoist	120	Recycling	1989
Shredder	6,400	Composting	1991

Note: All equipment was paid in full at the time of purchase.

*Equipment leased from The Sagadahoc Recycling Company for an annual fee of $7,800.

†Pallet trucks are used to raise pallets approximately 6 inches off the ground to facilitate transport of recyclables in the Recycling Barn.

Annual and Per Ton Operating and Maintenance Costs (FY 1990)

	Cost	Tons Covered	Per Ton Cost
Recycling and Composting Total	**$44,839**	**288**	**$156**
Drop-off Collection*	$6,754	288	$23
Recyclables Processing†	27,184	220	124
Administration	10,401	288	36
Education/Publicity	500	288	2

Notes: Costs given in table represent the Town of Bowdoinham's costs for recycling and composting in fiscal year 1990 (July 1989 to June 1990).

*Mixed paper used in the 1991 composting pilot was collected with recyclables; costs for its collection separate from recycling drop-off collection cannot be obtained.

†Processing costs include the $7,800 annual fee to lease the Recycling Barn, salary of 3 part-time employees, and 42 percent of the Solid Waste Manager's annual salary of $17,932 to supervise processing and market materials. These costs cover the processing of 220 tons of recyclables. The remaining 60 tons of mixed paper were not processed in 1990; the Town did no incur costs for the processing of 7.5 tons of yard waste.

Materials Revenues: $2,900 from the sale of recyclable materials went into the Town's general fund in FY 1990.

Source of Funding: State grants funded the majority of capital costs; Town taxes pay all operating and maintenance costs. The haulers fund their recycling service through their $2 per household per week fee.

Full-time Employees: None

Part-time Employees: 4 (1 part-time Solid Waste Manager administers recycling and composting activities 24 hours per week, and 3 employees process recyclables 20 hours per week each).

Future Solid Waste Management Plans

When the Town landfill closes in June 1992, Bowdoinham will have to contract with a private landfill or incinerator for waste disposal. In the early Spring 1992, Bowdoinham hopes to implement a pilot in-vessel composting project at the Recycling Barn. The project will compost organic waste, mixed paper, and fish waste.

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Carter, Marshall, and Bettina Blanchard. *The Bowdoinham/Bowdoin College Pilot Compost Program,* Brunswick, Me.: Bowdoin College and Compost Futures Inc., February 1991.

"Composting Project Tackles Separated Organics." *BioCycle,* January 1991.

"Converted Chicken House Serves as MRF." *BioCycle,* November 1990.

Fennimore, Wisconsin

Demographics

Jurisdiction:	City of Fennimore
Population:	2,378 in 1990
Area:	2 square miles
Total Households:	970 (874 in single-family residences and 96 in multi-unit buildings)
Total Businesses and Institutions:	100 businesses and 5 institutions
Brief Description:	The City of Fennimore is a rural community located in Grant County 42 miles northeast of Dubuque, Iowa, and 70 miles west of Madison, Wisconsin. The average per capita income in Grant County is $14,046. Major employers are a manufacturer of batteries and a local nursing home. There are many retired people living on fixed incomes in Fennimore, and many working at minimum wage jobs.

Solid Waste Generation and Recovery

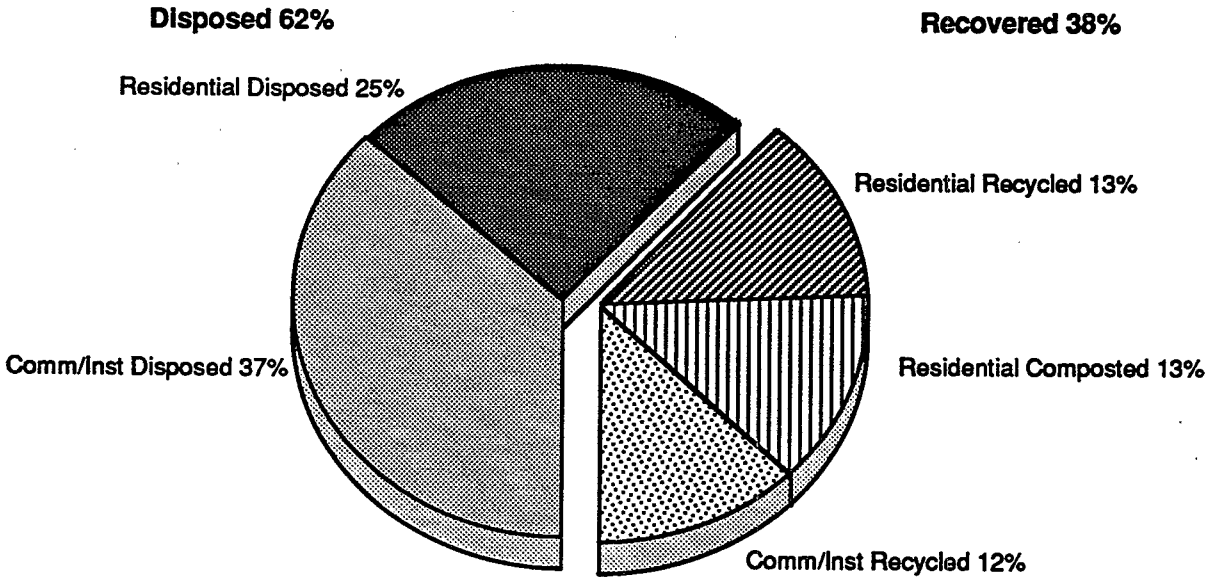
	Annual Tonnages (1990)		
	Residential	Commercial/ Institutional	Total MSW
Recovered	**333**	**158**	**491**
Recycled	164	158	322
Composted	169	0	169
Disposed	**315**	**473**	**788**
Incinerated	NA	NA	560
Landfilled	NA	NA	228
Generated	**648**	**631**	**1,279**
	Percent by Weight Recovered		
Recovered	**51%**	**25%**	**38%**
Recycled	25%	25%	25%
Composted	26%	0%	13%

Note: Waste generated does not include bulky items such as tires and appliances. Tonnages of construction and demolition (C&D) debris are not recorded; therefore, no figures for C&D or "Total Waste" are included in this table. According to Margaret Sprague, the City Clerk, no C&D is being recovered.

Landfill/Incinerator Tipping Fees: $0 in 1989 at the City-owned landfill; $32 per ton from March to November 1990 at the Muscoda Incinerator; $32 per ton at the transfer station in Cuba City, Wisconsin

Refuse Collection and Disposal: The City of Fennimore handles all the residential and commercial waste generated in the City. In 1990 the City incurred $49,016 for the collection and disposal of 788 tons of refuse (or $62.20 per ton) including tipping fees. The tipping fees alone cost the City $25,200, wages for the pick-up and hauling of refuse to Cuba City came to $17,160, and supplies cost $6,656. From January to March 1990, waste was taken to the City-owned landfill and tipped for free. After March, waste was disposed at the Muscoda Incinerator, approximately 25 miles away. The incinerator was closed in November because operating costs exceeded revenues and because the facility was not working properly. Wiederholt Sanitation currently ships Fennimore's waste to a landfill in Delavan, Wisconsin from the transfer station in Cuba City, Wisconsin.

Municipal Solid Waste Recovered and Disposed (Percent by Weight, 1990)



Refuse Collection and Disposal (cont'd):

Refuse is collected from residents, businesses, and institutions once a week. They are required to purchase special clear plastic bags from local grocery stores for refuse disposal. The 15-gallon bags cost $0.07 per bag, and the 30-gallon bags cost $0.09 per bag. Residents must purchase disposal tags in order to dispose of tires and appliances. These tags cost $4.00 for appliances; $2.00 for car-size tires; $3.75 for light truck tires; $12.00 for heavy truck tires; and $12.00 to $18.00 for tractor tires. The fee for these tags covers the City's cost for disposal or recycling of these items.

Total waste generated in Fennimore decreased from 1,692 tons in 1989 to 1,204 tons in 1990—a reduction of nearly 30 percent. Residential waste disposed has decreased by 25 percent from 418 tons in 1989 to 315 tons in 1990. The decrease in waste generated is attributed to improved record keeping in 1990; 1989 data artificially inflated actual tonnages. The decrease in residential waste disposed is also attributed to an increase in backyard composting (and leaving cut grass on the lawns).

Materials Recovery Overview

Goals and Legislative Requirements: On May 1, 1989, the City of Fennimore implemented mandatory recycling of newspaper; brown, green, and clear container glass; aluminum; ferrous metals; HDPE and PET plastic containers; corrugated cardboard; and mixed paper (junk mail, catalogs, magazines, and paperboard boxes). Recycling of plastic will be mandatory in the State as of 1995. Landfilling yard waste in Wisconsin has been forbidden since 1989.

During 1988 and early 1989, Fennimore City Council members visited several recycling programs in Wisconsin and held numerous committee meetings in order to develop the best recycling program for the community. The City needed to reduce its materials disposed as much and as quickly as possible because the City-owned landfill was scheduled to close in 1990. After the closing, the City hauled its nonrecyclable waste to the Muscoda Incinerator, approximately 25 miles north of Fennimore.

In 1989 Fennimore recycled 27 percent of its waste stream and composted 7 percent, yielding a recovery rate of 34 percent. The following year, the City diverted 35 percent of its municipal solid waste stream from disposal, 27 percent through recycling and 8 percent through composting, with most recovery occurring in the residential sector. Fennimore reported a significant decrease in waste generation between 1989 and 1990, which is attributed primarily to more accurate record keeping in 1990. According to City Clerk Margaret Sprague, 1989 waste generation rates, extrapolated from 8 months of data, artificially inflated Fennimore's waste disposed and recovered. Improved record keeping in 1990 shows low waste generation rates in Fennimore and an extremely low per capita residential waste generation rate of 1.3 pounds per person per day. The commercial recovery rate is low even though businesses in the City of Fennimore are required to recycle. Margaret Sprague, the City Clerk, attributes this low recovery rate to the fact that the businesses do not generate much recyclable material. Food waste, which is not compostable in the City, floor sweepings, diapers, and styrofoam are some of the items discarded by many businesses and institutions that cannot be recovered.

Fennimore received the *Best Overall Program in a Rural Area* award in the Institute for Local Self-Reliance's *Record Setting Recycling Contest 1989.*

Recycling Activities

Residential Curbside Recycling

Start-up Date:	May 1, 1989
Service Provider:	City of Fennimore, Recycling Department
Pick-up Frequency:	Once every two weeks for recyclables, by appointment for appliances
Same Day as Refuse:	No
Households Served:	970
Mandatory:	Yes, for all materials except appliances
Participation Rate:	100 percent (the participation rate is not actually measured; according to the City Clerk, everyone has participated with little need for enforcement.)

Materials Collected: Glass containers; tin; aluminum; PET and HDPE plastic beverage, detergent, and motor oil containers; newspaper; corrugated cardboard; mixed paper (paper sacks, labels from tin cans, junk mail, catalogs, magazines, and paperboard boxes such as cereal and kleenex boxes); appliances.

Set-out Method: Materials are separated into a set of three stackable 15-gallon bins provided by the City, each a different color. Newspaper is placed in one bin, plastic containers in another, and glass and metal in the third. Mixed paper, in a clear plastic bag, and corrugated cardboard are placed next to the bins.

Multi-Unit Collection: The City picks up recyclable materials from all multi-unit buildings. Multi-unit buildings in Fennimore range from 4 to 12 units each and are, on average, two stories high. Residents of these buildings are required to set out recyclable materials at the curb just as residents of single-family houses do. In retirement apartments, elderly tenants take their recyclable materials to a shed located on the apartment building premises where materials are separated by residents into the three categories.

Collection Method and Vehicles: Two workers collect recyclable materials in a used beer/pop truck that has 10 bins and 4 shelves for separated materials. There are two bins each for cans, mixed paper, newspaper, glass, and plastics. Each glass bin is further divided for the three colors of glass. Glass is set out commingled at the curb and color-sorted by the workers into these separate compartments. Corrugated cardboard is placed on the four shelves.

Economic Incentives: None. Residents must purchase special bags for the set out of refuse but because this fee is so low (7 to 9 cents per bag), this cannot be considered an economic incentive.

Enforcement: Residents must use clear plastic bags for nonrecyclable waste. Collection crews will not pick up refuse if they find it contains recyclables. Because of this, two to four bags a week are not collected. As of October no fines had been issued.

Annual Tonnage: Businesses and residents have their material picked up on the same route, and tonnages cannot be separated. An estimated 162 tons were collected in 1990.

Commercial & Institutional Curbside/Alley Recycling

Legislative Requirements: The City of Fennimore requires all City businesses and institutions to separate and recycle glass containers, tin, aluminum, PET and HDPE plastic beverage, detergent, and motor oil containers, newspaper, corrugated cardboard, household mix (mixed paper), and appliances effective May 1, 1989.

Service Provider: City of Fennimore, Recycling Department

Number Served: 100

Type Served: 96 businesses and 4 institutions (4 businesses and 1 institution do not produce recyclable materials)

Materials Collected:	Newspaper, mixed paper, corrugated cardboard, glass, plastic containers, aluminum, ferrous cans, and high-grade paper
Pick-up Frequency:	Four times a week for corrugated cardboard; other materials are collected every two weeks, on the same schedule as residential collection.
Set-out and Collection Method:	The City supplies commercial establishments with the same recycling bins as those supplied to residents, and requires businesses to separate the same materials. The businesses that produce large quantities of corrugated cardboard store it in dumpsters. A compactor garbage truck is used for the collection of corrugated cardboard. The same truck used for residential curbside collection is used to collect all other recyclable materials from businesses.
Incentives:	Businesses that recycle large quantities of waste have less frequent refuse pick-up, and consequently lower collection fees. Two grocery stores, two taverns, and one warehouse have lowered their refuse rates through recycling.
Enforcement:	Businesses are also required to put their refuse in clear plastic bags. If recyclable materials are seen in refuse bags, they are not picked up. While fines can be issued, none have been as of October 1991.
Annual Tonnage:	Businesses and residents have their materials picked up on the same route, and tonnages cannot be separated. An estimated 156 tons were collected in 1990.

Drop-off Center

Number and Type:	One drop-off center (This facility is also the processing center.)
Public or Private:	Public (City's Recycle Center)
Sectors Served:	All businesses, institutions, and residents
Materials Accepted:	Newspaper, mixed paper (junk mail, catalogs, magazines, and paperboard boxes), corrugated cardboard, glass, HDPE and PET plastic containers, aluminum, ferrous cans, and high-grade paper
Annual Tonnage:	An estimated 3.2 tons. Margaret Sprague, the City Clerk, estimates that less than 1 percent of the total tonnage reported comes from materials dropped off at the City's Recycle Center.

Processing and Marketing of Recyclables

The City of Fennimore owns and operates a materials processing center located in the east end of the City, 1 mile from the collection route. The City's Recycle Center was opened in May 1989 and does not have a specific capacity. The capital cost for construction was $81,896, of which $37,896 was spent on equipment. All equipment was financed through City taxes and paid for in full at the time of purchase. In 1990, 322 tons of recyclable materials, or 1.61 tons per day, were processed at the center during 200 days per year of operation. There is no material rejected because the collector controls the quality of material at curbside. Operating and maintenance costs came to $26,625 in 1990, or $83 per ton. There is one full-time employee and three part-time employees that work at the drop-off center and collect recyclable and compostable materials.

Corrugated cardboard, mixed paper (paper sacks, labels from tin cans junk mail, catalogs, magazines, and paperboard boxes such as cereal and tissue boxes), and plastic are baled at the City's

Recycle Center. Newsprint is shredded and baled for use as bedding by local farmers; bales are sold for $1. Glass is crushed. Appliances are given to a junk dealer from Ferryville, Wisconsin, who salvages what he can. The City delivers glass and metals to markets in Dubuque, Iowa, approximately 42 miles from Fennimore. Midwest Plastics of Stoughton, Wisconsin, picks up plastic from the Recycle Center and processes it into corrugated drain tile. Paper Processing in Madison, Wisconsin, picks up corrugated cardboard and mixed paper. The City receives revenues for all materials except low-grade mixed paper (junk mail, catalogs, magazines, and paperboard boxes). Materials are stored in an old renovated barn until they are marketed. Glass is stored for 4 months, tin for 3 months, cardboard for 2 to 4 months, mixed paper from 2 to 4 months, and plastic for up to a year.

Composting Activities

Backyard Composting

The State of Wisconsin forbids landfilling of yard waste. It is estimated that one-third of Fennimore's residents have backyard composting areas, and some burn their garden waste even though this is discouraged by the City. Other residents leave unraked leaves and grass clippings on their lawn.

Curbside Collection

Start-up Date:	April 1989 for composting. From 1960 to 1989 yard waste was collected but landfilled.
Service Provider:	City of Fennimore
Households Served:	970
Businesses Served:	None. The small amount of yard waste generated by businesses and commercial establishments is taken to the compost site as needed.
Mandatory:	Yes
Materials Collected:	Leaves and wood waste (brush is collected and burned)
Set-out Method:	Brush and all other wood waste are piled at the curb; leaves are set out loose.
Collection Vehicles & Method:	A City dump truck with a two-person crew. The street cleaning crew wets the leaves to make the collection easier.
Collection Frequency:	The City picks up leaves when the City workers sweep the streets, which they do two to three times during the fall season. Brush and wood waste (tree branches and trunks) are picked up monthly, year-round.
Enforcement:	Residents must use clear plastic bags for nonrecyclable waste. The City will not pick up refuse that is found to contain yard waste.
Annual Tonnage:	Not available. The City of Fennimore does not keep these tonnage records.

Composting Site

The City of Fennimore delivers leaves and wood waste to the City's compost site, located on 3 acres of land that previously served as the City's landfill. There was no preparation to convert the landfill to a composting site. Leaves that are dropped off, garden waste, and a small amount of food waste is placed in large windrows and one person turns it weekly for 1 to 2 hours with an end-loader (food waste is brought mostly by residents and the tonnage is negligible). The tonnage of organic waste dropped off by residents is estimated by using a conversion factor of 102 pounds per cubic yard, which was calculated by weighing a full truck and measuring its dimensions. It takes 12 to 15 months to produce the final product. The City uses the compost for landscaping projects. Brush is also brought to the site but it is burned and therefore these tonnages are not included in the 1990 figures below. Leaves that are collected curbside are not composted, but rather are spread on local farms. All the material brought to the compost site is used either for the production of compost or as a soil amendment. Residents must either leave grass clippings and small yard trimmings on their lawns, compost them at home, or haul these materials to the designated compost site. Residents must also haul leaves to the compost site except at designated biannual pick-up times. City Clerk Margaret Sprague estimates that only 5 to 10 percent of residents haul their yard waste to the compost site.

Amount and Breakdown of Materials Recovered

Material	Residential (Tons, 1989)	Commercial Institutional (Tons, 1989)	Total (Tons, 1989)
Newspaper	66	4	70
Corrugated Cardboard	9	143	152
Mixed Paper	108	6	114
Glass	64	14	78
PET Plastic	1	0	1
HDPE Plastic	6	0	6
Aluminum	0.5	0	0.5
Ferrous Metals	27	4	31
Subtotal Recycled	**281.5**	**171**	**452.5**
Brush and Wood Waste	50	0	50
Leaves	75	0	75
Subtotal Composted	**125**	**0**	**125**
Total Recovered	**406.5**	**171**	**577.5**

Note: The City extrapolated 8 months of tonnage data to 12 months, which probably inflated the tonnages, according to the City Clerk

Material	Residential (Tons, 1990)	Commercial/ Institutional (Tons, 1990)	Total (Tons, 1990)
Newspaper	34.82	2	36.82
Corrugated Cardboard	5.40	102.30	107.70
Mixed Paper*	88.70	15.23	103.93
Glass	14.50	21.74	36.24
PET and HDPE Plastic	9	6	15
Aluminum Cans†	0.42	0	0.42
Ferrous Cans	10.70	10.70	21.40
Subtotal MSW Recycled	**163.54**	**157.97**	**321.51**
Grass/Garden Waste/Food Scraps‡	106	0	106
Leaves§	63	0	63
Subtotal MSW Composted	**169**	**0**	**169**
Total MSW Recovered	**332.54**	**157.97**	**490.51**

Note: Less than 1 percent of tthe total materials recycled was collected at the drop-off center. All other materials were collected at curbside. 1.4 tons of motor oil were collected and burned. No C&D debris is being recovered.

*Mixed paper includes junk mail, catalogues, paperboard, and mixed office grades.

†According to the City Clerk many residents and businesses sell aluminum cans privately and such tonnages are not tracked.

‡These materials are dropped off at the compost site and mixed together. Tonnages are estimated and based on a conversion factor of 102 pounds per cubic yard.

§The City Clerk estimates that 48 truck loads of leaves were collected at curbside in 1990. Each truck load was 7.5 cubic yards. Using a conversion factor of 350 lbs. per cubic yard, the total amount of leaves is estimated to be 63 tons. Uncompacted leaves are about 250 lbs. per cubic yard and compacted leaves are 450 lbs. per cubic yard, [Source: Association of New Jersey Recyclers]. Since the City's leaves are loose but wet, the average of these two factors has been used.

Publicity and Education

The City coordinates the inclusion of recycling information fliers with utility bills, writes newspaper articles, makes radio announcements, develops programs for school children, and holds periodic open houses at the Recycling Center. Businesses and residents receive the same recycling publicity materials.

Economics

Costs Cover: The capital and operating and maintenance costs given below cover the collection and processing of 491 tons of material recovered by the City of Fennimore curbside collection and drop-off programs (322 tons of recyclable materials and 169 tons of yard waste). Less than 1 percent of total materials recycled was collected at the drop-off site.

Capital Costs: Collection

Item	Cost	Use	Year Incurred
Beer/Pop Collection Truck	$2,000	Recycling	1989
Construction of Bins for the Truck	6,320	Recycling	1989
Painting the Truck	3,400	Recycling	1989
1,300 Sets of 3 Bins for Source Separation @ $19.26	25,038	Recycling	1989
Dump Truck @ 10% of use	30,000	Composting	1989

Note: The City of Fennimore paid for all equipment in full at the time of purchase.

Capital Costs: Processing

Item	Cost	Use	Year Incurred
End-loader @ 1% of use	$36,700	Composting	1975
Newsprint Baler	700	Recycling	1988
Forklift	3,400	Recycling	1989
Skidloader	13,950	Recycling	1989
Cardboard Baler	7,500	Recycling	1989
Paper Shredder	9,111	Recycling	1989
Glass Crusher	3,235	Recycling	1989
Building/Remodeling	44,000	Recycling	1989
Storage Barn Remodeling	9,700	Recycling	1990

Note: The City of Fennimore paid for all equipment in full at the time of purchase.

Annual and Per Ton Operating and Maintenance Costs (1990)

	Cost	Tons Covered	Per Ton Cost
Recycling Subtotal	**$40,325**	**322**	**$125**
Collection	$12,500	322	$39
Processing	26,625	322	83
Administration	700	322	2
Education/Publicity	500	322	2
Composting Subtotal	**$12,350**	**169**	**$73**
Collection	$10,150	169	$60
Processing	2,200	169	13
Administration	0	169	0
Education/Publicity	0	169	0
Recycling & Composting Total	**$52,675**	**491**	**$107**
Collection	$22,650	491	$46
Processing	28,825	491	59
Administration	700	491	1
Education/Publicity	500	491	1

The annual operating and maintenance costs for the City's recycling program increased from $35,900 in 1989 to $40,325 in 1990. This increase is primarily due to a rise in the cost of processing recyclables, from $18,500 in 1989 to $26,625 in 1990, attributed to a substantial salary increase given to a long-time employee.

Materials Revenues:	$7,402 in 1990
Source of Funding:	State grant and local taxes
Full-time Employee:	1 Recycling Coordinator
Part-time Employees:	4 (1 employee works in processing, 2 City employees work with collection on Mondays only, 1 employee turns the compost piles 2 hours a week)

Future Solid Waste Management Plans

The City of Fennimore will apply in 1992 to participate in the Clean Sweep Program, a program sponsored by the State to encourage safe disposal of household cleaners. If the City is accepted, the State will provide it with a collection vehicle for a day or a weekend to collect these hazardous chemicals from residents and businesses.

Contact

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La Crescent, Minnesota

Demographics

Jurisdiction:	City of La Crescent
Population:	4,305 in 1990
Area:	2.2 square miles
Total Households:	1,568 (1,308 in single family households and 260 in multi-unit buildings)
Total Businesses and Institutions:	205 (200 businesses and 5 institutions)
Brief Description:	La Crescent, nicknamed "the Apple Capital" of Minnesota, is located in the southeastern corner of rural Houston County across the Mississippi River from La Crosse, Wisconsin. It serves as a bedroom community to La Crosse. The City's major employer is La Crescent Apple Growers. The average per capita income was $12,374 in 1987 (the most recent year for which figures are available).

Solid Waste Generation and Recovery

	Annual Tonnages (1990)				
	Residential	Commercial/ Institutional	Total MSW	Construction & Demolition	Total Waste
Recovered	**453**	**59**	**512**	**600**	**1,112**
Recycled	309	59	368	600	968
Composted	144	0	144	0	144
Disposed*	**656**	**624**	**1,280**	**319**	**1,599**
Incinerated	546*	624	1,171	0	1,171
Landfilled	110	0	109	319	428
Generated	**1,109**	**683**	**1,792**	**919**	**2,711**
	Percent by Weight Recovered				
Recovered	**41%**	**9%**	**29%**	**65%**	**41%**
Recycled	28%	9%	21%	65%	36%
Composted	13%	0%	8%	0%	5%

*Tires, collected for recovery, are burned as a fuel source; tonnages are included with residential waste incinerated. Residential waste andfilled includes bulky items such as furniture.

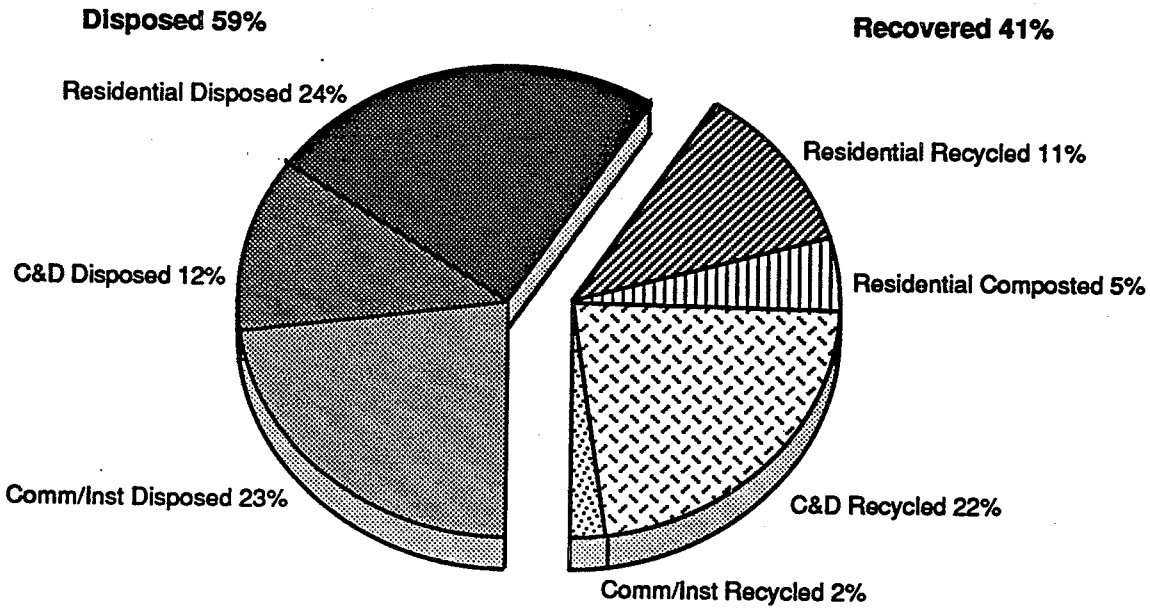
Incinerator/Landfill Tipping Fee: $15 per ton in 1988; $48 per ton in 1989 and 1990; $63 per ton in 1991; $30 per ton for construction and demolition debris in 1989 and 1990.

Refuse Collection and Disposal: Waste Management Inc. (WMI) of La Crosse, Wisconsin collects residential refuse once a week under contract from the City of La Crescent. Beginning in 1989, La Crescent residents have paid variable refuse rates. Residents pay the City $1.35 per bag for special 30-gallon garbage bags imprinted with the words, "The City of La Crescent." WMI will not pick up refuse set out in other containers. Residential bulky waste is collected by WMI and disposed of along with construction and demolition debris at the La Crosse County Landfill, located 10 miles outside of the city. WMI, Modern Clean-up Services, and Richard's Sanitation collect waste from the commercial and institutional sector.

Until 1989 all waste was landfilled. Municipal solid waste is currently incinerated at the La Crosse, Wisconsin waste incinerator, located 4 miles from La Crescent. The incinerator, which opened in 1987, is operated by Northern States Power. Houston County signed a 1-year contract in 1989 with the incinerator and a 20-year contract in March 1990. La Crescent's collection and disposal fees, including the incinerator tipping fee, totalled $95 per ton in 1990.

Residents may be disposing of their waste elsewhere. Anyone who owns 40 acres or more can legally burn their refuse. In addition, Houston County's Recycling Specialist suggests that some residents who work in

Total Waste Recovered and Disposed (Percent by Weight, 1990)



Note: Due to rounding, numbers do not add to 100%.

Refuse Collection and Disposal (cont'd):

La Crosse may be bringing their refuse there for disposal in order to avoid the volume-based refuse rates.

Materials Recovery Overview

Goals and Legislative Requirements:

State: In 1985 the State of Minnesota banned the landfilling of waste oil, tires, white goods, and batteries. In 1989 the State set a goal of recycling 25 percent of the waste stream by 1993. Counties were required to develop recycling plans and specific waste reduction goals by October 1990.

County: In January 1989, Houston County passed an ordinance requiring the separation for recycling of newspaper, corrugated cardboard, glass, aluminum and ferrous cans, and HDPE and PET plastics. The ordinance also bans the landfilling or incineration of yard waste; such material must either be dropped off at the City's compost site or composted in residents' backyards. An anti-scavenging clause prohibits the collection of recyclables by any person, firm, or corporation other than the owner or the hauler of the recyclable materials.

The Houston County Landfill closed in 1983. Since the County's geologic and soil conditions were unsuitable for siting a new landfill, refuse was diverted for 6 years to the Red Oak landfill in Iowa. In fall 1987 the Houston County Board of Commissioners appointed a Recycling Advisory Task Force to plan recycling activities within the County, and communities began to initiate recycling programs. In 1989 La Crescent's Mayor passed a mandatory recycling ordinance, and the City implemented a curbside program. La Crescent contracted Waste Management, Inc. (WMI), the City's waste hauler, to collect newspaper, corrugated cardboard, glass, aluminum and ferrous cans, and plastics at curbside from all 1,568 households. This recycling contract is up for bid on an annual basis. La Crescent sold refuse bags at $1.35 a piece to cover all City solid waste management expenses. The sole source of funds for WMI's contract is refuse bag fees; for each refuse bag sold in 1990, Waste Management received $0.79, of which it spent $0.42 on recycling collection and $0.37 on refuse collection. However, because WMI expected more bags to be sold, it lost money. In 1991 the City increased the refuse bag fee to $1.75. Waste Management receives $1.29 per bag, of which $0.42 is spent on recycling and $0.87 is spent for refuse collection.

The City's ordinance includes an anti-scavenging clause; however, it is not enforced. Two people have been caught and warned not to repeat the offense. No fines have been issued.

In 1990 the City began to accept branches, brush, leaves, grass clippings, and other yard waste for composting at the Shade Tree Disposal Site (the old city landfill) from May through October. Yard waste undergoes minimal processing and is available free of charge to City residents.

Houston County accepts bulky items and white goods at the landfill/dumpster site in order to minimize illegal dumping. Disposal and salvage costs for white goods are covered through a fee of $0.50 per household per month added to residents' utility bills. To further discourage illegal dumping, the County charges offenders $0.68 per pound of illegally dumped white goods or refuse.

In 1989 the County Commissioners approved construction of a regional intermediate processing center (IPC) in the City of Houston to ensure markets for recyclables. The IPC, which opened in January 1990, was funded through a Capital Assistance Grant from the State, met by matching County funds. This facility accepts recyclables collected through County curbside programs as well as materials from private haulers and businesses.

Recycling Activities

Residential Curbside Recycling

Start-up Date:	April 1989
Service Provider:	Waste Management Inc., La Crosse, Wisconsin
Pick-up Frequency:	Weekly
Same Day as Refuse:	Yes
Households Served:	1,568 households – 1,308 in single-family houses and 260 in buildings from 2 to 20 units
Mandatory:	Mandatory for newspaper, corrugated cardboard, glass, aluminum and ferrous cans, and HDPE and PET plastics; voluntary for magazines, PVC, polypropylene, all other plastics, and high-grade office and computer paper
Participation Rate:	74 percent (based on observation of selected streets)

Materials Collected:	Newspaper, high-grade paper (white office paper and computer paper), corrugated cardboard, magazines, glass, aluminum and ferrous cans, and HDPE, PET, PVC, polypropylene, and all other (#7) plastic containers
Set-out Method:	Residents place paper bags in their 20-gallon recycling bins supplied by the County. Glass is placed in one bag, aluminum and tin cans in a second, and flattened plastics in a third. Newspaper and high-grade paper are kept segregated and can be either bundled or placed in another bag. Magazines and cardboard must be tied separately. Bins are set out at curbside. Multi-unit tenants who dispose of their refuse in dumpsters place their recycling bins beside the dumpsters.
Collection Method and Vehicles:	Three-person refuse collection crews pick up recyclable materials after their weekly refuse runs. Haulers place materials in 55-gallon drums set in 13-foot-long by-3-foot-high containers designed by Nedland Industries. These containers are fitted into a flat-bed trailer pulled by a Darr Truck. Crews sort the glass by color; they place aluminum and ferrous cans in one barrel, and paper in another.
Economic Incentives:	La Crescent residents pay volume-based refuse rates. In 1990 residents paid $1.35 per bag of refuse. This fee includes $0.42 for recycling collection. In 1991 the fee increased to $1.75 per bag.
Enforcement:	Ordinance 261 requires the source separation of mandatory materials. Haulers will not pick up recycling bins contaminated with materials not mandated for collection; instead, they leave a sticker on the bin detailing which material should not have been set out. They may also put a second notice on bins to encourage residents to prepare materials properly, such as flattening milk jugs.
Annual Tonnage:	232 tons in 1990

Commercial & Institutional Curbside/Alley Recycling

Legislative Requirements:	Recycling is voluntary for business and most institutions. In 1991 Minnesota mandated that schools must recycle a minimum of three materials by 1993.
Service Provider:	Modern Clean-up Services
Number Served:	10 in 1990, 15 in 1991
Type Served:	Supermarkets, convenience stores
Materials Collected:	Corrugated cardboard
Pick-up Frequency:	Once a week
Set-out and Collection Method:	Most cardboard is generated from one grocery store, which owns a baler. Cardboard collected from Modern Clean-Up Services' other customers is set out loose.
Incentives:	Customers are charged weight-based rates for refuse and pay no fee for cardboard. Modern Clean-up Services will pay customers for cardboard when the market price reaches $40 per bale.
Enforcement:	Not applicable

Annual Tonnage: 52 tons in 1990

School & Office Recycling

The public high school and elementary school collect corrugated cardboard, ferrous and aluminum cans, and high-grade paper in boxes located in storage rooms. When the boxes are full, employees transport recyclable materials to the City drop-off centers.

In fall 1990, The Crucifixion School initiated a corrugated cardboard, newspaper, high-grade paper, and aluminum can recycling program. The recyclables are stored in a shed on the school grounds; tonnages collected average 400 pounds per week. The County Recycling Specialist, Nick Nichols, hauls the materials to the County IPC. Houston County pays the school for its aluminum cans. The school also recycles bingo cards from its weekly game.

High-grade paper is separated and shredded at the municipal building. Janitors haul the paper to the County drop-off site. Tonnages collected from The Crucifixion School and municipal office buildings are not included in listed breakdowns.

Drop-off Centers

Number and Type:	2 (one unstaffed recycling shed at the wastewater treatment plant and one staffed center at the old City landfill/dumpster site)
Public or Private:	Public (both drop-offs are County-owned)
Sectors Served:	Residential and commercial/institutional
Materials Accepted:	Both drop-off centers accept newspaper, high-grade paper, magazines, corrugated cardboard, glass, aluminum and ferrous cans, and HDPE, PET, PVC, polypropylene, and all other plastic resins. The dumpster site also accepts batteries, tires, and white goods free of charge. The County pays for aluminum cans at this site. Motor oil is collected at private service stations.
Annual Tonnage:	77 tons in 1990, including an estimated 5 tons of corrugated cardboard dropped off by commercial businesses

Many businesses bring their recyclables to the drop-off centers. At these sites, residents and businesses must sort glass by color and ferrous from aluminum cans plastics are not required to be sorted. Materials are placed in 55-gallon barrels set in an old truck body.

Salvage/Reuse

The three City employees who work part-time at the dumpster/recycling site may salvage bulky items such as furniture and other items including bicycles, scrap aluminum, and batteries. In 1990 they salvaged 3 tons of materials and kept the revenues from the sales. White goods brought to this site are salvaged for scrap metal by the County.

Construction and Demolition Debris Recovery

La Crescent recovered 600 tons of asphalt in 1990 at Mathy Construction in La Crosse, Wisconsin. The material was reground, separated, and relaid as asphalt. The company does not process other types of C&D debris.

Processing and Marketing of Recyclables

Waste Management transports sorted recyclable materials 18 miles to the County owned and operated Houston County Processing Center (IPC) in the City of Houston, Minnesota. The IPC also accepts recyclable materials from businesses and private haulers free of charge. The 4,000-square-foot building, located on a 3/4 -acre site, contains a tipping floor, a recyclables sorting area, and a processing area. Another 4,080-square-foot building is used for storage. Four semi-trailer loading docks occupy 1,280 square feet. The total capital cost of the facility was $260,000. Three handicapped people and two supervisors process approximately 15 tons per week. In 1990 the IPC processed 594 tons of recyclables, collected throughout the County, at a cost of $104 per ton. The IPC's goal is to process 825 tons per year. Designed to handle a maximum of 5 tons per day, the facility currently operates 235 days per year.

Operators move sorted recyclables to the appropriate processing area via a forklift with a special scoop attachment. Ferrous cans are flattened, baled, and loaded into trailers supplied by Alter Metals. Alter Metals purchases the ferrous cans and acts as a broker for Alcoa for aluminum cans. Alcoa provides a flattener and a blower to load the aluminum cans into a trailer parked in the dock area. All newspaper is shredded, baled, and sold to local farmers for $1.25 per bale as animal bedding. High-grade paper and corrugated cardboard are baled and sold to Waldorf Corp. in St. Paul. PET plastics are shredded and granulated; HDPE, PP, PVC, and #7 plastics are baled whole. Phoenix Recycling in Roseville, Minnesota purchases all plastics. Glass is crushed and sold to D&M Recycling in La Crosse, Wisconsin. Less than 1 percent by weight of the recyclables entering the IPC are rejected. Lead-acid batteries collected at the dumpster site are sold to Battery Mart in La Crosse for recycling. White goods are sold as scrap metal to Max Phillips and Sons in Eau Claire, Wisconsin.

Market Development Initiatives/Procurement

In September 1991, the County will put forth a resolution to allow a 10 percent price preference for the purchase of recycled paper and other recycled products such as re-refined motor oil and recycled plastic picnic tables.

The County has marketed its shredded newspaper to local farmers as a bedding source. The farmers need less shredded newspaper than other bedding materials such as straw or wood shavings.

Composting Activities

In April 1989, La Crescent began composting yard waste at the La Crescent Shade Tree Compost Site, located in La Crescent at the City dumpster in town. From April through October, residents, landscapers, and private haulers can deposit their leaves and grass clippings into a large pile free of charge. Brush, also accepted at the site, is burned. The pile undergoes minimal processing and is turned with a front-end loader three to four times per year. No materials delivered are rejected as noncompostable. Compost is available free of charge to all residents.

Amount and Breakdown of Materials Recovered

Material	Residential* (Tons,1990)	Commercial/ Institutional (Tons,1990)	Other (Tons,1990)	Total (Tons,1990)
Newspaper	107.4	0	–	107.4
Corrugated Cardboard†	58.6	57	–	115.6
High-grade Paper	1.65	1.65	–	3.30
Other Paper	5	0	–	5
Glass	43.1	0	–	43.1
PET Plastic	3	0	–	3
HDPE Plastic	33	0	–	33
Other Plastic	0	0	–	0
Aluminum Cans	18	0	–	18
Ferrous Cans	1.8	0	–	1.8
Appliances/White Goods	0.5	0	–	0.5
Motor Oil	33.6	0	–	33.6
Batteries	0.37	0	–	0.37
Other‡	3	0	–	3
Subtotal MSW Recycled	**309.02**	**58.65**	–	**367.67**
Leaves	128.16	0	–	128.16
Grass Clippings	15.9	0	–	15.9
Subtotal MSW Composted§	**144.06**	**0**	–	**144.06**
Total MSW Recovered	**453.08**	**58.65**	–	**511.73**
Asphalt	–	–	600	600
Total C&D Recovered	–	–	**600**	**600**
Total Materials Recycled	**309.02**	**58.65**	**600**	**967.65**
Total Materials Composted	**144.06**	**0**	**0**	**144.06**
Total Materials Recovered	**453.08**	**58.65**	**600**	**1,111.73**

Notes: Recovered tonnages represent materials recovered minus rejected materials.

Although tires are accepted at the drop-off sites, tonnages are not included here because the tires are burned.

*Residential tonnages include materials dropped off by commercial businesses, schools, and municipal buildings at La Crescent's drop-off sites. Of the 309 tons recovered from the residential sector, 232 tons were collected at curbside and 77 tons were collected at drop-off sites.

†Commercial tons recovered include 52 tons of corrugated cardboard collected by Modern Clean-up Services and 5 tons of cardboard recovered at the drop-off sites. They do not include a few tons of material collected at The Crucifixion School and municipal office buildings.

‡"Other" includes items salvaged by dumpster site operators, including furniture, batteries, scrap aluminum, and bicycles.

§Yard waste is not weighed. Tonnages are estimates based on weights of grass clippings and leaves measured separately for two weeks in summer and in fall multiplied by the total number of participating households.

Publicity and Education

La Crescent distributes its recycling literature with residents' and businesses' yearly tax statements. Articles on recycling and other environmental features are printed bimonthly in the local newspaper. The County Assistant Recycling Coordinator speaks at local schools on environmental and recycling issues.

Economics

Costs Cover: In 1990 the City of La Crescent paid Waste Management for collecting 232 tons of residential recyclables at curbside. The City also covered the cost of processing 144 tons of yard wastes, and the costs for administering municipal recycling and composting programs. Equipment was paid off through Capital Assistance grants.

Houston County paid for the collection of 77 tons of recyclables accepted at the City drop-off sites, and the processing of all 309 tons of recyclables. The County finances all the listed capital costs except for composting equipment, for which La Crescent paid.

Capital Costs: Collection

Item	Cost	Use	Year Incurred
1,400 Recycling Bins @ $6.00*	$8,400	Recycling	1989
5 Nedland Industries Recycling Containers @ $2,550†	10,200	Recycling	1989
2 Recycling Trucks @ $32,888†	65,776	Recycling	1989 & 1991
2 3/4 Ton Pick-up Trucks @ $16,500‡	33,000	Recycling	NA
Recycling Shed†	1,645	Recycling (DO)	1989
Truck Body with 6 55-Gallon Recycling Barrels†	NA	Recycling (DO)	NA
Other†	26,714	Recycling	1989

*La Crescent purchased the recycling bins, which it funded through revenues generated from the sale of refuse bags.

†Costs incurred by Houston County. Other equipment includes additional equipment such as tarps, signs, a hooklift, and additional containers. Equipment was paid in full at the time of purchase and was funded through the County and a Capital Assistance Grant.

‡The two 3/4-ton pick-up trucks were purchased and are owned by WMI; costs are not available.

Capital Costs: Processing

Item	Cost	Use	Year Incurred
Alcon Building (IPC)	$32,500	Recycling	1989
642 B Bobcat	11,561	Recycling	1989
ECOA Pallet Lifter	250	Recycling	1989
JD 336 Baler	2,584	Recycling	1989
GPI M-60 HP Vertical Baler	7,300	Recycling	1989
GPI BCB 2000 Can Baler	3,400	Recycling	1989
Shredder Knives with Plastic Shredder	6,284	Recycling	1989
Miller Glass Crusher	2,685	Recycling	1989
Magnetic Separator	1,950	Recycling	1989
Aluminum Blower and Flattener	Loaned	Recycling	–
Two Self-Dumping Hoppers @ $409	818	Recycling	1989
4 Ging Scales and Line Batteries	2,202	Recycling	1989
Toledo Scale	1,900	Recycling	1989
Paper Shredder with Cyclone	7,538	Recycling	1989
Other*	15,966	Recycling	1989
Front-end Loader (40% of time)†	58,200	Composting	1989

Note: All capital processing costs, except for the front-end loader, were incurred by Houston County. County equipment has been paid in full at the time of purchase.

*Includes additional equipment such as hard hats, tools, fork lifts, and grinders.

†La Crescent leased the front-end loader over a 5-year period. Each year the City pays 20 percent of its cost at an interest rate of 8 percent. After 5 years (in 1994) the front-end loader will become the property of the City.

Annual and Per Ton Operating and Maintenance Costs (1990)

	Cost	Tons Covered	Per Ton Cost
Recycling Subtotal	**$27,212**	**309**	**$88**
Collection	$25,723	309	$83
Curbside Collection*	25,723	232	111
Drop-Off Collection†	0	77	0
Processing†	0	309	0
Administration	938	309	3
Education/Publicity	551	309	2
Composting Subtotal	**$2,653**	**144**	**$18**
Collection‡	$0	144	$0
Processing	1,715	144	12
Administration	938	144	7
Education/Publicity	0	–	0
Recycling & Composting Total	**$29,865**	**453**	**$66**
Collection	$25,723	453	$57
Processing	1,715	453	4
Administration	1,876	453	4
Education/Publicity	551	453	1

Notes: Costs in this table represent costs incurred by the City of La Crescent. Monies generated through the sale of refuse bags cover the City's costs. Of the $1.35 per bag purchase fee, $0.009 per bag was spent on education and publicity, $0.03 on administrative costs, and $0.028 on compost processing.

*Represents contract fee City paid WMI for recycling collection in 1990, based on $0.42 from each refuse bag sold. In 1990 the City sold 61,245 refuse bags.

†Houston County covers drop-off site costs and the costs for processing recyclables at the County facility. Recyclable processing costs are $104 per ton.

‡Yard waste is not collected at curbside in La Crescent.

Materials Revenues: In 1990 the County received $30,000 in revenues from the sale of 594 tons of recyclable materials. La Crescent does not receive any materials revenues.

Source of Funding: Funds generated through sale of refuse bags plus a $0.50 per household per month fee

Full-time Employees: 11 (2 County employees and 1 City employee administer recycling and composting programs, 3 Waste Management employees collect recyclables, and 5 County employees process recyclables)

Part-time Employees: 3 City employees operate the dumpster/recycling drop-off site and process the yard waste 12 hours a week.

Future Solid Waste Management Plans

Houston County plans to collect used clothing at the drop-off shed and donate it to a thrift shop. The County also plans to encourage recycling of aluminum cans and glass at bars and restaurants; this program is slated to begin late in 1991. Although the businesses will have to supply their own barrels, the County will pick up the materials.

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Monroe, Wisconsin

Demographics

Jurisdiction:	City of Monroe
Population:	10,220 in 1990
Area:	4 square miles
Total Households:	4,271 (3,600 in single-family residences, 300 in two-family buildings, and approximately 371 in 59 buildings with three or more units)
Total Businesses and Institutions:	437 (5 schools, 10 City buildings, and 422 businesses, ranging from very small enterprises to approximately 5 large industrial firms)
Brief Description:	Monroe is a small rural city in the south central part of the State, 7 miles from the Illinois border. It is situated in a heavy dairy-producing area in Green County, and is also home to a large medical clinic. Monroe is the national headquarters for Swiss Colony, which is the City's largest employer. Other local industries include an independent manufacturer of transformers. Many residents are employed as non-union laborers at low wages. Monroe's per capita income was $15,565 in 1990; its 1990 median household income was $20,063.

Solid Waste Generation and Recovery

	Annual Tonnages (1989)				
	Residential*	Commercial/ Institutional†	Total MSW	Construction & Demolition‡	Total Waste
Recovered	**1,221**	**2,359**	**3,580**	**5,875**	**9,455**
Recycled	804	2,359	3,163	5,875	9,038
Composted	417	0	417	0	417
Disposed	**2,581**	**6,499**	**9,080**	**267**	**9,347**
Incinerated§	0	10	10	0	10
Landfilled	2,581	6,489	9,070	267	9,337
Generated	**3,802**	**8,858**	**12,660**	**6,142**	**18,802**
	Percent by Weight Recovered				
Recovered	**32%**	**27%**	**28%**	**96%**	**50%**
Recycled	21%	27%	25%	96%	48%
Composted	11%	0%	3%	0%	2%

*Residential waste recovered and disposed represents materials collected at curbside from one- to two-unit households, thus excluding 371 multi-unit households. Residential waste recovered also includes estimated tonnages of residential recyclables recovered at the two drop-off sites. In 1990 residential curbside tonnages rose 21 percent from 537 tons (in 1989) to 650 tons. In 1991 an estimated 748 tons of recyclables were collected at curbside, an increase of nearly 40 percent over 1989 rates.

†Commercial/institutional tonnages recovered include some material, such as corrugated cardboard and high-grade paper, collected from industrial sources, but do not include 5,540 tons of industrial scrap recovered from a transformer manufacturer, nor 4,091 tons of paper recycled from a manufacturer of business forms. If such paper waste were included, Monroe would have a 50% commercial recovery rate, and a 46% MSW recovery rate.

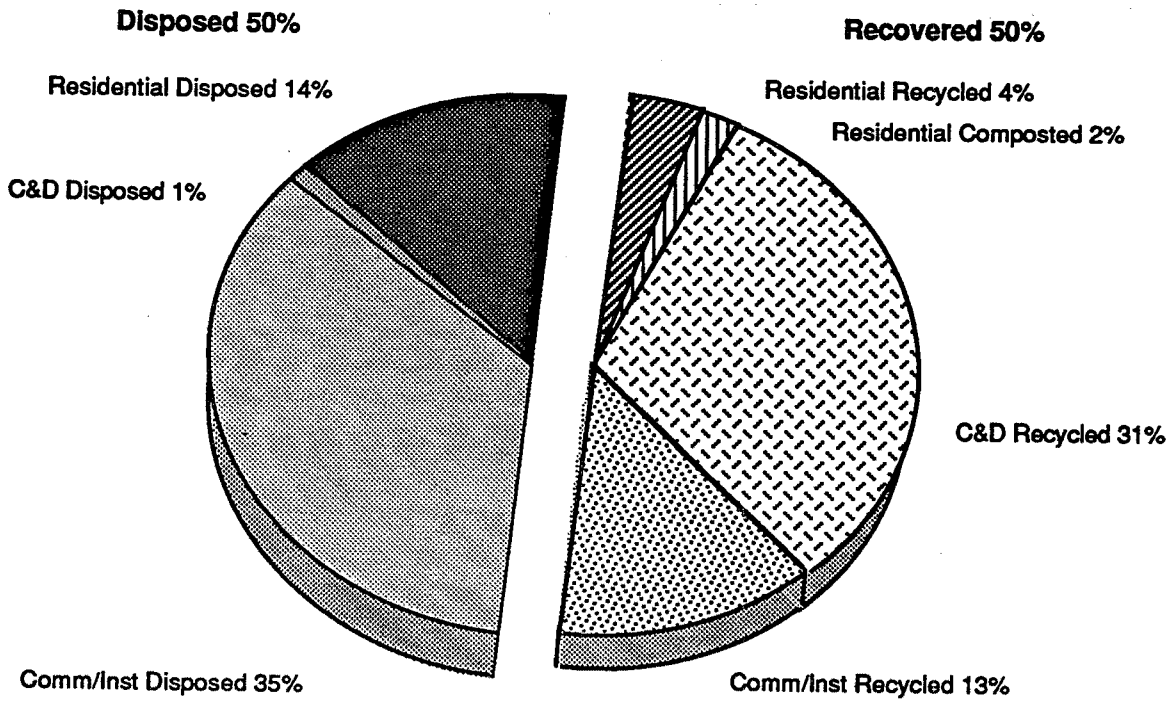
‡Tonnages for C&D debris disposed were obtained by extrapolating from data provided by Green Valley Disposal, the largest commercial hauler in the City. In 1989 Green Valley Disposal disposed 187 tons of C&D from the City of Monroe. According to Nate Klassy, the Director of Public Works, Green Valley Disposal hauls 70 percent of the City's C&D waste. Using this figure we estimate that Monroe disposed a total of 267 tons of C&D in 1989.

§Commercial waste incinerated is 9.95 tons of tires, which are chipped and used as fuel.

Landfill Tipping Fee: $15 per ton in 1988 and 1989; $20 per ton in 1990

Refuse Collection and Disposal: The City of Monroe collects refuse and recyclables from all residential units containing fewer than three households. Two private haulers collect refuse and recyclables from the remaining residential units and from the commercial/institutional sector. The City is divided into five areas for municipal refuse collection; City haulers service one area per weekday. In 1989 it cost Monroe $48.92 per ton, including tipping fee, to collect, transport, and dispose of its municipal solid waste at the County landfill. This excludes administrative costs. Until 1986 the City was assessed a fee by Green County for all materials placed in the landfill,

Total Waste Recovered and Disposed (Percent by Weight, 1989)



Refuse Collection and Disposal (cont'd):

whether they originated in the residential or the commercial sector. In 1986 the County instituted a per ton tipping fee, and private haulers were charged tipping fees for commercial tonnages. The City now pays only for the disposal of residential refuse.

Before implementation of the City recycling program, Monroe contributed two-thirds of the volume of solid waste in the County landfill. In 1990 the County reported a decrease of 30 percent in the amount of County garbage going to the landfill compared with 1984 levels.

Materials Recovery Overview

Goals and Legislative Requirements:

The City Source Separation Ordinance, adopted in 1985 and in effect since 1986, requires residents to separate listed recyclables (see below) from refuse and place them in a separate container for collection. In May 1990, a new recycling ordinance was passed (effective July 1990) that mandated source separation in multi-unit buildings and commercial enterprises. Beginning July 1990, the County landfill no longer accepts designated recyclables for disposal.

In 1983 the Green County landfill, Monroe's primary disposal site for residential and commercial refuse, was scheduled to close. A group of concerned citizens, upon learning that a new landfill was to

open in its place (at a cost of $1 million), petitioned the County to develop and implement a recycling program. Although the County's Solid Waste Management Board elected not to establish a county-wide recycling center, it did recommend that local communities plan their own programs. A year later, the Mayor of Monroe appointed a citizen representative to develop a recycling program for the City. Soon afterwards, the Monroe Area Recycling Committee (MARC), a planning group composed of citizen volunteers, was founded.

MARC, arguing that recycling would extend the lifespan of the new landfill and save disposal costs, succeeded in gaining City support for a large-scale recycling program. In 1984 the Street Superintendent established a municipal drop-off center that initially accepted only glass. MARC subsequently designed two recycling pilot studies, conducted in 1985, to determine how receptive Monroe citizens would be to curbside recycling, to ascertain the average amount of material that would be set out, and to evaluate the effectiveness of two different recycling containers.

Monroe's landfill disposal costs of $460,000 during 1985, coupled with results of the MARC recycling studies, convinced the City Council to adopt the City Source Separation Ordinance, which mandated separation of newsprint, corrugated cardboard, glass bottles and jars, all metal containers and scrap (including aluminum and tin cans, aluminum foil, brass, steel, copper, cast iron, and other metal scrap), lead-acid batteries, motor oil, tires, and grass clippings. Citywide curbside recycling of these materials began in January 1986. By 1989 Monroe residents were also required to separate PET and HDPE plastic containers, magazines, high-grade paper, and yard waste for recycling. In 1990 source separation of PVC and polystyrene plastics, glossy inserts, paperboard packaging, and hearing aid batteries became mandatory. Also in 1990, the County landfill stopped accepting recyclable materials for disposal, and Monroe passed a new Source Separation Ordinance that extended source separation requirements to multi-unit buildings and the commercial/institutional/industrial sector.

Soon after the implementation of curbside recycling, MARC published a report entitled *How to Set up a Recycling Program*, describing in detail the development and implementation of Monroe's recycling program, and offering advice to other communities wanting to set up similar programs. This publication, which was revised in 1989 and 1991, has been distributed to 150 communities throughout the country.

Recycling Activities

Residential Curbside Recycling

Start-up Date:	January 1986 (pilot programs instituted in 1985)
Service Provider:	The Monroe Street Department
Pick-up Frequency:	Weekly
Same Day as Refuse:	Yes
Households Served:	3,900 households (all households in buildings with fewer than three units)
Mandatory:	Yes. Residents are required to recycle all materials listed below.
Participation Rate:	At least 85 percent, based on observed set-outs per month

Materials Collected: Newspaper, magazines, corrugated cardboard, high-grade paper (including computer paper, windowless envelopes, colored office paper, adding machine tapes), kraft bags, aluminum cans and foil, glass bottles and jars, ferrous cans, other scrap metal (including brass, copper, aluminum, steel, and cast iron), white goods, PET and HDPE plastic containers, motor oil, and lead-acid batteries. In 1990 PVC and clean PS plastics containers, glossy inserts, telephone books, catalogues, telephone directories, paperboard packaging (including cereal boxes), asphalt, and hearing aid batteries were added. Tires are collected for a fee of $1.00 per tire. White goods are collected once a year in the spring.

Set-out Method: Newspaper, magazines, and glossy inserts are tied together or set out in kraft bags; high-grade paper is tied together or stacked in boxes; all other materials are commingled in a City-distributed 12-gallon recycling bin. Bins require an initial deposit of $6, charged to residents' water/sewage/garbage bills.) Motor oil is placed in an unbreakable, leakproof container.

Collection Method and Vehicles: The City uses two modified dump trucks, with one crew member on board each, for collection of recyclables. The trucks have doors on either side, and the tailgate pulls down to serve as a shelf for unloading. Recyclables are collected at the same time as regular refuse. The recycling truck travels behind the garbage truck; one worker loads refuse into the garbage truck while the other loads recyclables into the recycling truck. Recyclables are loaded commingled. Collection crews place containerized motor oil and lead-acid batteries on a rack under the main body of the truck.

In October 1991, the City purchased one side-loading Kann Curbsorter collection truck. The vehicle has six compartments and an on-board plastic compactor. According to the Director of Public Works, this new vehicle is more convenient to load than the retrofitted dump truck formerly used, as the sides of the dump truck were quite high. The new truck is operated by one crew member, and material is currently loaded commingled. The City decided to purchase a compartmentalized vehicle in order to leave them the option of switching to segregated collection in the future. Additionally, the Department of Public Works feels that a compartmentalized recycling truck has a better resale value.

Economic Incentives: None (City advertises long-range savings to the City as a result of recycling and waste reduction activities.)

Enforcement: If workers believe that a resident is not following recycling requirements they may "kick" bags and open them so that they can examine their contents. According to the City's Source Separation Ordinance, residents leaving recyclables in their refuse can be charged a fee equal to the cost of paying a City employee to separate the items, estimated at $60. First-time violators receive a warning and a request to separate. As of October 1991, no fines had been issued.

Annual Tonnage: 537 tons in 1989; 650 tons in 1990; 748 tons estimated to be collected in 1991

Before implementing its citywide curbside program, Monroe conducted a study to gauge residents' participation rates and the suitability of recycling containers. The City observed that the type of collection container used had an effect on the amount of recyclables collected. During the pilot studies, households that received a plastic recycling bin set out an average of 4.94 lbs. of recyclables each week. Households that received a plastic bag set out an average of only 2.18 lbs. each week. While other

factors may have also influenced the results of this study, this disparity convinced Monroe to distribute reusable plastic containers to all its residents.

In addition to the municipal curbside collection, the Boy Scouts conduct a monthly pick-up of aluminum cans and newspapers. The City assists by transporting materials to market in City vehicles.

Monroe's residential curbside recycling program has experienced significant growth since its inception in 1986, both in types of materials collected and tonnages recovered. In 1990 Monroe added PVC and PS plastic containers, magazines, glossy inserts, paperboard packaging, telephone books, and hearing aid batteries to its curbside program. Monroe recovered 409 tons of materials through curbside collection in the first year of the program (1986), 537 tons in 1989, and 650 tons in 1990—an increase of nearly 60 percent over 4 years, and of 21 percent from 1989 to 1990.

Multi-unit Collection

On July 1, 1990, recycling became mandatory for all multi-unit buildings. (Multi-unit buildings in Monroe may contain from 3 to 83 units each.) Residential buildings with three or more households are required to source-separate basically the same listed recyclables as all other residential units (except PVC and PS plastic, oil, magazines, and mixed paper). Private haulers service these units for refuse and most recyclables, with Green Valley Disposal servicing the majority of multi-unit buildings. Because refuse collection fees are based on the size of refuse containers, apartment building managers can save money through recycling by down-sizing refuse containers.

Green Valley Disposal collects recyclables weekly from custom-designed recycling containers located outside the buildings, adjacent to refuse containers. Recycling containers have six separate compartments for the segregation of recyclables. Green Valley Disposal uses three Kann recycling trucks with on-board plastic compactors for collection. The container inserts are removed, and each material is emptied into a separate compartment on the recycling truck. Residents are required to bring recyclable materials (as they do refuse) outside to the central recycling container. Residents supply their own paper or plastic bags for storage of recyclables within their households. According to Green Valley Disposal, this system is most compatible with the space constraints of apartments, and the fact that most apartment dwellers deposit recyclables on their way out of the building, and would be inconvenienced by returning a reusable recycling container to their home. Participation is high among apartment dwellers, and there has not been a significant problem with contamination of materials, according to Green Valley Disposal.

Commercial & InstitutionalCurbside/Alley Recycling

Legislative Requirements:	Since July 1, 1990, commercial and industrial enterprises and institutions have been required to recycle all materials that one-to-two-unit households are required to recycle. Listed recyclables are not accepted for disposal at the municipal landfill, and must be either source-separated for collection or self-hauled to a recycling drop-off or buy-back center.
Service Provider:	Businesses are served by two private haulers, Green Valley Disposal and Reufs Sanitary. Green Valley services approximately 70 percent of commercial customers.
Number Served:	In 1989 only a few businesses were served with curbside collection of recyclables. Other businesses self-hauled materials to the drop-off or buy-back center. Beginning July 1990, an estimated 140 businesses and 15 institutions were served with curbside collection.

Type Served:	In 1989 a few businesses and institutions, such as the local hospital and Swiss Colony, Inc., received pick-up service.
Materials Collected:	In 1989 businesses primarily recycled corrugated cardboard. Beginning July 1990, other recyclables were also collected, including high-grade paper, glass, aluminum cans, PET and HDPE plastic containers, newspaper, motor oil, lead-acid batteries, magazines, catalogues, and telephone books.
Pick-up Frequency:	Varies
Set-out and Collection Method:	Varies. Many use dumpsters and/or compactors for collection of corrugated cardboard. Green Valley Disposal outfits its commercial customers with either 20-, 60-, or 90-gallon containers, depending on the specific type and quantity of recyclables. To determine appropriate collection frequency and collection containers, Green Valley conducts a waste audit for its commercial customers before beginning pick-up.
Incentives:	Refuse fees are based on per-container charges, and businesses can save money through recycling by reducing the number of containers or down-sizing containers. Businesses can earn extra revenue by self-hauling recyclable materials to a buy-back center or market.
Enforcement:	The manager at the County landfill will inspect refuse periodically. If recyclables are found in the refuse, the landfill manager will photograph the refuse and contact Monroe's Director of Public Works. The Director will contact offending businesses and advise them on how to comply with recycling regulations. As of fall 1991, three businesses have been found to be in noncompliance with recycling regulations.
Annual Tonnage:	Not available

The commercial/institutional sector generates the majority of waste in the City. While many businesses in Monroe are presently serviced with curbside or alley collection of recyclables, when recycling first became mandatory, many businesses self-hauled materials to drop-off and buy-back sites. In 1990 Monroe began a special promotional program to encourage offices to recycle newspaper, telephone books, high-grade paper, and magazines.

Local schools recycle all grades of paper from all classrooms, and steel cans from the kitchen. A special education class collects materials and sells them to the Green County Salvage Yard. All revenue from materials sales is kept by the special education class.

Monroe's industrial sector also disposed of its waste in the County landfill. To extend the lifespan of the landfill, the City actively encourages industrial recycling efforts. In 1989, for instance, a local manufacturer of transformers recycled 5,540 tons of metal scrap, and a manufacturere of business forms recovered 4,091 tons of waste paper. Because this waste is considered industrial rather than municipal waste, these tonnages are excluded from listed figures.

Drop-off Centers

Number and Type: The City is serviced by one municipal drop-off center and one private buy-back, the Green County Salvage Yard. The public drop-off center is located at the municipal garage, near the City's shopping centers, and is open 24 hours per day, 7 days per week. Some materials collected through the a curbside program, including cardboard, aluminum and other metals, are hauled by the City to the Green County Salvage Yard for cash. While the Green County Salvage Yard discourages small loads of material, some residents and a number of businesses bring in aluminum cans and other metals. Some Monroe residents bring their glass bottles to buy-backs in Madison, Wisconsin.

Public or Private: The municipal drop-off center is publicly operated. The Green County Salvage Yard is privately operated.

Sectors Served: Monroe residents and businesses, as well as other residents of Green County utilize the drop-off centers. In 1989 some small businesses, including restaurants and taverns, self-hauled glass bottles to the City drop-off center.

Materials Accepted: The same materials collected at curbside are accepted at the municipal drop-off site. These include newspaper, high-grade paper, corrugated cardboard, glass containers, aluminum cans, ferrous cans, scrap metal, motor oil, lead-acid batteries, and PET and HDPE plastic containers. PVC and PS plastic containers, paperboard, glossy inserts, magazines, telephone books, and hearing aid batteries have been accepted since 1990. The private scrap yard buys metals, white goods, corrugated cardboard, and paperboard.

Annual Tonnage: An estimated 215 tons of material were collected from Monroe residents in 1989 through these two drop-off centers. (Monroe residents bring an unknown but small amount of recyclables to buy-backs in Madison.)

Processing and Marketing of Recyclables

Municipal crews deliver recyclable materials collected through the a curbside program to Monroe's municipal garage, where they are tipped for free. A minimal amount of equipment is used to process Monroe's recyclables. Public works staff or workers from Greenco, a local sheltered workshop, sort materials by hand. (While City employees do most of the sorting during the winter months, disabled workers perform the sorting during the remainder of the year, when City workers are occupied with other jobs.) The main body of the recycling truck is hoisted hydraulically, and the rear tailgate pulls out to serve as a sorting tray. Typically three workers and a supervisor sort recyclables and place materials in separate bags, bins, or hoppers. Some materials, such as aluminum and cardboard, are sold immediately, while others are stored until a sufficient volume is accumulated or a suitable market found.

Paper products are sorted into four different grades and sold to different end users. Newspaper, office paper, and telephone books are baled, either separately or alone depending on the volume, and sold to Madison Paper Processing in Madison, Wisconsin. The City purchased its first baler during the third year of its program. (Previously, materials had been transported for baling from the municipal garage to the landfill or Salvage Yard.) Newspaper which exceeds market demand is shredded at the County landfill into hay bale-sized bundles and sold as animal bedding. Magazines and glossy inserts are taken to Manistique Paper, Inc. in Manistique, Michigan. (This plant uses no virgin materials in its papermaking process.) Kraft paper bags mixed with corrugated cardboard and paperboard are sold to

the Green County Salvage Yard along with ferrous cans, aluminum cans, and other metals. The Salvage Yard bales the cardboard before selling it. Some mixed cardboard and paperboard is used to make insulation at Celotex near Madison. Glass is sorted by color, smashed into cullet with a sledgehammer or small bottle crusher, and sold to a broker, Midwest Steel in Madison, or to markets in Burlington, Wisconsin or Streator, Illinois. Aluminum cans are sold to the Green County Salvage Yard, which markets the material to Midwest Steel in Madison. PET plastics are sold to Wellman in New Jersey and to other processors. HDPE plastics are sold to Midwest Plastics in Stoughton, Wisconsin. PVC and PS plastics are sold to Poly-Anna Plastic Products in Milwaukee for manufacture of minnow buckets sold by Wal-mart. (PVC and PS plastics, however, were not sold in 1989 or 1990.)

Motor oil is stored in a 250-gallon tank and sold to Roger's Oil Company in Verona, Wisconsin for reprocessing. (Fomerly, it was used to heat the Municipal Garage Building; however, in early 1990 the Municipal Building switched to gas heat, and motor oil is no longer used for this purpose.) Auto batteries are taken to the Green County Salvage Yard. Button and other mercury, lithium/manganese, cadmium sulfide, and nickel/cadmium batteries are currently being stored. Hearing aid batteries are given to Janesville School for the Deaf, which markets them. Monroe currently bales and stores tires for future market opportunities. An estimated 0.5 percent by weight of materials brought to the municipal garage are nonmarketable.

Private haulers market their own materials. Green Valley Disposal unloads its materials directly from its compartmentalized recycling truck into 20-cubic-yard roll-offs. Materials are then hauled directly to three different markets in Madison.

In 1989 Monroe repaved many of its streets with recycled asphalt. The old street beds were ripped up, and the bituminous concrete was remixed and relaid. A total of 5,875 tons of asphalt were recycled in this process. The work was performed by a Monroe-based company, Reese Construction.

Market Development Initiatives

The Monroe Area Recycling Committee (MARC) has secured a number of in-state brokers and end users for the City's recyclables. Much of the material collected through the curbside program is sold locally to the Green County Salvage Yard, which resells it to various end users. MARC is considering selling more of the City's recyclables directly to end users, such as paper mills.

MARC seeks additional markets when the supply of recyclables exceeds the capacities of existing markets. For example, when traditional paper outlets are filled, the County shreds and bales its paper for sale as animal bedding.

Certain materials, such as PVC and PS plastic containers, tires, and button-type batteries are not currently marketed but are stored for future market opportunities.

Composting Activities

Backyard Composting

MARC promotes backyard and farm composting through the local media. According to the Director of Public Works, an estimated 10 percent of Monroe's citizens are composting yard waste in their own backyards. MARC attributes Monroe's low a waste generation rate, in part, to the prevalence of backyard composting.

Curbside Collection

Start-up Date:	1981 for leaves, 1986 for grass clippings and brush
Service Provider:	City Street Department
Households Served:	3,900
Mandatory:	Yes. Source separation of leaves and garden trimmings became mandatory in 1981. Source separation of grass clippings became mandatory in 1986.
Materials Collected:	Leaves, grass clippings, garden trimmings, brush no more than 6 inches in diameter, and Christmas trees
Set-out Method:	It is recommended that grass clippings and small brush be set out in transparent bags (supplied by residents). Branches are tied, and leaves are raked into the gutter.
Collection Vehicles and Method:	A push broom attached to the front of a jeep pushes leaves to block corners, and a front-end loader scoops leaves into one municipal packer truck. One crew member sits aboard each of these three vehicles. Bagged grass clippings and brush are opened and emptied into the same packer truck. (Plastic bags are brought to a local retailer for recycling.) Christmas trees are also collected in the packer truck.
Collection Frequency:	Grass clippings are collected weekly, on the same day as refuse collection, from April until November. Leaves are collected weekly, from October 15 until Thanksgiving Day, not on refuse collection days.

Composting Site

Municipal crews bring leaves, grass clippings, brush, and other yard waste to the 4.5-acre municipal composting site, located approximately 2 miles from collection routes. The site is situated on 200 acres of City-owned property, on which the City's airport is also located. Materials are mixed and ground in a tub grinder and formed into a large mound. Christmas trees are run through a chipper and placed on top of the mound. The compost pile is turned four times per year, and compost is ready within 1 or 2 years, depending on weather conditions. (Because the mound is not watered, the compost takes longer to cure during dry years.) Compost is given away free to local residents or used in city parks as a soil amendment. In 1991 one local gardener took nearly the entire lot of compost (approximately 5 years, worth of material, estimated to weigh 810 tons). [1]

Amount and Breakdown of Materials Recovered

Material	Residential* (Tons, 1989)	Commercial/ Institutional (Tons, 1989)	Other (Tons, 1989)	Total (Tons, 1989)
Newspaper	252.28	0	–	252.28
Corrugated Cardboard	94.83	1,984.84	–	2,079.67
High-grade Paper	0	17.00	–	4.92
Mixed Paper†	4.92	0	–	4,095.82
Glass	149.60	0	–	149.60
PET Plastic	0.18	0	–	0.18
HDPE Plastic	19.76	0	–	19.76
Aluminum Cans	148.00	20.00	–	168
Ferrous Cans	49.65	0	–	49.65
Appliances/White Goods	2.00	18.00	–	20
Other Metal	47.87	235.20	–	283.07
Motor Oil	33.63	40.99	–	74.62
Batteries	1.29	42.90	–	44.19
Subtotal MSW Recycled	**804.01**	**2,358.93**	–	**3,162.94**
Leaves	150	0	–	150
Other Yard Waste‡	267	0	–	267
Subtotal MSW Composted	**417**	**0**	–	**417**
Total MSW Recovered	**1,221.01**	**2,358.93**		**3,579.94**
Asphalt	–	–	5,875	5,875
Total C&D Recovered	–	–	**5,875**	**5,875**
Total Materials Recycled	**804.01**	**2,358.93**	**5,875**	**9,037.94**
Total Materials Composted	**417**	**0**	**0**	**417**
Total Materials Recovered	**1,221.01**	**2,358.93**	**5,875**	**9,454.94**

Note: Tonnages listed above represent marketed material.

*Residential tonnages include material collected through the municipal curbside program, estimated tonnages received at two local drop-off centers, and materials collected through the Boy Scouts' monthly pick-up. They do not include small amounts of material brought to private buy-back centers in Madison, tonnages of yard waste composted in residents' backyards or farms, or tonnages of materials collected by private haulers from multi-unit buildings.

†A local manufacturerer of business forms recycled 4,091 tons of high-grade and mixed paper. If this industrial waste is included in above figures, Monroe recovered 6,449.83 tons of commercial waste, and 7,670.84 tons of MSW in 1989.

‡Includes brush, grass clippings, and Christmas trees.

The following chart lists the total tonnage of recyclables and yard waste collected at curbside through the residential municipal program from its onset in 1986 to 1991 (1991 tonnages were estimated from the first 9 months of data). The 21 percent increase in curbside tonnages recovered in 1990 over 1989 levels can partially be explained by the addition of materials, such as paperboard packaging, to the curbside program. Income earned through the sale of recyclables over these years is also listed. While total tonnage has steadily increased, income earned has not, due to fluctuations in market conditions.

Year	1986	1987	1988	1989	1990	1991
Tonnage (Curbside)	409	465	506	537	650	748 (est.)
Revenue	$16,740	$24,788	$30,263	$27,944	$21,615	–

Source Reduction Initiatives

MARC actively encourages source reduction through articles in the local media and by working with large volume generators such as cafeterias and fast food restaurants. For example, MARC's volunteer coordinator has met with many elementary school classes to discuss recycling concepts and to encourage faculty and students to pressure the school administration to reduce use of disposable products. As a result, in 1990 local elementary school cafeterias switched from disposable polystyrene food trays to reusable plastic trays. One school estimates that the switch has reduced by 75 percent the volume of trash generated on an average day. Monroe is strongly considering purchasing metal silverware for all school cafeterias

According to MARC's recycling coordinator, Monroe's recycling literature helped influence the City schools of Portland, Oregon to discontinue use of disposable polystyrene food containers in their lunch program and replace them with reusables.

Publicity and Education

Education and publicity are key components of Monroe's recycling program. MARC's publicity subcommittee arranges media coverage for local recycling activities. Its coordinator reports the success of local and other recycling efforts in a local newspaper column. Recycling activities are also promoted on a local cable television station, on the radio, through utility bill inserts, and at town meetings. MARC's promotion subcommittee coordinates outreach programs in local public schools, holds recycling poster and essay contests in the schools, distributes recycling brochures, and promotes the purchase of products made from recycled materials.

Private commercial haulers provide publicity materials to explain collection procedures to their own customers.

Economics

Costs Cover: Costs given below cover the City's costs of collecting, processing, and marketing 804 tons of recyclables and 417 tons of yard waste from the residential sector via municipal curbside and drop-off collection, including monthly collections by the Boy Scouts. While the City does not incur costs for the small amount of residential recyclables collected from the Green County Salvage Yard, these tonnages cannot be separated out and are thus included in the tonnage figures listed below.

Capital Costs: Collection

Item	Cost	Use	Year Incurred
2 Modified Dump Trucks @ $20,000	$40,000	Recycling	1972
4,500 Recycling Bins @ $4.50	20,250	Recycling	1985
Barrels*	NA	Recycling/DO	NA
Kann Curbsorter	72,000	Recycling	1991
Packer Truck @ 75% of use	60,000	Composting†	1972
Jeep (used)	7,500	Composting	1981
Sweeper Attachment	1,000	Composting	1981

Note: All equipment has been paid for in full. The two dump trucks were owned prior to the onset of the recycling programs.
*Barrels are used at the municipal drop-off center. The purchase of these predates the recycling program, and their cost is unknown.
†This packer truck is also used for refuse collection occasionally, when a garbage truck is out of service.

Capital Costs: Processing

Item	Cost	Use	Year Incurred
2 Down-stroke Balers @ $6,000	$12,000	Recycling	1988, 1990
10 Dumping Hoppers @ $400	4,000	Recycling	1989
Sledge Hammer	15	Recycling	Pre-exists program
Glass Crusher	NA	Recycling	1986
Tub Grinder*	Rented for 2 weeks	Composting	–
Chipper	6,000	Composting	1982

Note: All equipment has been paid off.
*The rental fee for the tub grinder ($2,000/week for 2 weeks/year) is included under operating and maintenance costs for composting.

Annual and Per Ton Operating and Maintenance Costs (1989)

	Cost	Tons Covered	Per Ton Cost
Recycling Subtotal	**$77,777**	**804**	**$97**
Collection (Curbside and Drop-off)	$33,311	804	$41
Processing	36,138	804	45
Administration	8,328	804	10
Education/Publicity	0	804	0
Composting Subtotal	**$37,500**	**417**	**$90**
Collection	$28,125	417	$67
Processing	7,500	417	18
Administration	1,875	417	4
Education/Publicity	0	417	0
Recycling & Composting Total*	**$115,277**	**1,221**	**$94**
Collection	$61,436	1,221	$50
Processing	43,638	1,221	36
Administration	10,203	1,221	8
Education/Publicity	0	1,221	0

Note: Education/publicity program is conducted by an all-volunteer staff. Television and radio coverage is obtained free of charge. No publicity materials were published in 1989.

*Of total recycling and composting costs, approximately $100,000, or 87% consists of labor expenses. Of this, $5,366 is paid to four part-time workers from the Greenco sheltered workshop. Municipal workers are paid an hourly wage of $7.50 for the collection of recyclable and compostable materials.

Materials Revenues: $27,944 from the sale of recyclable materials in 1989; $21,615 from the sale of recyclable materials in 1990

Source of Funding: General taxes, 33 percent of the $48 per household garbage user's fee (or $15.80 per household), and revenues from recyclables. (In 1990 the City received a State grant of $13,200.)

Full-time Employees: 1 (truck driver)

Part-time Employees: 10 (1 City employee at the municipal drop-off center, 4 workers from the sheltered workshop to process materials, 1 college student in the summer for grass and brush collection, 3 crew members for leaf collection vehicles, and 1 DPW Director who spends a small amount of his time on recycling and composting activities)

Future Solid Waste Management Plans

Monroe is targeting multi-unit buildings and commercial businesses in the next phase of its recycling program. The City also hopes to obtain a larger bottle crusher. MARC is researching ways to recover food and other organic wastes, including expanding its composting programs and producing liquid fuels or methane gas.

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Endnotes

[1]Compost tonnage was obtained using a conversion factor of 1,500 lbs/cubic yard. (*Source*: U.S. EPA, *Yard Waste Composting: A Study of Eight Programs*, April 1989.)

Peterborough, New Hampshire

Demographics

Jurisdiction:	Town of Peterborough
Population:	5,239 in 1990
Area:	36 square miles
Total Households:	1,800 single-family households in 1990
Total Businesses and Institutions:	267 (257 businesses, 4 industries, and 6 institutions)
Brief Description:	Peterborough is a small rural New England town situated in southern New Hampshire in the Mount Monadnock region. Its primary industries are mail order companies and magazine publishing. The Town is also a retail center for neighboring communities. Its 1990 per capita income was $22,000.

Solid Waste Generation and Recovery

	Annual Tonnages (1990)				
	Residential	Commercial/ Institutional	Total MSW*	Construction & Demolition†	Total Waste
Recovered	**847**	**120**	**967**	**NA**	**967**
Recycled‡	847	120	967	NA	967
Composted	0	0	0	0	0
Disposed§	**1,156**	**2,878****	**4,034**	**273**	**4,307**
Incinerated	NA	298	NA	–	604
landfilled	NA	2,580	NA	273	3,703
Generated	**2,003**	**2,998**	**5,001**	**NA**	**5,274**
	Percent by Weight Recovered				
Recovered	**42%**	**4%**	**19%**	**NA**	**18%**
Recycled	42%	4%	19%	NA	18%
Composted	0%	0%	0%	NA	0%

*MSW recycled and recovered contains a small amount of construction debris salvaged at the Recycling Center.

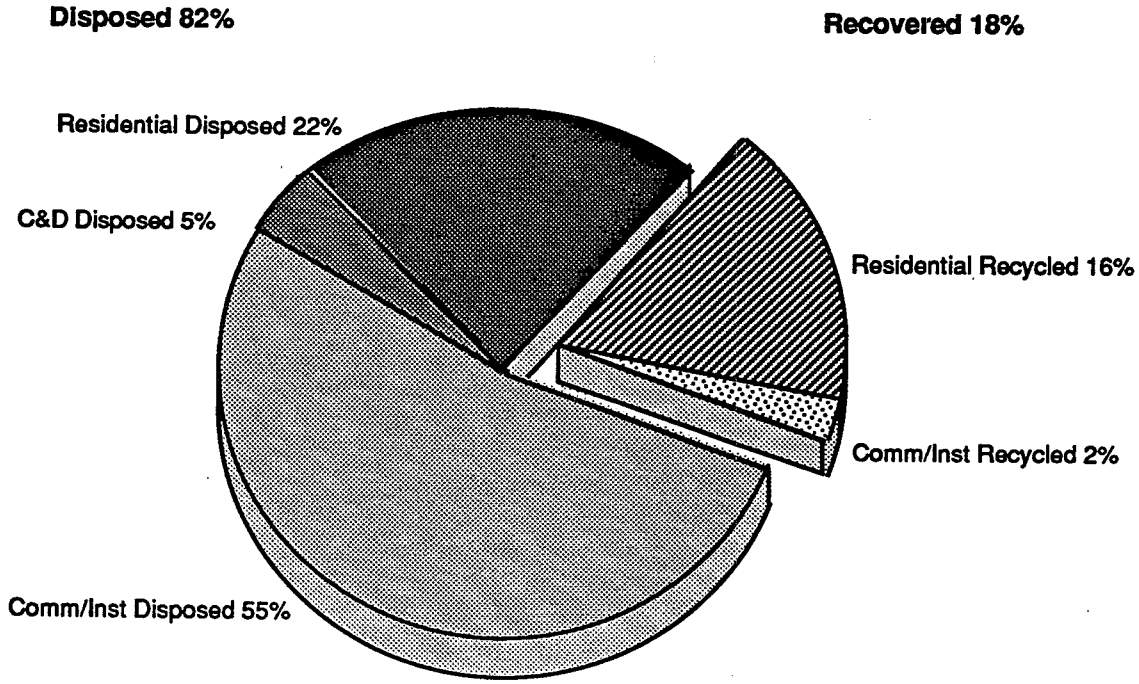
†Waste Management (WMI), the City's hauler of construction debris, disposed of 1,500 cubic yards of uncompacted construction debris, consisting primarily of wood waste and shingles, from the City of Peterborough in 1990. Using a conversion factor of 364 lbs. per cubic yard of mixed wood waste, WMI disposed 273 tons of C&D from Peterborough. An untracked amount of construction debris, such as old doors and lumber, is salvaged at the Recycling Center. (Source of conversion factor: Office of Recycling, Department of Environmental Protection, Trenton, New Jersey)

‡Waste recycled includes materials recovered through the Town Recycling Center totaling 892 tons (1990), an estimated 95 percent of which comes from residential sources and 5 percent from commercial sources. (Of the total 1,452 tons of material brought to the Town Recycling Center, 892 tons, or 61 percent, consisted of recyclable materials.) An additional 75 tons of corrugated cardboard were collected by Waste Management, Inc. (WMI) from the commercial sector.

§Waste disposed consists of nonrecyclable materials collected at the Town Recycling Center, and waste disposed from residents and commercial businesses not using the Town drop-off center. A total of 337.23 tons of material was disposed from the Town drop-off center. Ninety-five percent of this, or 320 tons, is estimated to come from the residential sector. Waste Management, Inc. (WMI) hauls an estimated 80 percent of all refuse collected from residents not using the Recycling Center. WMI collected an estimated 500 tons of material from its residential customers.1 We estimate from this information that a total of 625 tons of waste was disposed from residents not using the drop-off center. Adding 320 tons of waste collected through the drop-off center, and 211 tons of wood collected at the drop-off and burned as a fuel source, yields a total of 1,156 tons of waste disposed from Peterborough residents. WMI incinerated 10 percent of all waste it collected from Peterborough.

**Waste Management collected an estimated 2,850 tons of waste for disposal from the commercial sector, and an estimated 17 tons of waste and 11 tons of wood chips were disposed of at the Town drop-off from commercial sources, yielding a total of 2,878 total tons of commercial refuse disposed.

Total Solid Waste Recovered and Disposed (Percent by Weight, 1990)



Landfill Tipping Fee: $65 in 1988, $85 in 1989, and $85 in 1990 at the Turnkey landfill in Rochester, New Hampshire.

Refuse Collection and Disposal: The Town of Peterborough has never offered municipal refuse collection. An estimated 64 percent of residents bring their refuse and recyclables to the Town Recycling Center.[2] Of the households not utilizing the Town Recycling Center, an estimated 300 contract privately with Waste Management, Inc. (WMI) of New Hampshire for curbside refuse pick-up, up to 100 contract with S&S Services or another private hauler, and 250 self-haul material to Waste Management's transfer station. Waste Management charges its customers $5 per pick-up for weekly or biweekly curbside service. Customers who set out more than four 30-gallon containers are charged an additional $1 per bag. Residents are charged $1 per 30-gallon container of refuse brought to Waste Management Inc.'s transfer station. Waste Management disposes of all residue material (nonrecyclable refuse) brought to the Town Recycling Center. It is also the primary hauler of construction and demolition debris and commercial waste.

Waste Management hauls 90 percent of the refuse collected from Peterborough residents and the Town Recycling Center to its landfill in Rochester, New Hampshire. Ten percent is burned at either the Wheelabrator incinerator in Concord, New Hampshire, or the incinerator in Claremont, New Hampshire. Waste Management delivers all heavy construction debris collected in the Town to the Rochester landfill.

Materials Recovery Overview

Goals and Legislative Requirements:

In 1980 a mandatory source separation ordinance was passed in Peterborough that requires all residents and businesses utilizing the Town dump (also known as the Town Recycling Center) to separate materials into recyclable and nonrecyclable components. There are no recycling requirements for residents or businesses who choose not to utilize Peterborough's Recycling Center.

In response to rising disposal costs, Peterborough established a voluntary recycling drop-off program in the late 1970's, at the initiation of John Isham, Town Administrator. Since 1979, refuse and separated recyclables were brought to the Town dump. Source separation of recyclables at the dump (also known as the Town Recycling Center) was mandated in 1980, and nonrecyclable waste was baled and stacked in the Town landfill beginning in 1981. Since 1989 Waste Management of New Hampshire has disposed of nonrecyclable refuse collected at the Town Recycling Center.

Approximately 64 percent of Peterborough's residents utilize the Town Recycling Center.[2] An estimated 20 businesses haul recyclables to the Town drop-off center, or contract with a local hauler for this service. Of the materials deposited at the Town Recycling Center, 95 percent are generated by residents and approximately 5 percent are from commercial sources. Deposit of recyclable and non-recyclable materials is free; however, users must receive an annual permit prior to use. In 1990, 1,900 permits were distributed to residents, businesses, and private haulers. At least 10 percent were distributed to households already holding a permit. (The first permit is received free of charge; subsequent permits cost $1 each.)

Open 4 days per week, 8 am to 6 pm, the Town Recycling Center is a simple horseshoe-shaped facility. Peterborough residents access the Recycling Center via a paved road through the woods known as Sanitation Lane. But before individuals can dump their refuse, they must pass through a carefully plotted route, along which they can deposit color-separated glass at the first stop; plastics, textiles, aluminum and ferrous cans, and mixed paper into separate containers at the second; and food waste at the third. At the very last stop, residents may discard nonrecyclable refuse, which may include rubber, leather, disposable diapers, and other items. Residents, businesses, and private haulers utilizing the Town Recycling Center are required to bring all materials they generate or collect to the center, and not just nonrecyclable items (refuse) or materials with a low market value. Of a total of 1,452 tons of materials brought to the drop-off center in 1990, 892 tons, or 61 percent, consisted of recyclable materials. A total of 222 tons of wood chips collected at this site are included in the 1,452 ton figure, but because this tonnage was burned as fuel, we do not consider it recycled.

Of households not self-hauling refuse and recyclables to the Town Recycling Center, approximately 100 (or 15 percent of such households) received curbside collection of recyclable materials in 1990 from S&S Services, a local private hauler who delivers collected recyclables to the Recycling Center. By fall 1991 nearly 200 households received curbside collection of refuse and recyclables from S&S Services and Kodiak Recycling. John Isham believes that a lack of participation by residents in the Town's recycling drop-off program has limited Peterborough's ability to maximize its recovery rate.

Recycling Activities

Drop-off Collection Program

Start-up Date:	1979
Number:	One
Public or Private:	Public
Sectors Served:	Peterborough residents and approximately 20 Peterborough businesses. One private hauler, S&S Services, picks up materials from a few residents and commercial businesses and delivers them to the Town Recycling Center. A total of 1,900 permits to use the drop-off center were distributed in 1990.
Mandatory:	Source separation of recyclables is mandatory for residents, businesses, and haulers utilizing the Town recycling/refuse drop-off center.
Participation:	Approximately 70 percent of residential households. An estimated 64 percent of residents self-haul recyclables to the Recycling Center. An additional 6 percent contract with a hauler to deliver recyclables to the center, and approximately 1 percent (12 households) self-haul only recyclables to the center.
Materials Accepted:	Newspaper, corrugated cardboard, high-grade paper, mixed paper, magazines, junk mail, glass, PET and HDPE plastic containers, polystyrene containers, aluminum cans, ferrous cans, appliances and white goods, leaves, food scraps, motor oil, lead-acid batteries, textiles, wooden pallets, and salvaged items for reuse
Separation Method:	Recyclables are segregated by material type as they are dropped off at the Center. Glass is separated by color. Food scraps, which include meat and fat, are brought by residents in plastic bags and deposited in closed 55-gallon drums. All other materials are deposited in gaylord containers.
Annual Tonnage:	892 tons of recyclables in 1990.

Food Waste Recovery

Peterborough has been recovering food waste for the last 3 years. A local hog farmer, Glen Shaw of Shaw Farms in New Ipswich, New Hampshire (approximately 10 miles from Peterborough), picks up food scraps twice a week in the summer and once a week the rest of the year. Food waste is boiled with a steam boiler. While only 9.7 tons of food waste were recovered in 1989, 32.84 tons were recovered in 1990—an increase of nearly 240 percent. According to the Town Administrator, nearly all residents utilizing the Recycling Center drop off food waste. At the drop-off there have been some occasional fly problems and no reported odor problems. Approximately 4 percent of materials recoveredat the drop-off in 1990 was food waste. Food waste collection benefits the community as well as the local hog farmer, who says that it is too expensive to raise hogs on grain. Food scraps provide a cost-effective alternative feed. Shaw Farms, which has been in business for 20 years, raises swine exclusively on food scraps. Glen Shaw also collects food waste from the Massachusetts Institute of Technology in Cambridge, Massachusetts, and from the Town of Townsend, Massachusetts; he had collected food waste from the Towns of Acton, Concord, and Fitchburg, Massachusetts, until a few years ago when the

programs were eliminated due to budget constraints (from the passage of Massachusetts' Proposition 2 1/2).[3]

Residential Curbside Recycling

There are few curbside recycling opportunities in Peterborough. In 1990 one private hauler offered curbside pick-up of recyclable materials for a fee to approximately 100 households. A new company, Kodiak Recycling, started a second curbside collection business in 1991. Kodiak picks up recyclables from its residential and commercial customers in customized recycling vehicles. The trucks have eight separate compartments; aluminum and steel cans are placed in one compartment; glass is segregated by color and placed in three separate compartments; bagged food scraps are placed in a fifth, lined compartment; plastic containers are placed in the sixth compartment; newspaper is placed in the seventh compartment; and mixed paper in the eighth. This hauler offers weekly, monthly, or bimonthly pick-up for a fee of $22 per month for an average load of recyclables plus two bags of mixed refuse. He charges $1 per bag for additional refuse. By the summer of 1991, Kodiak Recycling had approximately seven Peterborough households signed up for recycling collection. Kodiak's customer base continues to grow.[4]

Commercial & Institutional Curbside/Alley Recycling

Legislative Requirements:	None
Service Provider:	Waste Management of New Hampshire
Number Served:	15
Type Served:	Small businesses
Materials Collected:	Corrugated cardboard
Pick-up Frequency:	Varies
Set-out and Collection Method:	Cardboard is placed in separate containers or dumpsters and picked up by Waste Management in rear-loading packers.
Incentives:	None
Enforcement:	Not applicable
Annual Tonnage:	75 tons in 1990

Waste Management estimates that it collected 75 tons of corrugated cardboard from 15 commercial customers in 1990. Waste Management hauls this cardboard to the Container Recovery Corporation in Nashua, New Hampshire. S&S Services collects a small amount of recyclable materials from commercial businesses, which it brings to the Town Recycling Center.

Kodiak Recycling, a new recycling hauler, will collect a wide range of recyclable materials in compartmentalized vehicles (see above description) from approximately eight Peterborough businesses beginning mid-1991. The haulers will bring all materials to the Town Recycling Center. Kodiak is hoping to expand its business and increase the number of customers served.

Processing and Marketing of Recyclables

Three full-time employees work at the Recycling Center to prepare materials for market. Materials are processed using few pieces of equipment. A home-built 6-foot conveyor and a magnetic roll drum separate cans. Paper is baled with a Union Manufacturing downstroke baler. HDPE base cups are removed from plastic bottles and shredded. All HDPE plastic containers are shredded with a small granulator into chips about 1/4-inch wide. PET plastics are baled. Aluminum cans and glass bottles imprinted with a deposit stamp (totaling only 140 pounds in 1990) are returned for cash. Wooden pallets and skids are reconditioned and sold. More recently the Town grinds them and sells them as mulch. Bulky items, such as lumber, windows, and wire, are given away free to residents. Other reusable items, such as small household goods and books, are displayed and sold to residents. According to the Town Administrator, the Recycling Center has gained a reputation as a thrift store, where people look for hard-to-find items and sometimes put in requests for particular items.

Peterborough uses a variety of markets, nearly all of which are out of state, and some of which are even out of the country. Many materials, such as glass, corrugated cardboard, cans, and plastic containers, are marketed collectively through the New Hampshire Resource Recovery Association (NHRRA).

Mixed paper and corrugated cardboard are eventually sold to markets in Canada. Glass is marketed in Connecticut. Textiles are sold to Haiti. Aluminum cans are sold to Hartford, Connecticut. Other metals are sold to Italy and Greece. Polystyrene plastic was marketed to Plastics Again in Leominster, Massachusetts and is now marketed to Clean Environmental Corporation. Oil and wood chips are the only materials used locally. Both are used as a heating fuel.

Market Development Initiatives

Peterborough is very active in the New Hampshire Resource Recovery Association (NHRRA). Begun in Peterborough in 1979, NHRRA helps to develop new markets for recyclable materials. Peterborough collectively markets some materials, such as glass, corrugated cardboard, newspaper, and plastic containers, through the NHRAA. Member communities are charged a fee of $0.03 per capita for this service plus a fee for brokering specific material; in return they receive revenue from the sale of certain materials. The NHRRA markets 53 percent of all recyclables collected in the State of New Hampshire.

Composting Activities

Prior to 1991, all the brush and wood waste collected at the Peterborough Recycling Center was chipped with a wood chipper and eventually burned. In 1990 Peterborough chipped and burned a total of 222 tons of discarded wood. In 1991 Peterborough decreased the volume of material burned. It purchased a tub grinder, and with state grant funding, purchased a conveyor to compost yard and wood waste. Ground material will be sold to Town residents and landscapers for use as a mulch.

Amount and Breakdown of Materials Recovered

Material	Town Center (Tons, 1990)	Other (Tons, 1990)	Total (Tons, 1990)
Newspaper	220.13	–	220.13
Corrugated Cardboard	69.24	75	144.24
Other Paper*	105.56	–	105.56
Glass	147.02	–	147.02
HDPE Plastic	9.29	–	9.29
Polystyrene Plastic	1.25	–	1.25
Aluminum Cans	15.29	–	15.29
Ferrous Cans	24.72	–	24.72
Assorted Deposit Containers	0.07	–	0.07
White Goods/White Iron	242.1	–	242.10
Food Waste	32.84	–	32.84
Batteries	3.09	–	3.09
Textiles	7.89	–	7.89
Palletst†	11.45	–	11.45
Salvage/Re-use	2.01	–	2.01
Subtotal MSW Recycled	**891.95**	**75**	**966.95**
Subtotal MSW Composted	**0**	**0**	**0**
Total MSW Recovered	**891.95**	**75**	**966.95**
Total C&D Recovered	**NA**	**NA**	**NA**

Note: "Town Center" tonnages list all materials recovered at the Town Recycling Center. "Other" includes material collected through other collection programs, such as WMI's corrugated cardboard program. Brush and wood waste totaling 222 tons was chipped and burned for fuel, as was 1.52 tons of motor oil. These tonnages are not included in waste recovered.

*Includes high-grade paper, magazines, and junk mail.

†Pallets are repaired and reused, or ground into wood chips.

Publicity and Education

In 1989, to promote recycling of 90 percent of the Town's waste stream by 1990, Peterborough ran a "Ninety-by-Ninety" campaign. The Town also promotes its programs through newspaper articles and displays. A few teachers independently utilize a recycling curriculum.

Economics

Costs Cover: Costs cover the processing and marketing of 892 tons of recyclables and 222 tons of wood delivered to the Town drop-off center. While the wood was burned in 1990 and thus not counted as waste recovered, the Town's annual recycling costs include the handling and chipping of such material.

Capital Costs: Processing

Item	Cost	Use	Year Incurred
Downstroke Baler	$5,100	Recycling	1980
Downstroke Baler	7,400	Recycling	1989
Can Sorter/Conveyor	1,100	Recycling	1980
Forklift/Truck	12,000	Recycling	1989
Plastic Granulator (Used)	3,200	Recycling	1983
Chop Saw (for cans)	425	Recycling	1989
Ban Saw	Donated	Recycling	1990
Wood Chipper	Former Hwy. Dept.	Wood chipping	–
Tub Grinder and Conveyor	26,774	Composting	1991

Note: All equipment has been paid off.

Annual and Per Ton Operating and Maintenance Costs (1990)

	Cost	Tons Covered	Per Ton Cost
Recycling Total	**$73,000**	**1,114**	**$66**
Drop-off Collection and Processing	$50,000	1,114	$45
Administration	23,000	1,114	21
Education/Publicity	0	1,114	0

Materials Revenues: $19,831 in 1990

Source of Funding: Town taxes

Full-time Employees: 3 (2 workers and 1 manager at the processing facility)

Part-time Employees: The Town Administrator spends a small percentage of his time on the recycling program.

Future Solid Waste Management Plans

There are no immediate plans to expand the recycling program. The Town Administrator hopes to increase the number of residents participating in the drop-off program.

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References

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Isham, John. "Cutting Small Town Solid Waste Disposal Costs." *Public Works*, February 1982.

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Endnotes

[1]According to David Boutwell from Waste Management, 3,500 cubic yards of uncompacted waste were collected from residential customers in Peterborough in 1990, and an additional 1,500 cubic yards of uncompacted waste were brought by residential customers to Waste Managements transfer station. Using a conversion factor of 200 lbs/cubic yards of uncompacted waste (source: US EPA, *Solid Waste Data*, August 1991), a total of 500 tons of waste was disposed by Waste Management from the residential sector. Waste Management estimates it collected 9,500 cubic yards of compacted refuse from commercial businesses. Using a conversion factor of 600 lbs/cubic yard of compacted refuse (source: Association of New Jersey Recyclers, 1987), they disposed of an estimated 2,850 tons of commercial waste.

[2]Approximately 650 households are served with refuse pick-up. This leaves 1,150 households, out of 1,800 households in the Town, that use the Town's drop-off for refuse disposal (and delivery of recyclables).

[3]Glen Shaw, hog farmer, New Ipswich, NH, personal communication, 1991.

[4]John Schlim (Kodiak Recycling, Peterborough, MA), personal communication, May and July 1991.

Sonoma County, California

Demographics

Jurisdiction:	Sonoma County
Population:	388,222 in 1990
Area:	1,590 square miles
Total Households:	160,000 households (108,000 single-family dwellings, 21,000 in two- through four-unit buildings, 17,000 in multi-unit buildings of five units or more, 12,000 in mobile homes, and 2,000 in other dwellings)
Total Businesses and Institutions:	15,000
Brief Description:	Sonoma County is a rural/agricultural region located just north of the San Francisco Bay area. Its climate and geography make it ideal for wine production, a major industry for the County. Next to wine, agriculture, high-tech manufacturing, and tourism are Sonoma County's largest industries. There are 8 incorporated and over 115 unincorporated areas in Sonoma County. Santa Rosa, the County seat, is the largest city, with a population of 113,313, nearly one-third the County population. Primarily a professional community, Santa Rosa also has a significant senior citizen population. In 1985 per capita income in Sonoma County was estimated to be $11,809.

Solid Waste Generation and Recovery

	Annual Tonnages (1990)				
	Residential	Commercial/ Institutional	Total MSW*	Construction & Demolition†	Total Waste
Recovered	**18,973**	**33,889**	**52,862**	**14,604**	**67,466**
Recycled	18,571	32,319	50,890	14,089	64,879
Composted	402	1,570	1,972	515	2,487
Disposed	**105,872**	**306,408**	**412,280**	**116,897**	**529,177**
Incinerated‡	0	4	4	0	4
landfilled	105,872	306,404	412,276	116,897	529,173
Generated	**124,845**	**340,297**	**465,142**	**131,501**	**596,643**
	Percent by Waste Recovered				
Recovered	**15%**	**10%**	**11%**	**11%**	**11%**
Recycled	15%	9%	11%	11%	11%
Composted	‡	§	§	‡	‡

* Municipal solid waste generated includes most bulky items, such as white goods, office furniture, and tires.

† C&D includes concrete, asphalt, and other inert materials.

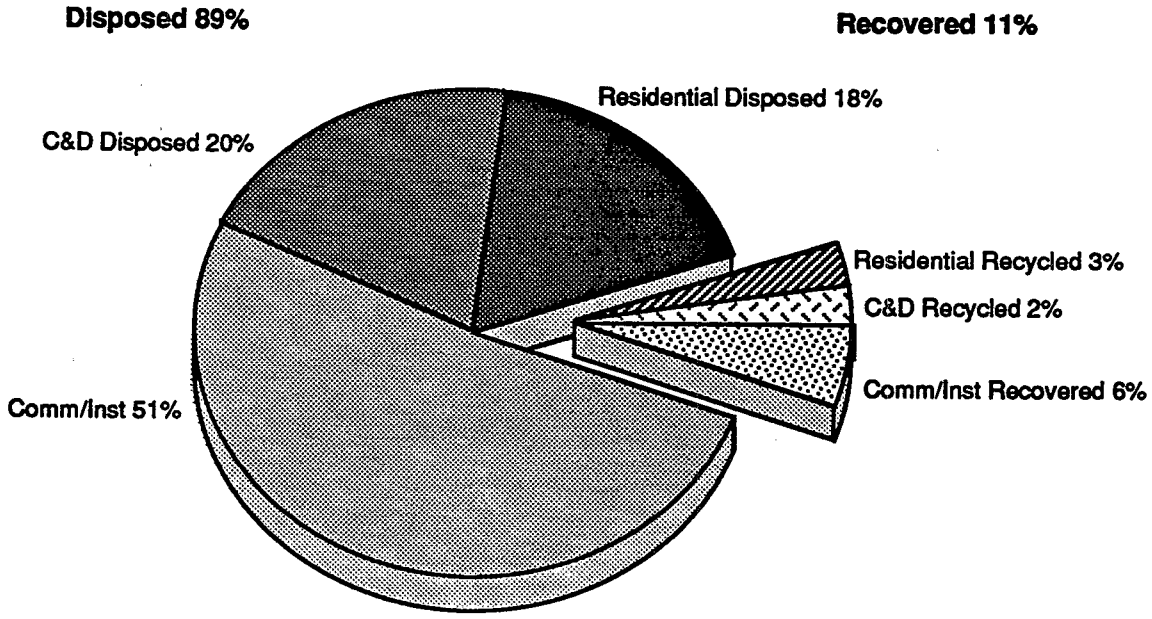
§Less than 1%

‡ In 1990 Garbage Reincarnation collected 6 tons of tires, of which approximately 4 tons were incinerated as a fuel source.

Landfill and Transfer Station Tipping Fees: $4.10 per cubic yard of compacted waste ($10.45 per ton) in 1988, $5.30 per cubic yard ($13.50 per ton) in 1989, and $6.64 per cubic yard ($16.64 per ton) in 1990 at the two County-owned landfills and three transfer stations. In 1990 Sonoma County charged $2.00 per cubic yard to tip debris boxes ($12.51 per ton), $2.25 per cubic yard for loose waste ($13.46 per ton), and $6.50 per cubic yard for demolition debris ($12.92 per ton). With the exception of transfer trailers, which are weighed, volume of waste is estimated based on vehicle size.[1]

Refuse Collection and Disposal: The County issues licenses to eight private haulers for the collection and disposal of refuse from the residential and commercial sectors. Each hauler is granted a franchise for a given area of the County. The licensee has exclusive hauling rights for the refuse collected in that area. Most haulers also offer refuse service to the commercial establishments in their

Total Waste Recovered and Disposed (Percent by Weight, 1990)



Refuse Collection and Disposal (cont'd):

area. Empire Waste Management (a subsidiary of Waste Management, Inc.) collects refuse in the Cities of Santa Rosa, Healdsburg, and Rohnert Park, and in the unincorporated areas in the eastern part of the County. Petaluma Refuse Disposal (owned and operated by Empire Waste Management) collects refuse in Petaluma. Larry's Sanitary Service Inc. and Cloverdale Disposal (owned by Larry's Sanitary Service) collect refuse from the cities of Sebastopol, Cotati, and unincorporated areas in the southern part of the County. Sonoma Garbage Collector collects refuse from the City of Sonoma. West Sonoma County Disposal Services, Sunrise Garbage Service, and Pacific Coast Disposal collect refuse in the western unincorporated regions. In addition to these eight haulers, Industrial Carting collects refuse from debris boxes located throughout the County. Residents and businesses pay volume-based monthly fees (from $4.05 to $10 per 30- or 32-gallon can) for refuse collection and disposal.

During 1988 three County landfills and three transfer stations were in operation. The Healdsburg Disposal site reached capacity and was converted to a transfer station in July 1989. As of 1990, there was one central landfill, the Central Disposal site, a small rural landfill, and four County transfer stations. Central Disposal is expected to reach capacity in 1999, and the County is currently looking for a new landfill site. The Refuse Disposal Division of the Department of Public Works is responsible for the management and operation of the County-owned solid waste facilities. Tipping fees are adjusted annually to cover costs associated with running the facilities.

Materials Recovery Overview

Goals and Legislative Requirements:

California Assembly Bill 1462 required that County Solid Waste Management Plans establish a goal of 20 percent recycling of the solid waste generated in the County and detail actions to be taken to achieve that goal. As of 1989, most incorporated cities in Sonoma County had ordinances or clauses within franchise agreements requiring haulers to collect recyclable materials. In September 1989, the California legislature passed the Integrated Waste Management Act (AB939) effective January 1, 1990, requiring counties and incorporated cities within those counties to prepare Integrated Waste Management Plans (CoIWMP). State goals were increased to 25 percent solid waste reduction by 1995 and 50 percent by the year 2000. In addition, California is a bottle bill State (AB2020, passed 1986).

Sonoma County has a long history of recycling. In 1977, in response to a request from the California Solid Waste Management Board (CSWMB), the City of Santa Rosa and Redwood Empire Disposal Corporation jointly proposed to provide three containers for source-separated multi-material recycling at curbside. The purpose of this project was to determine if the use of three standardized colored containers would significantly increase participation, and if such a program was a viable alternative to landfilling of recyclable materials. In January 1978, a pilot program called Recycle 3 was initiated. One of the first curbside recycling programs in California, Recycle 3 was comprised of weekly collection of newspaper, glass, and aluminum and ferrous cans from single-family households in the City of Santa Rosa. For 6 weeks beginning mid-November 1978, the CSWMB collected data on the participation rate of residents in the pilot program. It was found that 76 percent of the households serviced set out recyclables at least once a month. Expansion of the Santa Rosa curbside recycling program was stymied by a State funding freeze. In 1986 Empire Disposal Corporation was purchased by Waste Management, Inc. and continued to provide curbside collection to one-third of the residents in Santa Rosa. In late 1989, State funding was made available for the purchase and citywide distribution of multi-colored bins and the program increased its curbside service.

With the exception of Santa Rosa, curbside recycling programs have had a slow start in Sonoma County. Drop-off was the primary method of recycling. Even in 1989, when many of the refuse haulers had begun curbside collection in the incorporated cities, drop-off accounted for over 55 percent of the 83,000 tons of waste recovered through recycling. (Curbside accounted for 16 percent.) The first County drop-off site opened in 1976, when Sonoma County signed a contract with Garbage Reincarnation, Inc., a nonprofit community-based organization and long time promoter of recycling, to operate recycling and reuse depots at County landfills. From 1978 to 1984, the County contracted with Empire Waste Management for the operation of drop-off centers. In 1985 the County renegotiated its contracts: Garbage Reincarnation was awarded a 5-year contract for the collection of recyclables and the operation of reuse centers at Central landfill, the Healdsburg Transfer Station, and at Occidental Transfer Station; contracts were signed with Empire Waste Management and West Sonoma County Disposal for the operation of drop-offs at the Sonoma and Guerneville transfer stations.

Since 1977, the hauler holding the franchise for refuse collection in Santa Rosa (Empire Waste Management) has been required to offer curbside recycling. More recently, State solid waste reduction goals have encouraged other municipalities within Sonoma County to require that recycling be included in the services offered by the franchised haulers. West Sonoma County Disposal, the primary refuse hauler in the rural western region of the county, began collecting recyclables in March 1989; Larry's Sanitary began curbside collection in Cotati and Cloverdale in July 1989 and in Sebastopol in early 1990. Sonoma Garbage Collectors began servicing residents of the City of Sonoma in early 1990. By late 1989, six out of eight incorporated cities had curbside programs. In 1990 all incorporated areas had curbside programs and most haulers expanded their residential programs by increasing the area serviced or accepting more materials.

Santa Rosa has been the forerunner of curbside recycling and composting programs in the County. In 1989 Santa Rosa began collecting recyclable materials from multi-unit buildings. As of mid-1991, the program serviced 3,000 units in apartment buildings. A 1-year pilot yard waste collection program began in September 1990, servicing 1,100 households with biweekly collection. The program is scheduled to go citywide in January 1992, and plans are being formulated for a countywide yard waste collection program beginning in July 1992. Linda Medders of Empire Waste Management, won the National Recycling Coalition's *Recycler of the Year Award* in 1991. In March 1991, the EPA recognized Garbage Reincarnation's landfill recycling/reuse programs as one of the top 30 recycling programs in the U.S.

A bottle bill was passed in the State of California in 1986. Unlike other bottle bills in the country, California's bill enables consumers to recycle through curbside programs, drop-off sites, and buy-back centers, and does not require recycling centers and retailers to sort different brands of containers. Initially, consumers were required to pay a 1-cent surcharge on each beer and soft drink bottle or can purchased, to be refunded when the container was returned. When early recycling rates proved disappointingly low, the Legislature increased the surcharge to 2 cents and the refund rate to 2.5 cents per container. Return rates rapidly increased. Sixty-eight percent of all beverage containers (76 percent aluminum, 51 percent glass, and 31 percent plastic) was recycled in 1990. This represents a doubling of the rate of return since the program's inception in 1987.

Recycling Activities

Residential Curbside Recycling

Start-up Date:	January 1978 in Santa Rosa; 1988 in Petaluma; March 1989 in the unincorporated regions serviced by West Sonoma County Disposal; July 1989 in Cotati, Cloverdale, and Healdsburg; early 1990 in Sebastopol, Sonoma, and Rohnert Park. Six out of eight cities in the county had curbside recycling programs by the end of 1989. All eight incorporated cities and most unincorporated areas had curbside recycling by early 1990.
Service Provider:	Local franchised refuse haulers: Empire Waste Management in Santa Rosa, Petaluma, Healdsburg, and Rohnert Park; Larry's Sanitary Service in Cotati and Sebastopol; Cloverdale Disposal in Cloverdale; West Sonoma County Disposal in unincorporated regions in the west; and Sonoma Garbage Service in Sonoma.
Pick-up Frequency:	Weekly
Same Day as Refuse:	Yes
Households Served:	60,000 throughout the County in 1989
Mandatory:	No, recycling is not mandatory for residents. In most franchise agreements the haulers are required to collect recyclables.
Participation Rate:	54 percent participation calculated from set-outs per month in Santa Rosa in 1989. As of June 1991, participation rates for that year, calculated monthly, were averaging 85-90 percent.
Materials Collected:	Newspapers, glass containers, aluminum and bimetal cans, and PET and HDPE plastic beverage and milk containers

Set-out Method:	Empire Waste Management collects materials that are segregated and set out in three multi-colored stackable bins, which it provided, or in clearly marked separate containers. Commingled plastics and metal cans are placed in one container, glass in another, and newspapers in a third. Residents serviced by Larry's and West Sonoma County Disposal set out glass in one 5-gallon bucket and commingled metal cans and plastics in another 5-gallon bucket. Newspapers are bundled and placed next to the buckets at curbside. Larry's added PET and HDPE to its collection in fall 1990. Empire Waste Management, Larry's, West Sonoma County Disposal, and Sonoma Disposal provide containers or buckets for most of their customers but will collect materials set out in separate bags or boxes.
Collection Method and Vehicles:	Collection methods and vehicles vary with hauler. Most haulers collect source-separated materials at curbside with a one-person crew. Empire Waste Management collects recyclables in Santa Rosa using 44- and 50-cubic–yard front–end loaders with three compartments. Haulers in other communities collect recyclables in smaller three-compartment vehicles with 5- to 6- or 8- to 10-cubic–yard bins. Haulers servicing smaller communities use modified pick-up trucks.
Economic Incentives:	Residents are charged a per-can fee for refuse, which covers the costs of recycling. Haulers that process recyclables receive revenues from the sale of marketable materials.
Enforcement:	None
Annual Tonnage:	Empire Waste Management collected 7,244 tons of recyclables at curbside in 1989 and 13,789 tons in 1990, an increase of 90 percent.

Multi-unit Collection

In 1989 Santa Rosa initiated a pilot program for the collection of recyclables from multi-unit buildings with more than four units. The City funded Empire Waste Management to collect commingled recyclables from 500 apartments. Three-cubic-yard automated bins with three compartments were placed outside of the buildings, near refuse dumpsters. Materials were collected by a one-person crew using front-end loading packer trucks. As of mid-1991, Empire Waste Management was in the process of negotiating rates for recycling collection from multi-unit buildings in the City of Santa Rosa and conducting a pilot multi-unit program in Rohnert Park.

Commercial & Institutional Curbside/Alley Recycling

Legislative Requirements:	None
Service Provider:	Franchised refuse haulers collect recyclable materials from the commercial sector in their area. As of 1990 Garbage Reincarnation serves County buildings, hospitals, and the commercial sector for beverage container and office paper recycling. In addition, Industrial Carting collects high-grade paper and corrugated cardboard from the commercial sector.
Number Served:	Varies. Empire Waste Management serviced approximately 1,000 businesses in Santa Rosa in 1989, and 1,500 in 1990. Garbage Reincarnation serviced approximately 500 businesses in 1990

Type Served:	Varies
Materials Collected:	Office paper, corrugated cardboard, glass, aluminum cans, and newspaper
Pick-up Frequency:	Varies
Set-out and Collection Method:	Most of the franchise haulers and Industrial Carting provide bins for their commercial customers.
Incentives:	Businesses pay haulers less for recyclable materials collection than for refuse collection. Haulers avoid cost of disposal and earn revenue on marketable recyclables.
Annual Tonnage:	In 1990, 30,282 tons were collected from the commercial sector in Sonoma county, of which 14,312 tons were derived from Santa Rosa.

Garbage Reincarnation offers a full-service office paper recycling program to businesses and institutions within the county, and offers beverage container collection to some of its commercial accounts. The company supplies desktop boxes and large colorful bins for two-step recycling. Garbage Reincarnation has a long standing contract (since the late 1970s) with the County for the weekly collection of office paper from County buildings. Confidential documents are delivered by County staff to the Manual Skills Training Center (an occupational center for the mentally disabled in Santa Rosa), where they are shredded and bagged. Garbage Reincarnation collects the bagged paper, and bales and sells it to local businesses as a packing material.

To facilitate expansion of its commercial collection program, Larry's Sanitary Service made an arrangement, in March 1990, with Middle Way, a nonprofit organization for developmentally disabled adults, to provide recycling pick-up for small businesses in Sebastopol. Collectors from Middle Way go door-to-door to retail and wholesale establishments to pick up corrugated cardboard, aluminum and tin cans, glass, and newspaper. Larry's supplied Middle Way with one hundred 32-gallon wheel-out cans and debris boxes for collection. Middle Way provides collection of recyclable materials to many small businesses that Larry's Sanitary would probably not service. Middle Way is paid "top dollar" for the materials that it collects, nonetheless, its collection costs exceed its revenues.

Other Commercial Sector Activities

Empire Waste Management has a full service office paper recycling program, providing intermediate containers and outside storage bins. Empire Waste Management also provides waste audits and survey services to commercial customers, and will set up recycling programs for its large and small accounts. Many other businesses in Sonoma County have begun to recycle. The Fountaingrove Country Club recycles glass and aluminum beverage containers. OCLI, a glass lens coating firm, recycles wood pallets. Memorial Hospital in Santa Rosa is converting from one-use foam overlay mattresses to reusable mattresses and has begun using cloth diapers. The Montgomery Village Shopping Center has arranged with Empire Waste Management for the collection of cardboard, glass and aluminum, and in addition, several tenants have their own recycling programs. For example, Lucky's accepts plastic bags for reuse, encourages customers to use cloth shopping bags, gives vegetable waste to a pig farmer, donates day-old bread to the Senior Center, and sends old meat and fat to a tallow factory; several coffee shops encourage customers to bring their own mugs; and Mostly Kitchens & Surroundings sells a canvas shopping bag that gives customers a 5 percent discount when they shop with it again. *The Press Democrat*, the local newspaper, recycles 1,380 tons of newsprint a year, approximately 17 tons of aluminum (at a profit), 52 tons of wood waste, oil, silver from photo processing, and office paper. Many wineries send their wine bottles to ENCORE! for washing and reuse.

Drop-off Centers

Number and Type:	15 drop-off and 9 buy-back centers
Public or Private:	Five are at County facilities, the rest are private.
Sectors Served:	Both residential and commercial sectors are served by drop-off and buy-back sites.
Materials Accepted:	Newspaper, corrugated cardboard, kraft paper, high-grade paper, mixed paper (including telephone books, magazines, colored ledger paper, brown bags, and chipboard), glossy inserts, glass, aluminum, bimetal cans, scrap metal, used motor oil, batteries, tires, textiles, furniture, old appliances, building materials, asphalt, concrete, animal waste, and grease
Annual Tonnage:	A total of 9,720 tons was recovered by Garbage Reincarnation at Central Disposal and Healdsburg Transfer Station, two independent drop-off/buy-back centers, and its mobile drop-off services. An additional 1,688 tons of recyclable materials were recovered at the Sonoma, Occidental and Guerneville Transfer Stations.

Drop-off and buy-back sites have played a major role in the recovery of recyclable materials in Sonoma County. Until July 1989, only residents and businesses in Santa Rosa and Petaluma were serviced with curbside collection. Other residents and businesses in the County used drop-off sites for recycling. Garbage Reincarnation Inc., a local nonprofit organization operates the largest drop-off/ buy-back center in the county. In addition, Sonoma County contracts with Garbage Reincarnation for the operation of two "recycling/reuse/resale" depots at the Central landfill and the Healdsburg Transfer Station. These unique centers offer a wide variety of reusable items for resale, such as bicycle parts, books, and appliances. Newspaper, office paper, glass bottles and jars, aluminum cans, and nonferrous metals are purchased at the buy-back centers, and kraft bags, mixed paper, corrugated cardboard, used oil, batteries, wine bottles, and other reusables are accepted for drop-off from residents, businesses, and community groups in Sonoma County. The County also contracts with Empire Waste Management for the operation of drop-off sites at the Sonoma Transfer Station.

Since 1973 Garbage Reincarnation has been servicing rural communities such as Oakmont and Forestville with mobile drop-off centers that accept glass, aluminum and bimetal cans, newspapers, cardboard, motor oil, brown bags, and used household goods. These communities, which do not support full-time recycling centers, use the mobile drop-off centers and the depots at County disposal facilities for recycling. There are 30 additional "Convenience Zone Recycling Centers" in the County (primarily supermarkets) that are certified under the bottle bill for the collection of California redemption glass and metal beverage containers. Garbage Reincarnation does not collect plastic containers that can be redeemed under the bottle bill. A clause was written into AB2020 exempting existing recycling centers that did not wish to handle plastics from being required to do so.

Empire Waste Management also operates a buy-back center, which accepts newspaper, corrugated cardboard, aluminum and tin cans, glass containers, and plastic bottles. The center services more than 100 customers a day.

Salvage/Reuse

At its recycling/reuse depots located at the Central Landfill and the Healdsburg Transfer Station, Garbage Reincarnation accepts a wide range of materials that residents can purchase for reuse. Residents or businesses, self-hauling refuse to the landfill or transfer station, may stop at the depots and drop off any salvageable items. These include appliances, bicycle parts, books, tires, wine bottles, batteries, and building materials. Many items are either repaired or set out "as is" in the recycling/reuse yard. Car batteries accepted at the drop-off sites are sent to Economy Battery in Sebastopol where they are reconditioned. Used wine bottles are sent to ENCORE! (an acronym for ENvironmental COntainer REuse) in Richmond, CA, for rewashing and resale to wine distributors. Peter Heylin from the company estimates that they now process 1 percent of premium wine bottles used in California. In addition, ENCORE! uses recycled cardboard cartons, and now markets recycled corks as a replacement for bark in playgrounds and around buildings. Garbage Reincarnation sponsors a "paint-give-away" at Central Disposal where unused paint that has been diverted from the landfill is available to the public for free. On Earth Day it sponsors the "Annual Junk Art Sculpture Competition," in which residents are encouraged to salvage and convert their "junk" into art work and compete for cash prizes. The County is discussing whether to require vehicles that self-haul material to stop at the reuse yard.

Approximately 600 tires were collected in 1990 at the recycling depot at the Central Landfill. Seventy percent of tires collected by Garbage Reincarnation at the Landfill reuse yard is sold to Oxford Energy in Modesto California, which burns them for electricity. The remaining 30 percent of used tires is remolded forreuse by Oxford Tire Recycling, a subsidiary of Oxford Energy. Of the tires that Oxford Tire Recycling recycles, an estimated 20 percent is used for retreading automobile, truck, and plane tires, most of which are sold overseas. A small percent of the tires are shredded for use as "safety soil" for playgrounds.

Processing and Marketing of Recyclables

Most of the franchised haulers that collect recyclable materials from the residential and commercial sectors in the county have small baling operations for processing materials. Larry's Sanitary Service bales newspaper, glass, aluminum, and plastics and sells these to the highest bidder. West Sonoma County Disposal brings recyclable materials to Marin Recycling, an intermediate processing facility in San Rafael, Marin County. Sonoma Garbage Collector bales corrugated cardboard and sells other recyclables to the highest local bidder. The largest volumes are handled by Empire Waste Management and Garbage Reincarnation.

Empire Waste Management owns and operates the largest intermediate processingcenter (IPC) in the County processing primarily newspaper and corrugated cardboard. The 30,000-square foot-facility opened in 1969 and currently processes approximately 74 tons per 10-hour day. Of the incoming material, approximately 85 percent is segregated and 15 percent is commingled. In 1988 the IPC processed 15,840 tons of recyclable materials, in 1989, 20,340, and in 1990, 26,504 tons. There are seven full-time employees working at the IPC; two load and operate the baler, and five sort materials. Trucks are weighed on scales and the contents are emptied into receiving pits. A series of conveyors is used to elevate material to sorting belts, storage bays, or surge hoppers to await baling. There are two sorting lines: one for color sorting glass and the other for sorting metal and plastic containers. Glass is color sorted by hand and carried by conveyor to cinder block bunkers where it is stored prior to transportation. A magnetic separator separates aluminum/tin cans from plastics. Paper is tipped, spread out onto the main floor of the facility, and hand sorted.

Color-sorted glass is sold to Anchor, Owens-Brockway, or NoCal (Northern California) Beneficiation. Aluminum is baled in 3x4x5 foot bales and sold to a broker, Weis County Recycling. Three grades of plastic (HDPE, PET, and mixed) are hand sorted, baled, and sold domestically or exported to the Far East. Old newspaper and corrugated cardboard are baled and sold through a

regional broker to markets in Korea and Taiwan. The reject rate from the processing operation is estimated to be between 1 and 1.5 percent.

Garbage Reincarnation has been operating in the county since 1972 and has been under contract with the County to operate recycling/reuse depots at the County Landfill and Healdsburg Transfer Station since 1981. All materials collected at these sites and at its buy-back are processed at the main yard in Santa Rosa. The facility is located on 1.1 acres and currently processes 27 tons of recyclable material per day. Residents and local business persons in Sonoma County may deposit color-sorted glass, aluminum cans, newspaper, corrugated cardboard, and ferrous and nonferrous metals, in debris boxes, which are set on scales for weighing. Garbage Reincarnation has 15 full-time employees, 5 part-time employees, and uses volunteers from local schools, court-referral programs, and mentally disabled to sort and prepare materials for market. Sorted glass is transferred to 30-cubic–yard debris boxes and shipped to buyers in the San Francisco Bay area (CalCRinc Processing or Owens-Brockway), or the contents are transferred to shipping containers and shipped to markets in the Pacific Rim. Aluminum cans are densified into 30-pound units, stacked and strapped into 3,000-pound bisquettes and shipped by flatbed to Alcoa facilities in the Midwest for the production of new sheet aluminum. In 1990 Garbage Reincarnation processed 660 tons of aluminum cans. For the sale of certain recyclables, Garbage Reincarnation works with a regional broker. Some old newsprint, for example, is shipped to the Far East for deinking and reprocessing. But for most recyclable materials, Garbage Reincarnation actively seeks local markets. Corrugated cardboard is sold to Empire Paper (a division of the local paper company, Industrial Carting), which processes 500 tons of cardboard a month. Shredded high-grade paper, collected through Garbage Reincarnation's Office Paper Recycling Program, is baled and sold to local businesses for use as packaging material and product insulation. Some high-grade and mixed paper is sold to Weyerhauser and other mills in Washington State and Oregon.

West Coast Metals, a San Francisco–based company, supplies Garbage Reincarnation with roll-off containers for the collection of white goods and other ferrous metals; white goods and other appliances are then disassembled and shredded. Motor oil is stored in a temporary on-site oil depository, donated to Evergreen Environmental Oil Recycling, a local company in the Bay area, which reprocesses it into lubricating oil. No material that Garbage Reincarnation collects is rejected as nonrecyclable.

Market Development Initiatives/Procurement

In 1991 the Cities of Santa Rosa and Rohnert Park passed a recycled product procurement resolution requiring City offices to purchase recycled materials whenever practicable. Sonoma County passed a products procurement ordinance in 1990. As of 1991, Santa Rosa has required that all construction and renovation bids include a recycling element.

Composting Activities

Composting in Sonoma County began in the commercial sector. In 1985 the Bennett Valley Farm began accepting vegetative waste, including leaves, grass clippings, brush, and landscapers' waste, from commercial establishments, composting it to produce a soil amendment for farm grown flowers. When businesses in the county learned of the quality compost and began inquiring, Bennett Valley Farm began marketing the soil amendment. Finished compost is sold to landscapers, farmers, and backyard gardeners as a soil amendment for $15 to $25 per cubic yard. A newspaper clipping describing the farm's success prompted the City of Santa Rosa and Empire Waste Management to commission the Bennett Valley Farm to produce and test compost from yard waste collected in Santa Rosa. In September 1990, the City of Santa Rosa initiated a pilot curbside collection program, servicing 1,200 single-family households.

Curbside Collection (Pilot Program)

Start-up Date:	September 1990 (pilot)
Service Provider:	Empire Waste Management
Households Served:	1,200 single-family households selected for the pilot program
Materials Collected:	Leaves, grass clippings, weeds, prunings, and branches up to 4 inches in length and less than 2 inches in diameter. Curbside collection of Christmas trees was provided by Empire Waste Management for residents of Santa Rosa, Petaluma, and Rohnert Park in 1990, and expanded to include the City of Healdsburg in 1991, Sonoma Garbage Collectors began serving residents in the City of Sonoma also in 1991.
Mandatory:	No
Set-out Method:	Yard waste must be placed in 90-gallon containers provided by Empire Waste Management, 3 feet from containers for refuse or recycling.
Collection Vehicles and Method:	Automated 44 cubic–yard packer trucks are used for the collection of yard waste.
Collection Frequency:	Weekly for the duration of the 1-year pilot program
Economic Incentives:	None
Annual Tonnage:	In 1990 Empire Waste management collected 50 tons of yard waste and 33 tons of wood waste.

Yard waste is compacted in packer trucks and transported to the Sonoma Transfer Station where it is ground in a tub grinder, passed through a 2-inch screen, and transported to the compost site. The Bennett Valley Farm site is located on an organic farm just south of Santa Rosa. Screened yard waste is deposited in windrows using a manure spreader. A hose attached to the spreader allows the operator to wet the material while forming the windrows. The windrows are approximately 7 feet at the base, 5 feet high, and vary in length. Temperature and pH are tested often to determine the optimum time for turning. Windrows are turned with a front-end loader when the temperature reaches approximately 130 degrees F, and watered as necessary. Compost is finished in 1.5 to 2 months. During the pilot program, compost is being tested by several different evaluators including several vineyards and apple orchards in the county.

A countywide Christmas tree recycling program began in 1990. The Sonoma County Department of Public Works coordinated the effort, provided space and labor at the Central Disposal Site and the Transfer Stations, and accepted trees from January 2nd to 6th. Curbside collection was provided by Empire Waste Management for residents in Rohnert Park, Santa Rosa, and Petaluma, and by Sonoma Garbage Collectors for residents of the City of Sonoma. In 1991 the program was expanded, and four additional drop-off locations were added. The drop-off period was extended from 5 to 12 days, and curbside collection was expanded to include the City of Healdsburg. Empire Waste Management contributed a tub grinder, Larry's Sanitation and West Sonoma County Disposal contributed by supplying debris boxes and hauling chipped trees. In 1990 the County diverted 890 cubic yards of chipped trees from the landfill and in 1991, 1,660 cubic yards were diverted. The chipped trees were used by Darlings Nursery in Petaluma as mulch and service road surfacing. In January 1990, the Christmas tree collection program cost the County $4,238.

Amount and Breakdown of Materials Recovered;

Material	Residential (Tons, 1990)	Commercial/ Institutional (Tons, 1990)	Other (Tons, 1990)	Total (Tons, 1990)

Newspaper	12,439	2,997	–	15,436
Corrugated Cardboard	298	20,522	–	20,820
High-grade Paper	46	1,226	–	1,272
Other Paper	0	1,769	–	1,769
Glass	1,033	405	–	1,438
CA Redemption Glass	2,646	642	–	3,288
PET Plastic	42	0	–	42
HDPE Plastic	108	0	–	108
Other Plastics	0	116	–	116
Aluminum Cans	81	16	–	97
Ferrous Cans	393	4	–	397
Other Aluminum	0	490	–	490
Appliances/White Goods	0	908	–	908
Other Metal	2	1,021	–	1,023
Motor Oil	0	0	–	0
Mattresses	3	11	–	14
Food Waste	0	1,479	–	1,479
Textiles	0	711	–	711
Tires*	0	2	–	2
Other (Resusables)	1,480	0	0	1,480
Subtotal MSW Recycled	**18,571**	**32,319**	–	**50,890**
Leaves and Grass	0	42	–	42
Branches and Brush†	402	1,528	–	1,930
Subtotal MSW Composted	**402**	**1,570**	–	**1,972**
Total MSW Recovered	**18,973**	**33,889**	–	**52,862**
Asphalt/Concrete	–	–	14,089	14,089
Wood Waste	–	–	515	515
Total C&D Recovered	–	–	**14,604**	**14,604**
Total Materials Recycled	**18,571**	**32,319**	**14,089**	**64,979**
Total Materials Composted	**402**	**1,570**	**515**	**2,487**
Total Materials Recovered	**18,973**	**33,889**	**14,604**	**67,466**

Note: Tonnages represent materials collected and do not exclude tons rejected as contaminants. Tonnages of beverage containers recovered under the State bottle bill are included under PET Plastic and Aluminum cans in addition to CA Redemption Glass.

*Tonnages of tires recycled were estimated based on the County Recycling Coordinator's estimate that of the 600 tires recovered at the Recycling Depot, 30 percent of tires recovered were retreaded or reused, and 70 percent were incinerated. ILSR converted tires to weight using a conversion factor of 20 pounds per tire. (Source: Department of Environmental Protection, New Jersey 1990.)

† Included in this figure are 42 tons of Christmas trees.

Source Reduction Initiatives

Educational efforts, legislation, and volume-based refuse rates contribute to source reduction in Sonoma County. Garbage Reincarnation produces educational material and a newsletter, the *Sometimes Monthly Recycling Rag,* which encourage "environmental shopping" (using reusable shopping bags, buying in bulk) and discouraging the use of disposables, polystyrene, and plastics. Garbage Reincarnation will not accept plastics at its drop-off centers in an effort to promote reduced use of plastics. The City of Santa Rosa and Empire Waste Management promote source reduction measures in pamphlets and other media.

In 1988 the County passed an ordinance banning the use of polystyrene in County facilities. Four cities, Santa Rosa, Sebastopol, Sonoma and Cotati, followed suit by passing similar ordinances banning the use of polystyrene in City facilities.

Publicity and Education

Sonoma County has produced videos and brochures on litter, waste reduction, and environmental protection. The County also staffs a booth for 2 weeks at the County Fair. Department of Public Works staff make presentations on recycling to schoolchildren and to various community groups on the AB939 process and other integrated waste management topics. In addition, the DPW offers tours of the landfill and a visit to the recycling center. In addition, Sonoma County has a resource library containing magazines and other resources on solid waste management and recycling. The library is open to the public. The DPW also coordinates and conducts an annual countywide promotional campaign for Christmas tree and telephone book recycling. These campaigns are promoted through press releases, posters, and brochures.

Garbage Reincarnation has been the major contributor to raising the "reduce, reuse, recycle" consciousness in Sonoma County. In 1976 Garbage Reincarnation coordinated the Great Sonoma County Litter Cleanup Campaign and currently coordinates the recycling of materials collected during this annual campaign. Also in 1976, Garbage Reincarnation produced the *Curriculum Guide for Materials Conservation and Recycling* for the California Waste Management Board. An updated version of this curriculum guide, *Garbage Reincarnation,* is used throughout the United States and Canada for educational purposes. In addition, Garbage Reincarnation provides speakers, slide shows, and educational displays for fairs, schools, community groups, and conferences, and produces workshops for the public on waste management issues and alternative disposal methods. Garbage Reincarnation also operates a library of comprehensive resource materials on solid waste management, recycling, and education. This library is open to the public on request. The *Sometimes Monthly Recycling Rag* is a newsletter with a distribution of 7,000, almost half of which are sent to local, national, and international environmental/community groups. The community group also uses direct mailings, utility bill inserts, posters, and newspaper, television, and radio advertisements to promote recycling and reuse.

Empire Waste Management offers an education package that addresses recycling, hazardous waste disposal, and other waste management issues. The program includes a slide presentation for the classroom or auditorium, and 40- to 60-minute field trips to the recycling operation, emphasizing the environmental and economic benefits of recycling. An activities package, which can accommodate many different grade levels, accompanies the slide presentations and plant tours. Empire also publishes a guide for apartments, townhouses, condominiums, and office recycling programs; educational pamphlets on business recycling; and fliers detailing the do's and don'ts of the curbside and yard waste recycling programs in its collection area. The City of Santa Rosa publishes a quarterly newsletter which accompanies utility bills and updates residents on waste management issues in the City.

Economics

Costs Cover:

No capital costs are incurred by the County government because recycling collection and processing are carried out by the private sector. The capital costs provided below are those incurred by Garbage Reincarnation and cover the collection and processing of 9,720 tons of recyclable materials from two County-owned drop-off sites, two independent drop-off/buy-back centers, and its mobile drop-off/buy-back service. Capital costs from other private drop-off sites and collection programs are not available.

Operating and maintenance (O&M) costs incurred by the County include contract fees paid to Garbage Reincarnation Inc., Sonoma Refuse and Transfer (a Waste Management Inc. company), and West Sonoma Garbage Disposal for the operation of recycling centers at the County landfill and transfer stations. In 1990 these companies recovered 4,063 tons of recyclable materials at County drop-off centers (2,375 tons collected by Garbage Reincarnation at Central Disposal and Healdsburg, 753 tons recovered by Sonoma Refuse and Transfer, and 458 and 476 tons collected at the Guerneville and Occidental transfer stations, respectively, by the West Sonoma Disposal). Also listed below are the County's costs for administration, education and publicity. The County also sponsored the collection and processing of 42 tons of Christmas trees. The cost of this program are included as a part of the County budget for administration and publicity.

Costs for the collection and processing of the remaining tons of recyclable material and organic waste collected and processed are incurred by the private sector and are not available.

Capital Costs: Garbage Reincarnation Collection

Item	Cost	Use	Year Incurred
Pick-up Trucks	$80,000	Recycling	1978-1990
24 3/4-cubic-yard Bins	9,000	Recycling	1989
12 3- to 4-cubic-yard Dumpsters	8,000	Recycling	1990
20 30-cubic-yard Debris Boxes	40,000	Recycling	1990
Scale	7,500	Recycling	1990
2 Forklifts @ $7,500 each	15,000	Recycling	1990-91
3 Scales @ $3,500 each	10,500	Recycling	1991
Densifier	25,000	Recycling	1991

Capital Costs: Garbage Reincarnation Processing

Item	Cost	Use	Year Incurred
Densifier	$25,000	Recycling	1986
Forklift	5,000	Recycling	1981
2 Scales @ $3,000	6,000	Recycling	1981,1989
Baler	6,000	Recycling	1973

County Annual & Per Ton Operating & Maintenance Costs (FY 1990)*

	Cost	Tons Covered	Per Ton Cost
Recycling & Composting Total	**$91,612**	4,105	**$22**
Recycling Drop-Off Collection and Processing†	$48,020	4,063	$12
Christmas Tree Collection and Processing	‡	42	‡
Administration	38,142	4,105	9
Education/Publicity	5,450	4,105	1

Note: The County does not incur any costs for the collection or processing of materials collected at curbside. These costs are incurred by private franchised haulers and are not available.

* O&M costs reported are for July 1989 through June 1990 (FY 1990). Tonnage data are for calendar year 1990.

† Collection costs incurred by the County include contract fees paid to Garbage Reincarnation in the amount of $42,960 for the operation of recycling centers at the Central Disposal Site and the Healdsburg Transfer Station. For this fee, Garbage Reincarnation collected 2,375 tons, equivalent to $18 per ton. County drop-off costs also include $5,061 paid to Sonoma Refuse and Transfer (a Waste Management Inc. company) for the operation of a drop-off center at the Sonoma Transfer Station from April 1990 through December 1990. The contract fee paid to Garbage Reincarnation is a flat monthly fee. The fee paid to Sonoma Refuse and Transfer is approximately $6.50 per ton. West Sonoma County did not bill the County for tons collected at Guerneville and Occidental in 1990.

‡ County costs for the Christmas tree program ($4,238 for the collection of 42 trees) include coordination of the countywide project, publicity through press releases, public service announcements, utility inserts, posters, and fliers to Christmas tree vendors. Costs come out of the budget for administration, education, and publicity.

Materials Revenues: None. The County does not receive revenue for the sale of recyclable materials at its two contracted county sites. Garbage Reincarnation made approximately $60,000 from the sale of recyclable materials at its two contracted county sites.

Source of Funding: The County's recycling program is funded entirely through tipping fees charged at the landfill. Private haulers fund their recycling programs primarily through volume-based refuse collection fees charged to residents.

Full-time Employees: 1 full-time County employee. Garbage Reincarnation employs 20 people full-time; Empire Waste Management employs 30 people full-time for recycling programs.

Part-time Employees: Garbage Reincarnation has 5 part-time employees.

Future Solid Waste Management Plans

Sonoma County is working toward 25 percent diversion of solid waste from landfills (through recycling and composting) by 1995 and 50 percent by the year 2000, in compliance with AB939. An emphasis is being placed on expanding composting in the county and a countywide yard waste composting program is scheduled to begin in July 1992. The Solid Waste Task Force composed of representatives from the waste industry, business community, and environmental and community groups is developing plans that will require all self-haul vehicles entering the County disposal sites to stop and drop-off source-separated materials at the recycling depots. This plan will require expanding and upgrading equipment at transfer station reuse/recycle centers to improve capacity and facilitate better handling of recyclable materials.

In addition, Garbage Reincarnation is expecting to begin recycling CFCs from large appliances delivered to the Central landfill, and Empire Waste Management's apartment building recycling is expected to continue expanding in Santa Rosa and Rohnert Park. Garbage Reincarnation has begun recycling urethane foam at County reuse yards and will begin antifreeze and freon collection and recycling in the end of 1991 or early 1992. Garbage Reincarnation also plans to establish commercial reuse yards for use by commercial and industrial enterprises.

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References

Brown and Caldwell, *County of Sonoma: Solid Waste Management Plan Revision,* May 1990.

Endnotes

[1]Sonoma County converts cubic yards to tons using a conversion factor of 785 pounds compacted mixed waste per cubic yard; 320 pounds per cubic yard of debris box waste; 320 pounds per cubic yard of loose waste; and 1,006 pounds per cubic yard of construction and demolition debris.

Upper Township, New Jersey

Demographics

Jurisdiction:	Upper Township
Population:	10,861 in 1990. During the summer months the population increases to 16,000.
Area:	63.9 square miles
Total Households:	3,860 (3,780 in single-family households and 80 in duplex units)
Total Businesses and Institutions:	260 businesses and 1 institution
Brief Description:	Upper Township is a rural summer resort Township in Cape May County incorporating 10 towns. It is the fastest growing Township in the County, with a growth rate in the last decade of 62 percent. Average per capita income was $13,337 in 1987.

Solid Waste Generation and Recovery

	Annual Tonnages (1990)		
	Public Sector	**Private Sector and C&D**	**Total Waste**
Recovered	**3,411**	**1,956**	**5,367**
Recycled	2,527	547	3,074
Composted	884	1,409	2,293
Disposed	**3,469**	**3,776**	**7,245**
Incinerated*	18	7	25
Landfilled	3,451	3,769	7,220
Generated	**6,880**	**5,732**	**12,612**
	Percent by Weight Recovered		
Recovered	**50%**	**34%†**	**43%†**
Recycled	37%‡	10%	24%
Composted	13%	25%	18%

Notes: Public sector waste represents waste and recyclables collected from all residential households and recyclables collected from 222 businesses. Private sector waste represents municipal solid waste, collected from the commercial/institutional sector, and bulky waste and construction and demolition debris.

Waste generated includes bulky waste such as tires and white goods.

*Oil is collected for recovery in Upper Township. However, because it is burned as a heating source, it is included under waste incinerated.

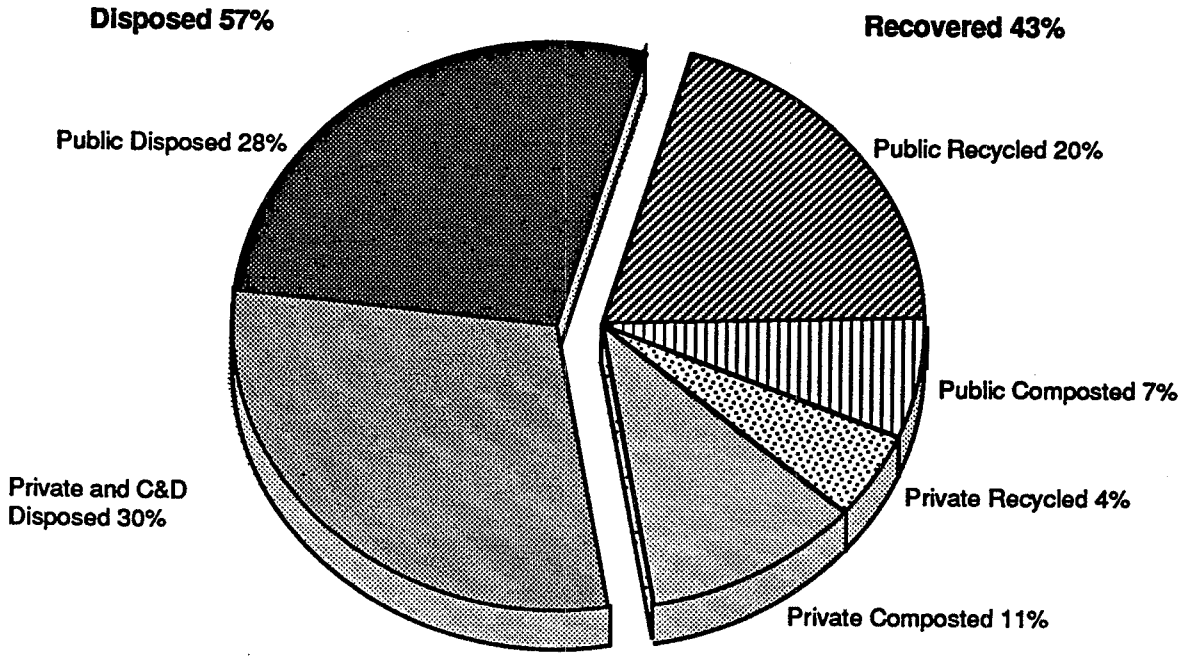
†Numbers may not add up to total due to rounding.

‡If the reject residue rate of 2.38 percent at the County recyclables processing center is subtracted from the collected tonnages listed above, Upper Township's public sector recycling rate would drop to 36%.

Landfill Tipping Fee: $49 per ton in 1989, $89 per ton in 1990, $83.50 per ton in 1991

Refuse Collection and Disposal: The Township collects refuse once a week from all residential households at a cost of $138 per ton. Businesses contract with one of five private haulers—Coggins, Martee (a subsidiary of WMI), ABC Removal, Reuben Smith Services, and Anchor Disposal—for collection and disposal of municipal solid waste and construction and demolition debris (C&D). Chambers Waste collects C&D waste and corrugated cardboard only. All refuse is disposed of at the Cape May County Municipal Utilities Authority Landfill.

Total Waste Recovered and Disposed (Percent by Weight, 1990)



Note: Due to rounding, numbers do not add to percent recovered and percent disposed.

Materials Recovery Overview

Goals and Legislative Requirements:

In 1987 New Jersey passed the Mandatory Source Separation and Recycling Act, requiring each municipality to recycle 25 percent of its waste stream by 1990. Each municipality must recycle a minimum of three materials. The Act banned leaves from all New Jersey landfills as of September 1988.

In June 1988, Upper Township passed Ordinance 15/88, requiring themandatory separation for recovery of newspaper, corrugated cardboard, high-grade paper, mixed paper (such as junk mail, magazines, and paperboard), aluminum and ferrous cans, glass, and leaves. Owners of gasoline stations or other motor repair facilities are required to recycle used motor oil. The Ordinance was amended in November 1989 to include HDPE and PET plastic beverage and detergent containers.

In 1984 Upper Township initiated a recycling program with curbside collection of commingled aluminum cans, ferrous cans, and glass from single-family residents on a voluntary basis. Public Road Department crew members separated the materials into a compartmentalized Eager Beaver trailer. In February 1988, the Township entered into a 5-year agreement with the County to process municipally collected glass, aluminum and ferrous cans, and mixed paper at the Cape May County Municipal Utilities Authority (CMCMUA). In accordance with the terms of the agreement, the Township stopped separating the materials at curbside. The compartmentalized trailers were no longer efficient,

so the Township removed the compartment walls and the individual doors. In January 1988, Upper Township mandated the recycling of mixed paper (including newspaper, magazines, high-grade paper, kraft paper bags, corrugated cardboard, paperboard, and junk mail), glass, aluminum (including foil, pie plates, and cans), ferrous cans, and leaves. In November 1989, the ordinance was revised to include HDPE and PET beverage and detergent bottles. In 1990 Upper Township stopped using trailers and began to collect mixed paper in one compactor truck and commingled glass, aluminum and ferrous cans, and plastic in a second compactor truck. It purchased an additional 20-cubic-yard compactor truck in 1991 for recycling collection. These vehicles require less maintenance than Eager Beaver trailers, and can be used for other purposes. The Township was able to reduce the recycling crew by one person.

Residents can place white goods, tires, and furniture on the curbside for collection twice a month; however, they must notify the Road Department prior to the day of collection. Residents also have the option of bringing glass, aluminum cans, other metal cans, and mixed paper—but not white goods, lead-acid batteries, or motor oil—to the drop-off center in the Road Department Yard.

In 1972 the Township began to collect leaves, grass clippings, and brush at curbside for composting. Workers chipped the brush and composted the grass clippings and leaves at the Public Road Department Yard. However, when the County opened its regional composting site in 1984, Upper Township began to deliver leaves and grass clippings to the site free of charge. The Township continues to chip brush at the Public Road Department Yard.

The County processing center, composting site, Bulky Waste Sorting and Recycling Center, and landfill are all located on a 443-acre site that began operations in 1984. Initially the permit request included the provision to construct a waste incinerator by 1991. However, due to citizen opposition, the plan was scrapped. The County is currently involved in a court battle about the right to continue to use the landfill.

During the summer months, Upper Township and CMCMUA provide additional recycling containers for tourists near and on the beach and launch a publicity campaign, including billboards and pamphlets. In 1991 the U.S. EPA awarded Cape May County the Region II Environmental Award for its recycling and composting programs.

Recycling Activities

Public Curbside Recycling

Start-up Date:	1984 for voluntary program. The program became mandatory in June 1988.
Service Provider:	Public Road Department
Pick-up Frequency:	Weekly for paper and commingled recyclables, oil, and batteries; twice a month for white goods and tires. During the summer months the Public Road Department collects commingled recyclables from commercial establishments.
Same Day as Refuse:	Yes, except for white goods and tires
Households and Businesses Served:	4,082 (3,780 single-family households, 80 residences in duplex buildings, and 222 businesses)
Mandatory:	Yes, for newspaper, corrugated cardboard, high-grade paper, mixed paper (such as junk mail, magazines, and paperboard), aluminum cans, ferrous cans, HDPE and PET containers, glass
Participation Rate:	95 percent, based on the number of times recyclables were included in trash and not collected at curbside.

Materials Collected:	Glass, HDPE and PET plastic beverage and detergent containers, aluminum foil, foil pie plates, aluminum cans, ferrous cans, newspaper, corrugated cardboard, high-grade paper, mixed paper (including kraft paper bags, junk mail, magazines, and paperboard), motor oil, lead-acid batteries, tires, and white goods.
Set-out Method:	Rinsed glass, plastic, and cans are commingled in a reusable container. Residents and businesses bundle mixed paper or place it in paper bags or cardboard boxes. Cardboard is set out bundled or bagged. Used motor oil is set out in sealed plastic containers. Doors must be removed from white goods prior to set-out at curbside.
Collection Method and Vehicles:	A three-person crew places all paper in one 20-cubic-yard compactor truck, and a second crew loads all other materials in a second compactor truck. Oil and batterie are placed on a side box of the compactor truck. White goods and tires are loaded onto a stake body dump truck. By 1991 the Township had decreased the collection crew size by one person and reduced the number of vehicles used from four to three.
Economic Incentives:	None
Enforcement:	Haulers will not collect waste from residents and businesses if they do not comply with the ordinance. Businesses that violate the ordinance can be fined $250 and/or up to 2 weeks of community service work. A second offense may result in a $500 fine and/or 3 weeks of community service. To date, no fines have been issued.
Annual Tonnage:	2,477 tons in 1990 (estimated)

The Township collects glass, aluminum and other metal cans, HDPE and PET plastic soda and detergent containers, and mixed paper (newspaper, high-grade paper, kraft-paper bags, junk mail, magazines, wrapping paper, corrugated cardboard, paperboard — including cereal boxes and shoe boxes) from 222 of the 260 commercial establishments. Upper Township has supplied 460 20-gallon containers to large generators of recyclable materials, such as campgrounds, bars, and restaurants. Businesses that receive municipal collection are not charged for the service, and can have materials collected twice a week, if necessary. The Township does not keep separate records of the tonnages of commercial versus residential materials recovered. Businesses that choose not to receive municipal collection contract with private haulers, but the tonnages collected must be reported to the Recycling Coordinator, according to the New Jersey Statewide Mandatory Source Separation and Recycling Act.

Private Curbside/Alley Recycling

Legislative Requirements:	The Township's Ordinance 15/88 requires businesses to recycle newspaper, corrugated cardboard, high-grade paper, mixed paper (including junk mail, magazines, and paperboard), aluminum, ferrous cans, glass, and HDPE and PET plastic beverage and detergent containers. Owners of auto service centers are required to recycle used motor oil.
Service Providers:	Coggins, Martee (WMI), ABC Removal, Reuben Smith Services, Anchor Disposal, and Chambers Waste
Number Served:	38

Type Served:	Businesses not served through the municipal curbside program, such as large retail stores, grocery stores, and restaurants. Most larger businesses, or businesses that received private collection of recyclables before the ordinance was enacted, arrange contracts with private haulers.
Pick-up Frequency:	Varies
Materials Collected:	Materials mandated by Ordinance 15/88 (see Legislative Requirements above) as well as meat and bone scraps at supermarkets
Set-out and Collection Method:	Many businesses compact their corrugated cardboard on site with compactor containers. Food waste is collected in 55-gallon drums and kept in cool storage until pick-up.
Incentives:	Businesses can be fined $250 if recyclables are mixed with refuse. To date no fines have been issued.
Annual Tonnage:	275 tons in 1990

Drop-off Center

Number and Type:	One unstaffed drop-off center at the Public Road Department Yard
Public or Private:	Public
Sectors Served:	Residential and commercial/institutional
Materials Accepted:	Glass, aluminum and ferrous cans, HDPE and PET plastic beverage and detergent containers, newspaper, corrugated cardboard, high-grade paper, and mixed paper including junk mail, magazines, and paperboard.
Annual Tonnage:	50 tons in 1990 (based on an estimate that 2 percent of publicly collected commingled materials are brought by residents and commercial businesses to the Public Road Department Yard)

Processing and Marketing of Recyclables

Upper Township Road Department crew members bring recyclable materials from the curbside and drop-off programs to the County-owned and privately operated Cape May County Intermediate Processing Facility (IPF), located 2 miles from Upper Township. The Township pays no tipping fee to deliver recyclable materials there. The facility began to accept recyclables in January 1990. Private haulers can also deliver recyclables to the facility for free. The IPF was financed through a 20-year bond issue incurred in August 1989 at a 6.75 percent interest rate. Although the capital cost of the facility was $5,725,400, a State refund and grant provided $1,335,300. The total net cost of the bond issue was $4,390,100. Resource Recycling Technologies RRT Empire Returns Corporation built and operates the IPF. Designed to process 225 tons per day of recyclables, the IPF processes 90 tons per day in the summer and 50 tons per day during the rest of the year. The 33,750-square-foot facility operates 256 days a year, with up to two shifts in the summer and one during the rest of the year. It employs 85 employees in the summer and 40 people the rest of the year. Approximately 79 employees sort and process recyclables in the summer; 35 perform these tasks during the remainder of the year. In order to expand market opportunities, the County hired additional employees to further sort paper in 1991.

Net revenues are to be shared between the County (80 percent) and RRT (20 percent). However, in 1990 operating expenses exceeded revenues. The 1990 contract arrangement between RRT and the County allowed for a $1,162,590 operating budget. Expenses totalled $1,234,070—$71,480 over the allotted

budget. RRT was responsible for covering costs over the budget. Revenues from the sale of recyclable materials ($604,030 in 1990) were applied to the County's $1,162,590 operating budget, for a net loss of $558,560. The contract is up for renegotiation at the end of 1991, at which time the County will increase RRT's operating budget.

Aluminum and ferrous cans are separated magnetically and densified into biscuits, and occasionally baled when the densifier fails to operate. A small amount of other aluminum collected, such as pie tins and aluminum foil, are baled. Approximately 50 percent of the glass delivered to the IPF is broken by the time it reaches the facility. Unbroken glass is separated by color and crushed. Aluminum and HDPE and PET plastics are separated from glass with an air classifier and plastics are baled. Paper is hand-sorted into three grades depending on markets: (1) a corrugated cardboard mix, (2) a high-fiber mix including all paper unsorted, and (3) a news mix including newspaper and mixed paper without cardboard. Cape May County is responsible for disposal of process residue under 5.5 percent of commingled glass and cans; RRT is responsible for disposal of commingled materials exceeding this percentage. The reject rate by weight of all incoming materials is 2.38 percent.

RRT is also responsible for marketing processed materials. Most paper is sold to local brokers for overseas shipment. Brokers include P.M.I. in Elizabeth, New Jersey, and Raff's in Cape May Courthouse. Some paper is sold to the Container Corporation of America (CCA) in Philadelphia. In 1991 a small amount of paper was sold to Marcel in Pennsylvania. Corrugated cardboard is sold to brokers including P.M.I., Giordano in Vineland New Jersey, and Smurfit, the parent company for CCA, and to the manufacturing plants of Consolidated Fiber in Oakland, California and Koplik and Sons, Inc. in New York City. Ferrous cans are sold to AMG Resources Corp. in Baltimore, Maryland. RRT sells aluminum to Hunter Douglas, a broker in Homewood, Illinois, Wise Metal, and American National Can in Millville, New Jersey. Plastics are sold to NICON in Long Island, New York or to Wheaton Plastics in Millville, New Jersey, where they are chipped into plastic flakes. Glass is sold to Foster Forbes Glass Manufacturing in Millville, New Jersey and to Ball Inc.; in 1991 glass was also sold to American National Can, Continental Metals in Brooklyn, New York, and Anchor Glass Container in Salem, New Jersey. Over 50 percent of the glass is delivered locally to Barrett Paving for manufacture of asphalt. The County delivers white goods and lead-acid batteries to Joe's Auto Wreckers, where batteries are recycled and white goods are sold as scrap metal. Tires delivered by private and municipal haulers are sent to the Southern State Prison, where inmates process them into artificial reefs to create habitats for marine life. This program is coordinated by CMCMUA, New Jersey Marine Fisheries, and the Southern State Correctional Facility.

Construction & Demolition Debris/Bulky Waste Recovery

Private haulers deliver concrete to Future Mining and Recycling in Middle Township, and concrete and asphalt to Daly's Pit in Upper Township. These materials are crushed and reused for roadbase material.

In April 1990, Cape May County opened the Bulky Waste Sorting and Recycling Facility at its landfill site to separate out scrap metal, tires, commercial corrugated cardboard, and bulky waste such as furniture, large brush, and wood waste from refuse headed for disposal at the Landfill. The County charges a tipping fee of $83.50 per ton, which can be reduced to $60 per ton if private haulers separate out clean wood waste; no fee is charged if they separate out corrugated cardboard and scrap metal. If more than 5 percent of the private hauler's load contains recyclable materials, the CMCMUA charges $200 in addition to the tipping fee.

Composting Activities

Upper Township composted its leaves and grass clippings at the Public Road Department Yard until 1984. In that year the County opened its 2-acre composting site at the landfill, where it accepted leaves and grass clippings free of charge from residents and commercial businesses. Upper Township continues to chip larger brush collected through its curbside program at the Public Road Department Yard. Christmas trees are an exception; the Township delivers these as well as grass clippings and leaves, to the County site.

The Cape May County Municipal Utilities Authority encourages backyard composting of leaves, grass clippings, and food scraps through its monthly newsletter.

Curbside Collection

Start-up Date:	1972 for leaves, brush, and grass clippings; 1982 for Christmas trees
Service Provider:	Township Road Department
Households Served:	3,860 in single-family and two-family residences
Mandatory:	Yes, for leaves only
Materials Collected:	Leaves, grass clippings, wood waste, brush, and Christmas trees
Set-out Method:	Residents set leaves and grass clippings at curbside in plastic bags or trash cans and bundle brush. During November and December, leaves are set out loose at curbside.
Collection Vehicles & Method:	A two-person crew empties bags of yard waste into a 20-cubic-yard compactor truck. During November and December, ten Township employees, in 2-to 3-person crews, vacuum loose leaves into two 20-cubic-yard dump trucks. Vacuums are pulled by two 15-cubic-yard dump trucks. Small brush is also collected in compactor trucks and brought to the CMCMUA. Larger brush is chipped by a two-person crew and ground materials are blown into a dump truck. Township crews collect Christmas trees during January and February.
Collection Frequency:	Leaves are collected weekly year-round. Brush and grass clippings are collected weekly from spring until November.
Economic Incentives:	None
Tonnage:	884 tons in 1990

Composting Site

Township crews deliver leaves and grass clippings collected through the municipal curbside program to the County-owned and -operated landfill site, located 2 miles from the Township. The site opened in 1984. The County does not charge municipalities or landscapers a tipping fee to drop off leaves and grass clippings. In 1990 a total of 7,791 tons of leaves, grass clippings, stumps, logs, and wood waste was brought to the facility. An estimated 5 percent of these materials was landfilled.

Operators place leaves and grass clippings in windrows on a 2-acre composting site. When internal windrow temperatures reach 140° Fahrenheit, the windrow is turned with a front-end loader. Windrows are turned approximately every 2 months. Compost is ready in 13 to 14 months. The finished

compost is used primarily for erosion control at the landfill; it is also available free to County residents.

Upper Township chips most of its brush, except for Christmas trees, at the Road Department Yard. Chipped materials are made available to residents at no charge, used by the Township in public parks, or used by the CMCMUA. The County charges a tipping fee of $35 per ton to process brush and wood waste at its Bulky Waste Sorting and Recycling Facility. Christmas trees delivered by Upper Township, and wood waste and brush delivered by other Townships, are sold as mulch or used as landfill cover. Two types of mulch are produced: mulch I, used as topsoil, sells for $7 per cubic yard; and mulch II, a coarser product, sells for $10 per cubic yard. Larger chips are used as bulking agents at the County sludge composting facility. Some large stumps and brush are not processed but set in an 8-foot deep trench and covered with soil. This site, known as a "Hibernaculum," serves as a habitat for wildlife. The County estimates that in 7 to 10 years the materials will have decomposed completely and the site can be used again for the decomposition of larger brush and stumps.

Amount and Breakdown of Materials Recovered

Materials	Total (Tons, 1989)	Total (Tons, 1990)	Percent Change
Paper*	1,790.6	1,695.56	
Commingled†	627.7	841.78	
Scrap Metal‡	12.3	108.11	
White Goods	76.2	128.66	
Food Waste	23.0	8.50	
Tires	NA	17.18	
Lead-acid Batteries	NA	2.30	
Subtotal Recycled	**2,529.8**	**2,802.09**	11%
Yard Waste	3,262.0	2,292.75	
Subtotal Composted	**3,262.0**	**2,292.75**	-30%
Total Recovered	**5,791.8**	**5,094.84**	-12%
Asphalt	0	81.50	
Concrete	0	191.00	
Total C&D Recycled	**0**	**272.50**	
Total Recovered	**5,791.8**	**5,367.34**	-7%

Notes: While the total amount of materials recovered in 1990 decreased by 424 tons from the total recovered in 1989, MSW disposed in 1990 decreased 3,425 tons in this period.

In 1989 tires and lead-acid batteries were collected for recovery; however, tonnages were not tracked.

In 1989 compostable materials recovered were not separated into MSW and C&D, thus, the figure for yard waste recovered includes C&D composted.

12 tons of motor oil in 1989 and 25 tons in 1990 were collected for recovery; however, because this oil was burned as a fuel source, tonnages are not included.

*Paper tonnages include newspaper, corrugated cardboard, high-grade paper, and mixed paper such as paperboard, junk mail, and magazines.

†Commingled materials include glass, aluminum cans, foil, foil pie plates, ferrous cans, and HDPE and PET plastic beverage and detergent containers.

‡Tonnage of scrap metal recycled appears higher in 1990 because one County scrap dealer, "Our World Recycling," did not report tonnages recovered from Upper Township in 1989.

Material	Public Sector (Tons, 1990)	Private Sector (Tons, 1990)	Total (Tons, 1990)
Newspaper	80.39	9	89.39
Corrugated Cardboard	138.53	101.95	240.48
High-grade Paper	16.07	0.60	16.67
Mixed Paper*	1,349.02	0	1,349.02
Glass	648.75	8.98	657.73
HDPE and PET Plastic	53.00	0	53
Aluminum Cans	62.70	0	62.7
Ferrous Cans	68.35	0	68.35
Appliances/White Goods	92.91	35.75	128.66
Scrap Metal	3.07	105.04	108.11
Food Waste†	0	8.5	8.5
Tires	12.96	4.22	17.18
Batteries	1.50	0.80	2.3
Subtotal MSW Recycled	**2,527.25**	**274.84**	**2,802.09**
Leaves and Grass Clippings‡	680.53	642.96	1,323.49
Brush§	178	0	178
Christmas Trees	25	0	25
Subtotal MSW Composted**	**883.53**	**642.96**	**1,526.49**
Total MSW Recovered	**3,410.78**	**917.80**	**4,328.58**
Asphalt	0	81.5	81.5
Concrete	0	191	191
Total C&D Recycled	**0**	**272.5**	**272.5**
Wood Waste	0	48	48
Brush, Stumps, and Logs††	0	718.26	718.26
Total C&D Composted	**0**	**766.26**	**766.26**
Total C&D Recovered	**0**	**1,038.76**	**1,038.76**
Total Materials Recycled	**2,527.25**	**547.34**	**3,074.59**
Total Materials Composted	**883.53**	**1,409.22**	**2,292.75**
Total Materials Recovered	**3,410.78**	**1,956.56**	**5,367.34**

Note: 25 tons of motor oil were collected in Upper Township in 1990; because the oil was burned as a heating source, these tonnages are not included.

*Mixed paper includes paperboard, junk mail, high-grade paper, wrapping paper, and magazines.

†Food waste, consisting of bone and meat scraps, is generated from one supermarket.

‡642.96 tons of yard waste delivered to the County site consists primarily of landscapers' waste generated from Upper Township.

§Upper Township collected 203 tons of brush, including Christmas trees, in 1990. The CMCMUA estimates 25 tons were Christmas trees.

**Yard waste collected is weighed.

††Includes a small amount of landscapers' waste recovered at the County Bulky Waste Sorting and Recycling Facility.

Publicity and Education

Residential

The County prints a monthly newsletter, the *Cape May County Recycler*, which is distributed to all residents. It reports on the recovery rates of the different municipalities, highlights the most successful communities through descriptions of their programs, and informs residents about new County-based programs. In addition, Upper Township mails out fliers to all residents and businesses informing them of collection days and explaining the proper separation of materials for collection.

Seasonal

During the tourist season the Township's population swells nearly 50 percent. Both the Township and the County provide recycling information and opportunities to vacationers. The Township places 20-gallon containers for commingled recyclables alongside refuse containers on beach-front dead-end streets, and sends recycling instructions to property owners for their seasonal tenants.

Cape May County provides stickers for rental units explaining how to recycle, distributes a "Vacationers' Guide to Recycling" to real estate agents, and gives out salvaged plastic recycling bins to landlords of efficiency apartments. County billboards and trolleys display the message, "Don't Take a Vacation from Recycling"; airplanes pulling the same slogan fly over County beaches. Cape May County places red containers for recyclables on the beaches and boardwalk in summer; however, the County has encountered problems with contamination in these bins. The County has also set up recycling areas at campsites and marinas.

Economics

Costs Cover: In 1990 Upper Township incurred capital and operating and maintenance costs for (1) the collection of 2,527 tons of recyclables at curbside and at the drop-off center, (2) the collection of 681 tons of leaves and grass clippings at curbside, and (3) the collection of 25 tons of Christmas trees and collection and chipping of 178 tons of brush. These costs are given below, as are capital costs for the CMCMUA composting facility, which were incurred by the County. Upper Township capital costs were paid off through Township taxes.

Capital Costs: Collection

Item	Cost	Use	Year Incurred
500 20-gallon Containers @ $7	$3,500	Recycling	1987-1989
20-cubic-yard Compactor Truck	54,582	Recycling	1989
20-cubic-yard Compactor Truck	63,000	Recycling	1991
Leaf Vacuum	9,000	Composting	1975
20-cubic-yard Compactor Truck*	35,000	Composting	1980
Leaf Vacuum	14,095	Composting	1987
2 Pick-up Trucks @ $12,000 & $14,000†	26,000	Recycling	1984 & 1988
2 Eager Beaver Trailers @ $12,000 & $14,000†	26,000	Recycling	1984 & 1988

*Vehicle cost is estimated by the Upper Township treasurer.

†These vehicles were used in 1989, but were replaced by compactor trucks.

Capital Costs: Processing

Item	Cost	Use	Year Incurred
Chipper @ 10% composting use	$12,594	Composting	1986
821 Case Front-end Loader*	118,000	Composting	1989
Read Screen-All*	65,000	Composting	1989
Tub Grinder*	176,000	Composting	1990

*Equipment purchased and owned by the Cape May County Municipal Utilities Authority.

Annual and Per Ton Operating and Maintenance Costs (1990)

	Cost	Tons Covered	Per Ton Cost
Recycling Subtotal	**$240,907**	**2,527**	**$95**
Collection*	$179,207	2,527	$71
Processing	0	2,527	0
Administration	58,700	2,527	23
Education/Publicity	3,000	2,527	1
Composting Subtotal	**$54,700**	**884**	**$62**
Collection†	$43,400	884	$49
Processing‡	10,200	884	12
Administration	900	884	1
Education/Publicity	200	884	§
Recycling & Composting Total	**$295,607**	**3,411**	**$87**
Collection	$222,607	3,411	$65
Processing	10,200	3,411	3
Administration	59,600	3,411	17
Education/Publicity	3,200	3,411	1

Notes: Some numbers do not add up to total due to rounding.

*Collection costs increased from $148,000 in 1989 to $176,000 in 1990 because additional collection crews were hired during the summer months to collect commercial recyclables. Recycling collection costs include $3,207 for equipment maintenance.

†Includes $800 for equipment maintenance.

‡ Includes $200 for tub grinder maintenance.

§ Less than $1.

Materials Revenue: Upper Township did not receive any of the $604,030 in revenue from the sale of recyclable materials processed at the IPF in 1990.

Source of Funding: Local taxes and a State Tonnage Grant

Full-time Employees: 9 in Upper Township (6 to collect recyclable materials, 2 to collect and process yard waste, and 1 to administer recycling and composting activities)

12 in Cape May County (4 to administer the County's programs and 8 to operate the Bulky Waste Sorting and Recycling Facility, including the tub grinder and front-end loader). One person works at the County compost and Hibernaculum facility.

In 1990 RRT Empire Returns Inc. employed 85 people at the IPF in the summer and 40 people during the rest of the year.

Part-time Employees: 3 (2 Upper Township employees to collect and process yard waste, and 1 County employee to process leaves and grass clippings)

Future Solid Waste Management Plans

Upper Township plans to begin curbside collection of household batteries in 1992. Cape May County plans to construct a mixed waste composting facility by 1994.

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References

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Wapakoneta, Ohio

Demographics

Jurisdiction:	City of Wapakoneta
Population:	9,214 in 1990
Area:	5 square miles
Total Households:	3,548 households
Total Businesses and Institutions:	456 (452 businesses, 4 institutions)
Brief Description:	Wapakoneta is a small rural city in west-central Ohio. Its economy is based on small-scale manufacturing, e.g., tool and dye companies, automotive suppliers, and agricultural processors. Wapakoneta is located in an agricultural region that produces soybeans, corn, and wheat. Its 1990 per capita income was $9,867, and its 1990 median household income was $36,600.

Solid Waste Generation and Recovery

	Annual Tonnages (Sept. 1989 to Aug. 1990)*		
	Residential	**Commercial/ Institutional**	**Total MSW**
Recovered	**NA**	**NA**	**1,824**
Recycled†	NA	NA	1,369
Composted	NA	NA	455
Disposed‡	**NA**	**NA**	**7,429**
Incinerated§	NA	NA	152
Landfilled	NA	NA	7,277
Generated	**NA**	**NA**	**9,253**
	Percent by Weight Recovered		
Recovered	**NA**	**NA**	**20%**
Recycled	NA	NA	15%
Composted**	NA	NA	5%

Note: Waste generated excludes bulky items such as tires, wood waste, and construction debris. A small percentage of tonnage recycled consists of material delivered by out-of-town residents to the Recycling Center.

* 450 tons of commercial recyclables and 2,685 tons of commercial refuse included above were collected from July 1989 to June 1990.

† Tonnage recycled includes 630 tons of recyclables collected through the City Recycling Center, 289 tons of corrugated cardboard collected from businesses, and an estimated 450 tons of mixed recyclables recycled by businesses.

‡ Tonnage disposed includes 4,592 tons of refuse collected by the City from residence and businesses and an estimated 2,685 tons of refuse collected from businesses not using City pick-up.

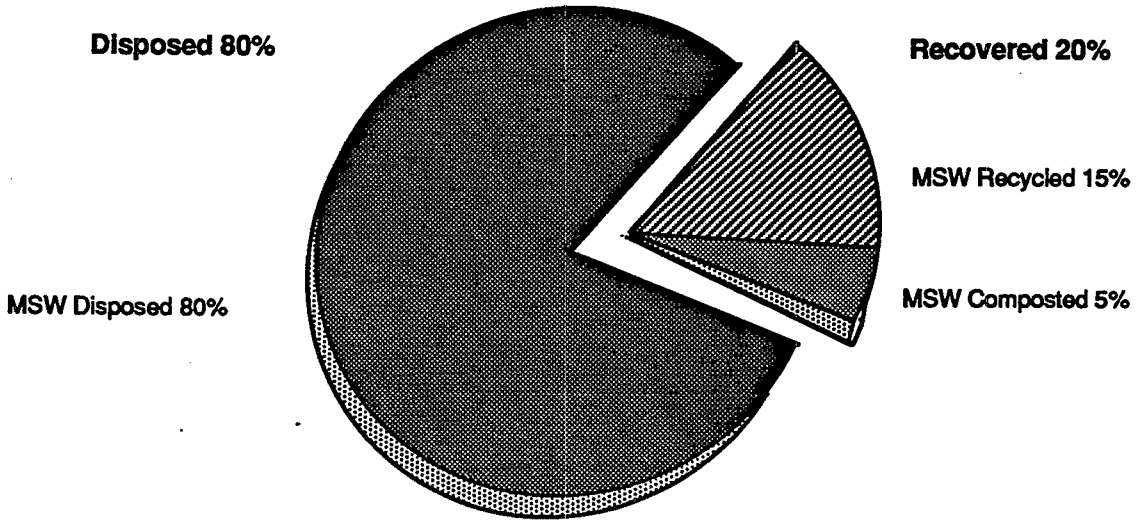
§ Incinerated, in this instance, refers to burned yard waste.

** The City does not track tonnages of yard waste composted. The Ohio EPA estimates a reduction of 36,000 cubic yards of refuse deposited from Wapakoneta in the St. Marys landfill from July 1989 to June 1990. Of this, 606 tons is attributed to yard waste diversion. The City estimates that 75 percent of this material, equivalent to 455 tons, was composted or land-applied. The remaining 25 percent was burned.

Landfill Tipping Fee: $6.00 in 1988, $22.20 in 1989 and 1990

Refuse Collection and Disposal: The City of Wapakoneta collects residential and commercial/ institutional waste and disposes of it in the St. Marys landfill, in St. Marys, Ohio. Due to a discovery of benzene at the landfill, Wapakoneta's own landfill has not accepted refuse since August 1989. Some large businesses contract privately for refuse collection with independent haulers, such as Waste Management, Inc., who dispose of refuse outside of the County (St. Marys) landfill. Refuse disposal in Wapakoneta costs $6 per household per month. In June 1990, Wapakoneta adopted a variable refuse collection rate, charging residents an additional $0.70 per 30-gallon bag of refuse set out. (Residents must set-out refuse in special white bags, which they purchase for $0.70 at the local market). This variable refuse rate has resulted in a 25 to 30 percent volume reduction, 20 percent weight reduction, in waste collected during the first year of implementation. This reduction is attributed to increased recycling activities, compaction of waste by residents, backyard composting, and a lower moisture content of waste.

Municipal Solid Waste Recovered & Disposed
(Percent by Weight, Sept. '89 to Aug. '90)



Materials Recovery Overview

Goals and Legislative Requirements:

The State of Ohio requires the formation of Solid Waste Management Districts. Any county with a population of over 120,000 constitutes its own district. Those with smaller populations form joint districts with other counties. Auglaize County, in which Wapakoneta is located, comprises a State Solid Waste Management District because of the long-term life expectancy of the St. Marys landfill (which serves as an exemption to the 120,000 population rule). Each district must submit a plan to the Ohio EPA demonstrating sufficient solid waste management capacity and the ability to meet the State waste reduction goal of 25 percent. The Auglaize County Solid Waste Management District completed a revised Draft Solid Waste Plan in May 1991. The plan was approved by more than 60 percent of the County's municipalities and is currently being reviewed by the Ohio EPA. After final approval, the District will begin implementation of the plan through a hired coordinator.

In 1989 the County terminated the collection of leaves and yard waste for landfill disposal. Ohio has banned vehicle batteries, yard waste, and tires from landfills, effective January 1993, December 1993, and January 1995, respectively.

All recycling activities in Wapakoneta have occurred through the efforts of volunteer community organizations and citizens, independent of County or State initiatives. The City's drop-off Recycling Center, sponsored by 17 Girl Scout and 2 Boy Scout troops, initiated recycling in Wapakoneta. Each week, a different troop operates the Recycling Center, involving a total of 400 volunteer scouts and parents. Individuals obliged to do community service are sent by the local courts as supplemental

workers. Wapakoneta's volunteer recycling coordinator and program initiator, Robert Sabo, has helped start five other recycling centers in Auglaize County.

In July 1988, Wapakoneta's recycling center (also known as the Auglaize County Scout Recycling Center), began to accept recyclable materials, including newspaper, glass jars and bottles, and aluminum cans, one day a week, in its parking lot location on the County Fairgrounds. In January 1989, as the scheduled termination of disposal at Wapakoneta's landfill drew near, the County allowed the recycling program to expand its operation into the old cattle barn located on the fairgrounds property. This recycling center was the only recycling location in the eastern half of the county at this time.

The expanded Recycling Center, located on the western edge of the City limits, began to accept a variety of additional materials including paper, corrugated cardboard, computer paper, batteries, and polystyrene egg cartons and containers. The Center continued to operate as a drive-through on Saturdays, but remained opened, unstaffed, the rest of the week. Approximately 40 percent of the material collected began to come in after hours. In June 1990, Wapakoneta instituted a variable refuse collection rate, which appears to have increased recycling tonnages. For example, in April and May 1990, only 8 tons of material were brought in per week; in June 1990, this amount doubled to an average of 16 tons per week collected. (Recycling tonnages, however, dropped off slightly in October 1990.)

The Auglaize County Solid Waste District Committee paid for the purchase of most of the equipment used to process the materials collected at the Recycling Center, which includes a 16-foot trailer, a baler, a fork lift truck, and a scale. Although the program has successfully diverted 630 tons (7 percent) of City hauled waste. Weekly curbside collection of recyclables will commence in the spring of 1991 based on a simplified plan. The neighboring city of St. Marys is also designing a curbside program as a result of Wapakoneta's serious examination of curbside options. The City has paid for the purchase of minimal equipment only (e.g., plastic baler, glass crusher, and can crusher), and pays nothing for the collection of material (except for its commercial corrugated cardboard collection). In September 1990, the County paid for the cost of a full-time employee to process plastic containers. In December of that year, a second full-time employee was hired to deliver recyclables to market and perform other tasks. Prior to the hiring of these two individuals, all staff at the drop-off and processing site were unpaid volunteers.

Tonnages collected at the Recycling Center have steadily increased. From September 1989 to August 1990, 630 tons of recyclables were collected at the Recycling Center. The following year (September 1990 to August 1991) 681 tons were collected. The Wapakoneta Waste Minimization committee was formed in 1990 in response to plans to construct a privately-owned 1,000 ton-per-day waste incinerator within the City. Instead of permitting trash burning, the City Council created a citizens' group to advise City government and residents on ways to minimize waste. In 1991 Wapakoneta's recycling coordinator and the Wapakoneta Waste Minimization Committee have formally proposed establishment of a mandatory curbside recycling program utilizing one collection vehicle for the collection of refuse and recyclables on alternative weeks. Since August 1991, the Committee has coordinated operations at the recycling drop-off center.

Recycling Activities

Drop-off Collection Program

Number and Type: One

Public or Private: Private nonprofit community groups (17 Girl and 2 Boy Scout troops)

Sectors Served:	Residents and commercial businesses in Wapakoneta. Most of the tonnage collected at the Center are delivered by residents. A few residents from adjacent rural areas outside of the City limits, bring material to the Center.
Mandatory:	No
Participation:	Not available
Materials Accepted:	Newspaper, high-grade paper, tab cards, corrugated cardboard, glass food and beverage containers, aluminum cans and scrap (including foil, pie plates, license plates, and lawn furniture), tin cans, scrap metal, HDPE and PET plastics, polystyrene plastic egg cartons and meat trays, and plastic grocery bags
Separation Method:	Residents are asked to bring in materials in grocery bags, source-separated by material type. All plastics are placed in one bag, except for polystyrene, which is placed in a separate plastic bag or container; all glass is placed in one bag; tin in another bag; aluminum cans are placed in a separate bag; newspaper is placed in a kraft bag; computer paper is collected in cardboard boxes; cardboard is placed in a box, or tied with biodegradable string; scrap aluminum is collected as is.
Annual Tonnage:	630 tons

Residents drive through the converted cattle barn to drop off recyclable materials. They are asked to remain in their cars, to expedite unloading of materials. Workers unload recyclables and bring them to designated areas of the barn. Plastics are brought by a Center volunteer to one area, glass to another, cans to a third. Newspaper is brought outside to a semi-trailer, and high-grade paper is stacked in a pile. All items are processed that day by the volunteer group.

Commercial Curbside Recycling

Since January 1990, the City has picked up old corrugated cardboard in a compactor truck from approximately 250 of the City's businesses. Cardboard is collected between one and three times per week, depending on the volume generated. Businesses place corrugated cardboard in a separate dumpster or pile it up in front of their door. Cardboard is collected in a packer truck operated by two crew members. The City charges businesses $8 per pick up. From September 1989 to August 1990, the City collected 289 tons of corrugated cardboard. From September 1990 to August 1991, the City collected 343 tons of corrugated cardboard from local businesses. The City is currently restructuring its refuse fees to provide businesses maximum incentive to source separate cardboard. It will charge businesses $10, $12, or $14 per pick-up of mixed refuse, depending on container size, but only $8 for the collection of cardboard.

Salvage/Reuse

In April 1991, Wapakoneta organized its first "Drop and Swap," sponsored by the Scout Recycling Center, the Wapakoneta Waste Minimization Committee, and the County's Solid Waste Advisory Committee. Residents brought their unwanted items to the County Fairgrounds to swap with their neighbors. More than 125 items, including vacuum cleaners, furniture, lamps, bicycles, heaters, sinks, typewriters, and luggage, exchanged hands.

Processing and Marketing of Recyclables

Materials are processed at the drop-off Recycling Center, using only a plastic baler, a can crusher, and a glass crusher. Processing equipment was purchased in 1990; prior to that time, materials were marketed without mechanized processing. Most materials are processed on Saturday, when the drop-off center is staffed with at least 30 volunteers. On an average Saturday, approximately 24 volunteers sort and process materials. Workers separate plastics by resin type and bale each type separately. Glass is manually separated by color. (The Center receives about 80 percent clear glass and 10 percent each of green and brown glass.) Clear glass is immediately crushed with the glass crusher. Brown and green glass are stored separately and crushed when a sufficient quantity has been collected. Before the purchase of the baler in March 1990, plastic was placed in 8-foot bags. Labels are removed from the tin cans and cans are crushed. Aluminum cans mixed with some bimetal cans are put in boxes. (Typically, about 25 percent of boxed cans are actually bimetal). Corrugated cardboard is loaded directly onto a packer truck.

Newspaper and HDPE plastic containers are used locally to produce new products. Newspaper is sold to a local manufacturer of insulation, USF Insulation, which sells its product primarily to lumber yards. Baled HDPE is sold to United Recovery in Findlay, Ohio. United Recovery manufactures plastic pipe out of this material and resells the remaining HDPE. Glass, aluminum, scrap metal, and computer paper are sold to Ohio Recycling, a recycling broker. Tin cans are marketed with the adjacent Mercer County's tin cans, to a de-tinner. Corrugated cardboard collected at the drop-off is sold together with the cardboard collected through the City's collection program, to Allen County Recycling in Lima, Ohio. Baled PET is sold to a broker, Minster Plastics, in Minster, Ohio. PET plastic containers are resold to a firm in Cleveland, Ohio for manufacturing into plastic lumber. Polystyrene packaging is given away to Mercer County, which resells it. In 1991 it was sold to Indiana for manufacturing into new egg cartons. Less than 1 percent of total tonnage brought into the Center is non-marketable and discarded.

Composting Activities

The City of Wapakoneta has been collecting leaves at curbside during November and December for at least 20 years. Formerly, leaves were collected using a leaf vacuum machine with an attached chasis. Beginning fall 1990, the collection method was altered. Leaves are now swept up into a grinder apparatus attached to a dump truck (Ford Model 710 Leaf Loader). Leaves are distributed free of charge to area farmers. According to Wapakoneta's volunteer recycling coordinator, area residents are extremely interested in obtaining organic materials, and demand has typically exceeded supply.

Grass clippings have been barred from Wapakoneta's landfill since 1987. Beginning June 1989, yard debris was no longer accepted for disposal at the Wapakoneta or St. Marys landfill. Residents brought organic materials (including grass clippings, brush, and some other yard waste), free of charge, to a 34-acre City-owned farm adjacent to the Wapakoneta landfill. Material was stockpiled and sometimes burned. According to the Ohio EPA, an estimated 606 tons (or 1,818 cubic yards) of yard waste were diverted from landfill disposal from July 1989 to June 1990. Twenty-five percent of this tonnage was burned. Beginning June of 1990, some material was land-applied using a manure spreader attached to a tractor. According to the Director of Public Service and Safety there is no noticeable objectionable odor from this operation as the site is in a remote area. From June 1990 to June 1991, the City estimates that 861 tons of yard waste were composted at the City site or in residents' backyards.

Since March 1991, the City has been experimenting with composting yard waste and Christmas trees, and has leased a tub grinder to grind brush dropped off by City residents. The City has also implemented an on-call brush and pick-up service. The City hopes to purchase its own tub grinder. Yard waste is now chipped for use as mulch in local parks, school grounds, and other public areas.

Amount and Breakdown of Materials Recovered

Material	Residential (Tons, '89-'90)	Commercial/Inst (Tons, '89-'90)	Total (Tons, '89-'90)
Newspaper	NA	NA	457.89
Corrugated Cardboard	46	289	335
High-grade Paper	NA	NA	4.27
Glass	NA	NA	74.22
PET and HDPE Plastic	NA	NA	22.93
Aluminum Cans	NA	NA	6.58
Ferrous Cans	NA	NA	16.37
Other Metal	NA	NA	1.80
Other commercial recyclables	0	450	450
Subtotal MSW Recycled	**NA**	**450**	**1,369.00**
Leaves	NA	NA	NA
Brush	NA	NA	NA
Other Yard Waste	NA	NA	NA
Subtotal MSW Composted	NA	NA	**454.5**
Total MSW Recovered	**NA**	**NA**	**1,823.5**
Total C&D Recovered	NA	NA	**NA**

Note: Listed tonnages were collected between September 1989 and August 1990 except for the 450 tons of "other commercial recyclables," which were collected from July 1989 to June 1990. Of the tonnage listed above, 630 tons were collected at the recycling center, 289 tons were collected through the commercial corrugated program, and 450 tons were collected from businesses. Most of the materials brought to the drop-off center are from the residential sector, but tonnage breakdowns are not available.

Source Reduction Initiatives

The City of Wapakoneta has instituted a per bag fee for garbage disposal. Beginning June 1990, households are charged a $0.70 fee per bag of mixed waste disposed in addition to the $6 monthly fee. Commercial businesses are charged a $3 fee per City pick-up, and a per volume charge of $3 per cubic yard. According to the head of City Services, the new fee scale has caused about 20 to 25 City businesses to choose private haulers, such as Waste Management, instead of the City collection service. He has observed that the volume of refuse collected in the City has decreased. The loss of commercial clients has partially contributed to this decrease, as has increased backyard composting, compacting of waste by residents, and increased recycling activities.

Publicity and Education

The City of Wapakoneta utilizes direct mailings, utility bill inserts, posters, newspaper ads and articles, radio ads, displays, and hand-outs to advertise its recycling program. Much of its publicity occurs through volunteer efforts. Some teachers of art and other subjects in local schools have chosen to incorporate recycling lessons into their curriculum.

The Wapakoneta Volunteer Waste Minimization Committee, formed in late 1990, educates residents on waste reduction, including environmentally minded shopping, through pamphlets, a

traveling recycling display, a weekly newspaper column ("Waste Watch"), and a cable television series.

Economics

Costs Cover: Capital costs cover the City's and County's expenses for the collection and processing of 630 tons of recyclable materials collected through the drop-off center, 289 tons of recyclables (corrugated cardboard) collected from the commercial sector, and an unknown amount of leaves. Listed operating and maintenance costs cover the City's limited expenses for the private drop-off collection program, and the City's composting program.

Capital Costs: Collection

Item	Cost	Use	Year Incurred
20-cubic-yard Packer Truck*	$1,200	Recycling/Commercial Program	1979
Ford Model 710 Leaf Loader	18,000	Composting	1990
Dump Truck @ 8% of use	18,500	Composting	1990

* The truck was purchased used prior to the onset of the commercial recycling program.

Capital Costs: Processing

Item	Cost	Use	Year Incurred
Baler*	$9,000	Recycling	1990
Fork Lift Truck (used)*	4,000	Recycling	1990
Scale*	400	Recycling	1990
Can Crusher†	1,400	Recycling	1990
16-foot Trailer*	800	Recycling	1988
Glass Crusher†	3,400	Recycling	1990
Manure Spreader‡	800	Composting	1991

Note: Costs of all equipment have been paid.

* Paid for by the County

† Paid for by the City

‡Manure spreader is rented at $20/hour for approximately 40 hours per season. This cost is included under operating and maintenance costs.

Annual and Per Ton Operating and Maintenance Costs (Sept. 1989 to Aug. 1990)*

	Cost	Tons Covered	Per Ton Cost
Recycling Subtotal	**$8,440**	**919**	**$9**
Commercial Curbside Collection/Processing†	$7,800	289	$27
Drop-Off Collection/Processing	$400	630	$1
Administration‡	240	919	††
Education/Publicity§	0	919	0
Composting Subtotal**	**$20,400**	**455**	**$45**
Recycling & Composting Total	**$28,840**	**1,374**	**$21**
Collection	NA	1,374	NA
Processing	NA	1,374	NA
Administration	NA	1,374	NA
Education/Publicity	$0	1,374	$0

*The costs listed above are those incurred by the City of Wapakoneta and do not include costs incurred by the County. Since fall 1990, the County has spent $10,000 per year to pay the salary of two part-time employees at the drop-off center. The County also spends $4,000 per year on operating expenses at the center.

†Labor for the corrugated cardboard collection is estimated to have cost $7,800 for 2 workers, 3 days/week, 52 weeks/year, @ $12.50/hour for 2 hours/day. Additional O&M expenses are not available.

‡The City took out a liability policy to protect volunteer workers at a cost of $240/year.

§Education and publicity costs are covered by donations and volunteer labor.

**Composting subtotal costs include the collection and distribution of leaves and some activities at the composting site.

††Less than $1

Materials Revenues:	$10,000 from Sept. 1989 to Aug. 1990 (given to Scouts)
Source of Funding:	Surcharge at local landfill
Full-time Employees:	2 paid workers were hired October and December 1990. Their salaries are paid for by the County from revenues generated from the $5 per ton landfill surcharge.
Part-time Employees:	3 City employees work 30 days collecting leaves; over 400 volunteers and 1 volunteer recycling coordinator manage the drop-off site.

Future Solid Waste Management Plans

Wapakoneta's volunteer recycling coordinator and the Wapakoneta Waste Minimization Committee (which was founded in 1990) have submitted a proposal to the City to implement mandatory curbside recycling. The plan proposes co-collection of refuse and yard waste every other week, collection of recyclables on the other weeks, using the same vehicles. Recyclable materials and refuse would be collected on alternate weeks in a compactor (garbage) truck with an attached trailer. Segregated recyclables would be placed in the trailer, and corrugated cardboard in the compactor (refuse) truck. Adoption of this program would require purchase of a trailer. Mixed paper (including

magazines and junk mail), oil, and polystyrene plastic would be collected during the last week in months that have 5 weeks. The plan also calls for construction of a new materials processing facility. The estimated cost for this program is $261,000. A volunteer has already secured .funding of $100,000 through a state grant (Ohio Litter Prevention grant), and the City has allocated $6,000 to the Waste Minimization Committee for research and educational efforts. Weekly pick-up of garbage and recyclables will begin in spring 1992 based on a revised plan by the Waste Minimization Committee.

Through its new solid waste plan, the County is hoping to triple its recycling and composting volumes within 3 years.

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