

Commercial Recycling Expansion and Implementation Plan

Report to Council

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I: EXECUTIVE SUMMARY

The City of Ann Arbor recently adopted its Solid Waste Plan Update 2002-2007. A key initiative in that plan update is development of commercial recycling on a scale that matches the progress made in single and multiple family recycling over the last 10 years. A goal of 50% diversion for commercial recycling by 2007 was established. The following executive summary and report outlines how this can be accomplished and what the financial and operational implications may be.

HOW MUCH COMMERCIAL WASTE DO WE GENERATE AND RECYCLE?

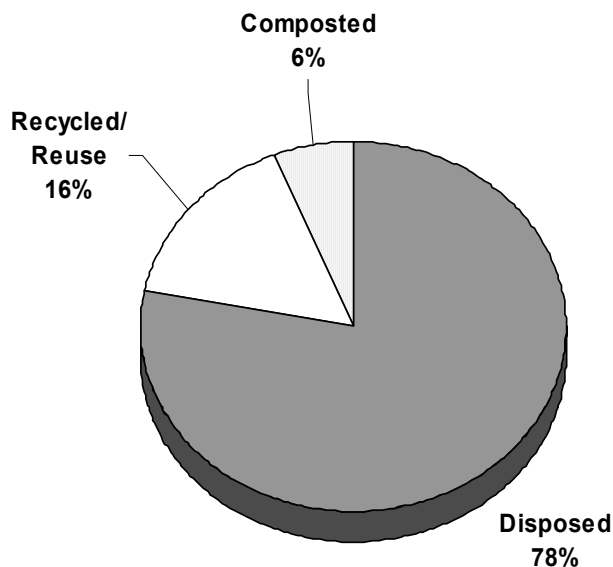
Accurate data about the volume and composition of business waste in Ann Arbor is not readily available, however, an estimate of commercial waste generation has been developed using industry benchmarks for waste generation based on employment. This includes the University, government agencies and the K-12 school system.

Table 1: Summary-City of Ann Arbor, Commercial Employment and Waste Generation

<i>Number of Employees</i>	<i>Number of Establishments</i>	<i>Waste Generation (tons/yr)</i>
106,552	3,689	103,754

Recovery of commercial waste from landfills was projected at 22,740 tons this year using a combination of actual measured data and some estimates based on engineering calculations. Recovery from all sources was considered, from the downtown recycling route to Food Gatherers to the RAA Reuse Center and private recycling programs. All these programs are projected to be achieving a combined recovery rate of 21.9% as shown below.

Figure 1: City of Ann Arbor Commercial Solid Waste Diversion



HOW CAN WE ACHIEVE 50% DIVERSION OF COMMERCIAL WASTE?

Increasing commercial waste diversion from the current 22% to at least 50% will require greatly expanded capacity for collection of recyclable and compostable material. Two program approaches were developed to accommodate some 25,000 tons of additional materials per year. The following chart shows the capture rate projection for typical business recyclable materials such as cardboard and paper under both of these approaches.

Table 2: Summary-Material Capture Rates for Current System

Material Group	Current Programs			Scenario A: Max Capture rate		Scenario B: Aggressive Capture w/ New Programs	
	Generation (tons/yr)	Recovery (tons/yr)	Capture Rate	Capture Rate	Recovery (tons/year)	Capture Rate	Recovery (tons/year)
Cardboard	18,839	7,620	40.4%	95.0%	17,898	80.0%	15,072
Containers	8,240	771	9.4%	75.0%	6,181	50.0%	4,120
Electronics	1,379	91	6.6%	6.6%	91	10.0%	138
Food/Organics	14,879	362	2.4%	2.4%	362	30.0%	4,464
Mixed Paper	24,584	4,568	18.6%	90.0%	22,126	75.0%	18,438
Other	24,846	1,342	5.4%	5.4%	1,342	10.0%	2,485
Scrap Metal	4,453	1,986	44.6%	50.0%	2,227	50.0%	2,227
Yard Waste	6,532	6,000	91.9%	91.9%	6,000	91.9%	6,000
TOTAL	103,754	22,740	21.9%	54.2%	56,226	51.0%	52,943

Recovery Scenario A: Max Out Target Materials – this approach projects maximum recovery of the currently collected materials, rates that will be difficult to achieve.

Recovery Scenario B: Aggressive Capture with New Programs – this approach exceeds 50% diversion by introducing a comprehensive food/organics collection and composting program modeled after pilots conducted with the University over the last year.

Either of these approaches will require a collection system with far greater capacity than the commercial sector currently has available. The following chart shows additional recycling dumpsters and recycling curb carts needed to allow small, medium, and large businesses to recycle their paper products and bottles/cans.

Table 3: Summary-Commercial Recycling Recovery Scenarios

Scenario	Additional Fiber Dumpsters	Container-only dumpsters	Container Curb Carts	Fiber Curb Carts
A: Max Out Target Materials	191	27	4,832	8,465
B: Add New Programs	146	14	2,416	4,232

These collection programs will need to deliver as much as 20,000 to 30,000 additional tons of commercial corrugated cardboard containers and mixed paper each year to an expanded processing system for commercial recyclables, anticipated to be at the City's existing MRF/Transfer Station. At present, the MRF is currently not equipped to handle

any significant commercial recycling and is already limited in its ability to handle additional residential tons.

WHAT COMMERCIAL RECYCLING SHOULD THE CITY IMPLEMENT?

Three strategies were evaluated for programs that the City should implement to develop the collection infrastructure:

- A. **Comprehensive Commercial Recycling:** The City provides a recycling opportunity to all commercial establishments in the City.
- B. **Basic Commercial Recycling:** The City provides a limited, basic level of recycling service to each business (such as one curb cart or dumpster pickup each week).
- C. **Targeted Commercial Recycling:** The City provides recycling services to targeted sectors, such as multi-family, the downtown area and for special materials such as the food waste and requires that all other recycling be provided by private recyclers, driven by a mix of regulations and incentives incorporated into a city ordinances.

All materials collected by the City or City contractors would be delivered to the City’s MRF. Supporting regulatory requirements in a city ordinance would require participation by businesses under any of the options proposed.

HOW MUCH WOULD THIS COST AND HOW WOULD IT BE PAID FOR?

The following chart shows the range of costs for a possible City role in developing this recycling system. Costs for upgrading the MRF and purchase containers and trucks would need to be capitalized, with the amortization of this capital covered in the operating costs projected below. Additional funds would be required for the food waste program, depending on the potential that system has for adding to recovery.

Table 4: Summary-Estimated Costs for Expanded Recycling

<i>Cost Category</i>	<i>Option A Comprehensive Recycling</i>	<i>Option B: Basic Recycling</i>	<i>Option C: Targeted Recycling</i>
Tons Collected	29,300	14,150	2,931
Service Cost	\$2,086,629	\$1,098,618	\$286,035
Container Amortization/Yr	\$138,700	\$69,438	\$13,889
Processing	\$351,758	\$175,8791	\$35,176
TOTAL COSTS	\$2,577,087	\$1,343,935	\$335,100
COST PER TON	\$87.92	\$91.70	\$114.32

There are currently four basic approaches used to fund recycling in Ann Arbor:

- A. **Dedicated Millage.** A portion of the City’s dedicated millage for solid waste could be used to fund expanded commercial recycling.

- B. **Municipal Service User Fees:** The City has the ability to bill for additional services with a fee schedule.
- C. **Private Hauler User Fees:** Some commercial recycling is provided on a limited basis within the City by private waste haulers and paid for by hauler user fees.
- D. **Private Recycler Payments:** Commercial establishments within the City with highly valued recyclables, such as a larger printing operation, may actually be paid for their paper, when markets are good. This would be expected to continue no matter what system is selected by the City, but will only recover the best recyclables from a small number of establishments.

A final decision on what option to develop and how to pay for it requires an assessment of the best role for public and private sector services for both recycling and solid waste. The following chart shows how each of the three options would rely on which funding systems.

Table 5: Summary-Options Comparison: Reliance on Funding Systems

	<i>Option A Comprehensive Recycling</i>	<i>Option B: Basic Recycling</i>	<i>Option C: Targeted Recycling</i>
Millage	High	Medium	Low
Municipal User Fees	Medium	High	Low
Private Hauler User Fees	Medium	High	High
Private Recycling Payments	Low	Low	Low

As the table indicates, Option A, and B rely on millage support with some reliance on municipal user fees as well as private hauler user fees for additional services. Option C, with low millage impact, requires a high level of reliance on private hauler user fees. Reliance on private hauler user fees requires that demand for services be created and that service providers make significant investments to supply that demand. Based on experience in other communities as shown in the case studies, this will require some type of enforceable program that includes regulations and incentives, developed through a strong ordinance.

The reliance on the millage will require shifting funds away from other programs, one possible approach being to transition commercial refuse service to a municipal user fee and/or private hauler based user fee system, freeing up about \$500,000 per year in collection and disposal costs and that could then be shifted to commercial recycling.

WHAT NEXT STEPS ARE RECOMMENDED?

The analysis shows that 50% recovery in the commercial sector is achievable and that the resources required, while significant, are within reach.

There are still many questions that remain to be answered, however, before final choices

are made on the strategic options covered in this implementation plan. Following are recommended implementation action steps that reflect these uncertainties while at the same time setting into motion those longer lead-time steps that are necessary for the goal of 50% commercial recovery to be reached on a timely basis.

Most of the steps that can be immediately taken have already been considered and included in the five-year Solid Waste Plan Update. Recommendations for immediate action include:

1: MRF Expansion for Commercial Paper Processing (in 5-year plan): MRF expansion to handle an estimated 20,000-30,000 tons of additional commercial recyclables per year must be completed to make commercial recycling work.

2: Near Term Upgrade of Commercial Recycling Collection (in 5-year plan): Expanding recycling routes currently operated by the City would lower unit costs, increase capacity, and increase recovery, in the short term.

3: Expand “Municipal User Fee” Services and Administrative System (in 5 year plan): Expand municipal user fees as a means of offering “on request” services that increase the recycling effort and increase funding at the same time.

4: Proceed with Food Waste Pilot and Compost Site Development/Expansion: The viability of food waste as a recyclable/compostable needs to be further evaluated. A pilot program would begin the process of determining best collection practices and costs.

5: Campaign to Improve Ability to Benchmark Current Status and Track Progress: Continue to collect data on recycling through surveying, pilot testing, and data reporting.

6: Outreach and Education: Prepare businesses to support the expansion and to participate in the system as it is developed.

7: Collection Program Design: Finally, the choices need to be made on how to develop the commercial recycling collection infrastructure as described in either Option A, B, or C. This will require discussion on providing refuse collection via user fees, the role of how to motivate private businesses to recycle, the implications of public and private sector roles in system operation, the role of contracting, franchising and hauler licensing strategies, the ordinance/rules/regulations that will be needed, and the technical and procurement steps to proceed with the selected system.

Expanding the MRF and compost facility will take 12 to 36 months depending on the need for changes in the refuse transfer operation. With careful planning the collection system can be ramped up and quickly brought to high levels of performance during the third through fifth year of the five-year plan update period. Moving forward on these recommended action steps as soon as possible will allow the 50% commercial recovery goal to be reached in the five-year planning period.

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II: WASTE GENERATION ASSESSMENT

II-A: DEFINITIONS

Throughout this document, several terms specific to waste and recycling will be used. These terms have specific meaning and, for clarity, are defined below.

Waste Generation: Defined here as the sum of waste disposed plus waste recycled/composted/reused.

Recovery: Material recovered or diverted from disposal is defined as recycling, composting, reuse, or source reduction.

Composition: The allocation of various waste categories, such as percent corrugated cardboard, paper, glass, metal, wood and other materials.

Municipal Solid Waste: Defined by Act 451, State of Michigan MCL which includes residential, commercial, and industrial solid waste, excluding industrial process waste and other special wastes (medical, ash, contaminated soils)

II-B: ASSESSMENT METHODS AND RESULTS

Before assessing the effectiveness of commercial recycling programs in the City of Ann Arbor and projecting the effect of modifications or expansions, it is paramount to develop a representation of the current state of solid waste generation in the commercial sector.

Actual measurement of waste generation is difficult due to lack of information about waste disposed or recycled. City of Ann Arbor municipal crews collect waste from businesses and multi-family housing complexes on the same routes. As a result, it is difficult to differentiate commercial from residential waste. Private sector waste haulers provide waste services to half or more of the commercial and industrial businesses in Ann Arbor and currently do not report this type of data.

Many communities estimate the generation of commercial sector waste by multiplying the total number of persons employed or per capita by a national average generation rate, such as the EPA's 4.4 pounds per capita per day rate (for residential and commercial). This method does not account for local or demographic differences. For the purposes of this report, project consultant Resource Recycling Systems, Inc. (RRSI) refined this generic approach using employment by business sector as a basis for estimating solid waste generation. A similar method of estimating commercial and industrial solid waste was used in the Washtenaw County Solid Waste Plan and is required for all solid waste plans in the State of Ohio. California requires strict reporting of business waste information by sector. In Michigan, only landfills are required to report to the state the County of origin of waste being disposed, and this information is not split into residential or commercial categories.

For this report, the estimate of solid waste generation is obtained by multiplying the number of employees in a given industry or business sector by a generation rate (in

pounds per employee per day). This results in a total amount of waste generated by that business sector. The total generation is then applied against an industry-specific waste composition divisor to allocate the amount of each waste material generated by a given industry. For a more detailed description of the methodology and assumptions used to derive these results, please refer to Attachment A.

The primary source of employment data was the 1997 Economic Census conducted by the United States Census Bureau every five years. All employers are assigned a numerical code in a hierarchy describing their type of business. These are called North American Industrial Classification, or NAICS, codes. Aggregate totals by NAICS code for employment, number of establishments, and gross receipts are made publicly available for many different geographical entities by the United States Census Bureau.

RRSI has allocated all of the NAICS codes, and some supplementary employment data, into categories with similar waste compositions. These categories, the number of employees, and number of establishments for each category are listed in Table 6 below.

Table 6: City of Ann Arbor, Employment by Sector¹

<i>Category</i>	<i>Number of Employees</i>	<i>Number of Establishments</i>
Accommodation	8,266	344
Arts, Entertainment and Recreation	533	43
Automotive parts stores	375	18
Building & Garden Equipment Stores	451	28
Computer & Electronics Manufacture	803	24
Educational Services	243	33
Electronics and appliance stores	355	33
Fabricated Metal Product Manufacture	768	12
Food and beverage stores	1,500	81
Foodservices and Drinking places	7,242	288
Gasoline stations	229	32
Government	4,131	n/a
Health Care and Social Assistance	2,913	305
Manufacturing	4,330	131
New Car Dealers	358	10
Other Professional Services	16,294	1,027
Other Retailers	4,160	199
Other Services	1,129	168
Printing	685	26
Public Schools	928	63
Retail Trade	9,645	647
University of Michigan	24,059	1
University of Michigan Hospital	15,388	1
Wholesale Trade	1,767	174
TOTAL	106,552	3,689

¹Source: 1997 Economic Census, Municipal Area Business Patterns, Ann Arbor, MI.

Data from the U.S. Census on-line breakdown of business employment by NAICS codes was used as a basis for Table 6 business sector classifications. Actual NAICS information is presented in hundreds of business-type categories, which were largely combined to form the groupings presented in the Table 6 and Table 7. A list of all these categories can be found in Appendix A.

In Table 7, the result of multiplying the sector-waste generation rates by the number of employees is shown in the “total waste” column. RRSI’s estimate of commercial solid waste shows a total generation of 103,755 tons per year. Note that this data includes all commercial, institutional, and industrial businesses in the city. This table shows an abbreviated summary of waste by category. Additional sub-categories were used in a more detailed evaluation, included in Attachment A.

Table 7: Annual Waste Generation by Ann Arbor Businesses (tons/year)¹

Category	Total tons/yr	Card-board	Mixed Paper	HDPE/ Glass	Scrap Metal	Electro nics	Yard Waste	Food/ Organic	Other
Accommodation	1,327	106	403	119	80		106	245	267
Arts, Entertainment and Recreation	559	95	139	38	17	9	56	51	154
Automotive parts stores	684	144	123	53	18	10	41	171	123
Building & Garden Equipment Stores	700	167	185	42	19	3	59	117	107
Computer & Electronics Mfg.	1,759	229	248	114	141	132	18	88	790
Educational Serv	182	31	45	12	5	3	18	17	50
Electronics and Appliance stores	551	132	145	33	15	3	47	92	84
Fabricated Metal Product Manf.	2,299	299	278	152	207	30	23	214	1,096
Food & beverage	2,737	655	722	164	74	14	233	459	417
Foodservices and Drinking places	19,825	4,956	4,798	1,408	515	178	991	4,163	2,815
Gasoline stations	418	88	75	33	11	6	25	104	75
Government	3,091	340	763	359	185	56	155	402	831
Health Care	3,721	409	919	432	223	67	186	484	1,001
Manufacturing	6,207	807	751	410	559	81	62	577	2,961
New Car Dealers	653	137	118	51	18	10	39	163	118
Other Prof Services	17,099	2,907	4,240	1,163	513	274	1,710	1,573	4,719
Other Retailers	4,365	1,045	1,152	262	118	22	371	732	665
Other Services	1,185	201	294	81	36	19	118	109	327
Printing	1,063	138	394	70	53	16	11	99	282
Public Schools	694	118	172	47	21	11	69	64	192
Retail Trade	11,638	2,785	3,070	698	314	58	989	1,951	1,772
University of Mich	10,428	1,147	2,576	1,210	626	188	521	1,356	2,805
U-M Health Systems	9,829	1,081	2,428	1,140	590	177	491	1,278	2,644
Wholesale Trade	2,741	822	545	151	96	14	192	370	551
Total	103,755	18,840	24,584	8,241	4,453	1,380	6,532	14,879	24,846

¹ Source: Resource Recycling Systems, Inc. 2002; waste generation multipliers and waste composition allocations are a compilation of actual waste sorts, on-site assessments, and reviews of benchmark community studies.

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III: CURRENT SYSTEM

III-A: PROGRAM DESCRIPTION

Commercial recycling is provided through a variety of services in Ann Arbor depending on the needs of the business receiving service. Service providers include the City of Ann Arbor municipal crews, various private sector businesses, and a few non-profits. Program descriptions follow.

City of Ann Arbor Municipal Programs

The City operates several programs that capture recyclables from businesses.

- **The Commercial Dumpster Program.** Businesses with the desire and available space are provided with a 6-cubic-yard dumpster for recyclables collection. The container may be filled with loose corrugated cardboard and other “bagged” fibers (mixed paper including office paper, newspaper, magazines). Dumpsters are collected on Tuesday, Thursday, or both days by a dedicated front-load truck. The commercial dumpster program now serves 66 businesses and schools in the City of Ann Arbor. The majority of customers on this route are also served by the City’s commercial trash collection program, although participation is not limited to businesses that receive the trash dumpster service. This program captures an estimated 1,000 tons of recyclables per year.
- **The DDA Recycling Program.** Any downtown business may participate in the DDA recycling program. This program uses a combination of collection approaches to accommodate the space limitations of downtown businesses. Participants can place bundled cardboard and bags of separated fibers or containers (bottles and cans) in the alleys by their business. Recyclables are collected on Mondays-Wednesdays-Friday by a dedicated side-load vehicle. Some businesses downtown also elect to use dedicated curbside carts for paper or containers. Approximately 150 businesses participate in the DDA program, which currently captures about 300 tons of material per year.
- **The Curbside Program.** Businesses outside the DDA may elect to join the curbside program. In this program, the City contracts with Recycle Ann Arbor (RAA) to provide the pick-up service. Businesses are provided with City-owned curbside carts that are collected weekly on the same routes that service multi-family curbside carts. Some businesses with recycling dumpsters also use curbside carts, particularly for commingled containers. RAA currently picks up from 348 businesses, capturing an estimated 380 tons of recyclables per year.
- **The Curbside Program.** Small businesses operating out of a home office or a small office located in a residential area may take advantage of the residential curbside program. Recyclables are collected weekly in the same curbside carts used by residents. Although the exact number of businesses using this system is

uncertain, an estimated 150+ businesses participate this way, diverting 40 tons per year.

- **The Drop-Off Station.** Businesses may also recycle at the drop-off station. According to RAA, nearly fifty percent of the cardboard collected at the drop-off station comes from small businesses. A recent DOS survey indicated that about 10 percent of users were businesses. The Drop-off Station accepts all materials collected on the curbside/curb cart routes and several additional materials, including polystyrene and bulky items. This program captures an estimated 100 tons of material from businesses per year, although this number is largely unknown.

Private Sector and Non-Profit Services

Businesses may elect to receive recycling service from private sector or non-profit vendors or scrap dealers. These vendors provide a wide range of services.

- **Commercial Waste Haulers.** The most common private sector service offering is dumpster service for corrugated cardboard. Vendors include Waste Management, Republic, and Great Lakes. These haulers may charge a fee or pay a revenue share for such services. Typically, large retailers or manufacturers use this service. Actual participation is unknown, but for the purposes of this report, estimated at 75 customers diverting some 1,900 tons of cardboard per year.
- **The University of Michigan.** U-M has a comprehensive recycling collection program for residence halls and academic buildings, collecting some 2,500 tons of material per year. A pilot food collection program also diverts about 35 tons of food per year. All food and recyclables collection is by University crews with recyclables going to the Ann Arbor Material Recovery Facility, and food going to the City's compost site.
- **U-M Hospital.** U of M's Hospital system collects about 830 tons of recyclables through a range of programs. Material is recycled mostly through private vendors.
- **Recycle Ann Arbor.** RAA operates its own commercial recycling program for about 20 businesses in Ann Arbor, contracting for specialty collection services directly. This program recovers about 400 tons per year.
- **Document Shredding.** Many banks, insurance companies, medical facilities and other businesses contract with document shredders to destroy confidential documents. The majority of this material is recycled following shredding. Little information is available regarding actual recovery, but an estimated 2,000 tons is being credited to this service for the purposes of this report.
- **Scrap Dealers.** Several scrap metal dealers in an around Ann Arbor accept or pick-up recyclables from businesses. Most of this is scrap metal, but some dealers may also pick up plastics, paper, and other materials. Again, an estimate has been made for this report, at 2,300 tons per year.

- **Grocers, printers, others with back-haul:** Some businesses that generate a large quantity of a single recyclable material such as corrugated cardboard or other paper make arrangements directly with a broker or distributor. Some 3,100 tons per year have been credited as recovered for the purpose of this report.
- **Food Gatherers:** This non-profit organization collects a significant quantity of potential waste food from businesses and instead diverts it to a useful end.
- **RAA Reuse Center:** Many contractors, apartment building owners and other small businesses use the RAA Reuse Center, in particular, for donating or buying used building products such as tile, lumber, plumbing and other items.
- **Other recovery:** Although difficult to assess, this report recognizes that many individual efforts are made by businesses through various means, to donate or recycle materials, ranging from charitable donations of computers, to recycling of plastics and other materials by larger manufacturers. This recovery is estimated at about 1,300 tons per year.

III-B: STRENGTHS AND WEAKNESSES OF CITY-MANAGED PROGRAMS

Commercial recycling programs managed by the City Ann Arbor have evolved over the past several years, but have performed well due to the success of solid design.

Strengths of the program include:

- **Flexible program options.** Businesses have a range of services from which to choose. These service options account for the cramped quarters in the DDA and the needs of larger generators elsewhere in the city.
- **Focus on paper and cardboard recovery.** Paper and cardboard make up over 40% of the generation from businesses in Ann Arbor. Aggressively targeting these materials provides the greatest diversion for a given level of effort.
- **Recycling services are provided at no additional cost.** Businesses may participate in any of the City-managed recycling programs without incurring monthly or annual service fees. Elsewhere, recycling collection fees that are higher than disposal costs serve as a disincentive to participation in recycling programs.

As with any system of this complexity however, there is room for improvement. Program weaknesses include:

- **No direct incentive for businesses to increase recycling and reduce waste.** For the majority of businesses using City-managed recycling services, both recycling and garbage service are paid for by city property tax. Businesses do not pay additional fees if they generate more waste or if they do not recycle at all. Likewise, there is no cost benefit to businesses which recycle aggressively.

- **Poor utilization of commercial recycling collection vehicles.** The front-load truck for the commercial dumpster route is used only two days per week and the side load truck used for the DDA routes is used only three days per week. This low utilization results in a poor economy of scale and higher per ton costs of recycling.
- **Infrequent collection of commercial dumpsters.** RRSI toured commercial recycling dumpsters throughout the city and found many to be full beyond overflowing. Increasing the frequency of collection or size of these containers would be very likely to increase the recovery from that location.
- **Indistinguishable waste and recycling containers dumpsters.** An inconsistent coloring or labeling scheme for apparent recycling dumpsters painted green or bearing the “Commercial Recycling” logo contained nothing but waste whereas some unlabeled dumpsters resembling trash dumpsters contained nothing but cardboard. Making these containers visually distinct would likely increase their use.
- **“Cherry Picking” by commercial vendors.** Other private-sector vendors providing recycling service in the city will generally only pursue the most valuable accounts. Namely, the businesses that generate large amounts of clean corrugated cardboard. This leaves a disproportionate amount of lower-value accounts to be handled by municipal programs.
- **Education Programs.** Education for the commercial program may be lacking in comparison to those in place for the residential programs. One area of note would be commercial recycling dumpsters that are not labeled with information regarding acceptable and unacceptable materials. Many business owners are unaware of the recycling options available to them. For example, an inspection of the recycling dumpsters indicated very little use of the bagged paper option. Dumpsters contained almost exclusively cardboard and some trash.

III-C: CURRENT ESTIMATED RECYCLING RATE

As noted in Section II of this report, total waste generated by businesses in Ann Arbor, including the University, is an estimated 103,755 tons per year. Using a combination of actual measured data and some estimated data, an estimated 22,740 tons of material is recovered or diverted from landfills per year. This results in a projected recovery rate of 21.9%.

Table 8: City of Ann Arbor Estimated Diversion Rate, Commercial/Industrial

Waste Generated	Recycled/Reuse	Composted	Disposed	Diversion Rate
103,755	16,378	6,362	81,015	21.9%

Figure 2: City of Ann Arbor Commercial/Industrial Solid Waste Diversion

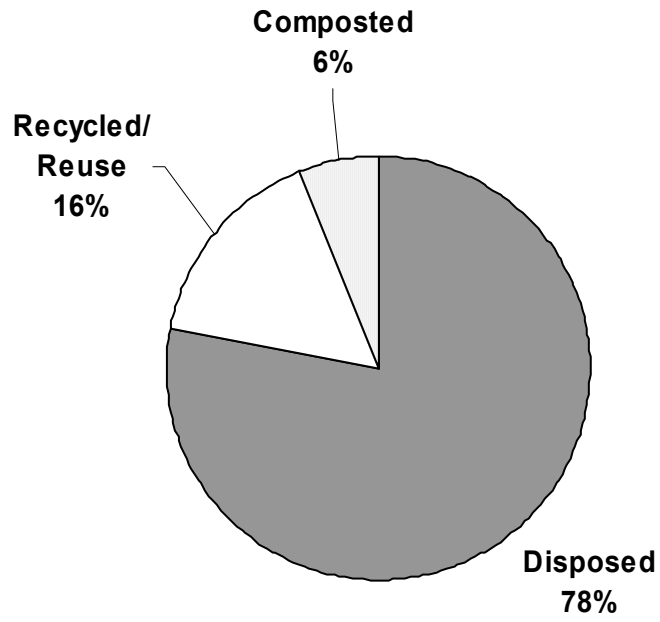


Table 9: Summary of Commercial Waste Recovery in Ann Arbor

<i>Program</i>	<i>Description</i>	<i>## of Businesses Served*</i>	<i>Tons of Recovery per Year*</i>
City Operated or Sponsored Programs			
DDA Recycling	Curb-carts and/or hand-loaded material from downtown district. M-W-F- pick-up.	150	307
Commercial Dumpster Program	Front-load collection of about 80 dedicated dumpsters. Cardboard and bagged paper. Once or twice weekly.	66	1000
City/RAA Curb Carts	Small businesses using curb carts.	348	380
Drop-off Station	A few small businesses, mostly cardboard.	100*	150*
Curbside	Small businesses on residential routes using totes.	150*	40*
Composting	City curbside collection.		6000
City-Operated Programs Subtotal		800+	7,800+
Private Sector/Non-profit Programs			
University of Michigan	All academic, administration, and housing buildings with the exception of the Health System.		2500
U-M Hospital	All buildings in the Ann Arbor campus of the UMHS.		830
Waste haulers	Commercial OCC dumpsters.	75	1900
RAA Commercial	Individual businesses contract with RAA for service	20	400
Document shredders	Shredders/recyclers of confidential documents	25	2000
Scrap dealers	Mostly metal recovery, possibly some plastics, paper	25	2300
Grocers, printers, others with back-haul	Return of excess cardboard and paper in trucks that deliver new supplies.	25	3100
Food Gatherers	Collects edible food from businesses, distributes to charitable groups, other users		200
RAA Reuse Center	Accepts donations of durable goods, building materials, furniture for resale.		200
Other Recovery	Other unclassified recovery (other reuse such as the Scrap Box, special materials, and individual efforts)		1300
Private Sector/Non-profit Subtotal		200+	14,730*
Total	Total of City and Private/Non-Profit Programs	1000+	22,000+

*Note totals for some City programs, and most private sector programs are estimates only. Data may be unavailable or non-existent.

III-D: CURRENT CITY COSTS FOR COMMERCIAL RECYCLING

Costs were examined for the three commercial recycling collection programs currently provided by the City. Two of them, the commercial dumpster route and the downtown recycle route, are operated by the City, with costs compiled from the 2000-2001 City Budget for the Solid Waste Department. The third program, the curbside route, is operated by Recycle Ann Arbor under contract to the City for a unit price per curbside lift.

As the following chart shows, the least expensive collection system for commercial recyclables is the commercial dumpster route at \$51.23 per ton recovered. Curbside and downtown collection both are more costly (\$147/ton and \$205/ton) due to size and space restrictions, which slow the rate of productivity for the collection vehicle and operator.

Table 10: Summary of Current City Costs for Commercial Recycling (Year 2000-2001)

Cost Category	Recycling Dumpster Route	Downtown Recycling Route	Commercial Curbside Route
Tons Collected	1,024	307	379
Labor/Equipment	\$36,332	\$53,348	\$51,164
Fringes/Overhead	\$3,841	\$5,761	\$0
Processing	\$12,288	\$3,684	\$4,548
TOTAL COSTS	\$52,461	\$62,793	\$55,712
COST PER TON	\$51.23	\$204.54	\$147.00

These costs, which include processing, compare to the City's commercial refuse collection and disposal costs as shown in Table 11, at \$78/ton for the most efficient front load routes and \$121/ton for the less efficient rear load routes.

Table 11: Summary of Current City Costs for Commercial Refuse (Year 2000-2001)

Cost Category	Front Load Refuse Route*	Rear Load Refuse Route
Tons Collected	19,319	1,476
Labor/Equipment	\$875,095	\$119,662
Fringes/Overhead	\$129,000	\$20,387
Disposal	\$502,294	\$38,376
TOTAL COSTS	\$1,506,389	\$178,425
COST PER TON	\$77.97	\$120.88

*Data includes multi-family routes.

III-E: COLLECTION CAPACITY & COSTS FOR COMMERCIAL RECYCLING

Analysis of the City’s commercial recycling dumpster route indicates that the route, which is only operating two days a week (Tuesday/Thursday), could operate more efficiently if more locations were served, resulting in a more dense route and less transport time between pickups. This would result in a 50% increase in capacity per day and a lower cost per recovered ton.

The analysis also indicates that higher efficiencies and lower costs per ton could be achieved if the route were upgraded to a higher capacity truck (40 cubic yard front load, versus the current 34 cubic yard front load) and higher volume recycling dumpsters (8 cubic yard slant top versus current 6 cubic yard.)

The following chart shows how this collection capacity would perform in an expanded commercial recycling initiative, using existing equipment operating at full 5 day/week capacity and in upgraded equipment at 70% and 100% capacity performance levels.

Table 12: Summary of Projected Costs for Commercial Dumpster Recycling Route

<i>Cost Category</i>	<i>Current Equipment Extended to 100% Capacity for 5 Day Week</i>	<i>Upgraded Equipment at 70% Capacity for 5 Day Week</i>	<i>Upgraded Equipment at 100% Capacity for 5 Day Week</i>
Tons Collected	3,879	4,725	6,750
Labor/Equipment/Fringe	\$100,432	\$110,475	\$110,475
Processing	\$46,545	\$56,700	\$81,000
TOTAL COSTS	\$146,977	\$167,175	\$191,475
COST PER TON	\$37.89	\$35.38	\$28.37

These costs, which include processing, show how additional investments in commercial recycling for the lowest cost collection system (recycling dumpsters) would perform in an initial expansion of the current route to five days and in an upgraded equipment route at 70% and 100% capacity levels. All achieve a cost per ton level of performance that is well below the net cost for refuse collection and disposal.

Not all businesses can be served by dumpsters, however. It is expected that curbcarts will need to be used for many of the smaller businesses and for those businesses that generate bottles and cans. This curbside collection system will not achieve the same low cost per ton performance levels. The cost of the combined services (recycling dumpster, downtown, expanded curbside), on average, is expected to achieve a comparable or better cost profile than refuse disposal.

IV: ACHIEVING 50% DIVERSION

IV-A: CAPTURE RATES BY MATERIAL

Increasing commercial waste diversion from the current 22% to at least 50% will involve significantly expanded recycling and composting collection. For the purposes of evaluating potential program options needed to accommodate some 25,000 tons of additional materials per year, capture rate projections were made for typical business recyclable materials such as cardboard and paper. These projections will help:

- Determine program design needs including containers, collection system
- Provide a focus for identifying target materials for recovery
- Reveal areas where new collection program are needed

The following section provides an estimate of current recovery and associated capture rates by materials, followed by two scenarios for recovery using two different sets of capture rates.

Current Recovery

Diversion rates in the commercial sector for the major recyclable categories are shown in Table 13 below.

Table 13: Projected Material Capture Rates for Current System

<i>Material Group</i>	<i>Current Generation (tons/yr)</i>	<i>Current Recovery (tons/yr)</i>	<i>Capture Rate</i>
Cardboard	18,839.7	7,620	40.4%
Containers	8,240.9	771	9.4%
Electronics	1,379.6	91	6.6%
Food/Organics	14,879.2	362	2.4%
Mixed Paper	24,584.0	4,568	18.6%
Other	24,846.2	1,342	5.4%
Scrap Metal	4,453.3	1,986	44.6%
Yard Waste	6,532.0	6,000	91.9%
TOTAL	103,754.9	22,740	21.9%

Recovery Scenario A: Max Out Target Materials

Under Recovery Scenario A, Ann Arbor would reach a near 55% commercial diversion rate by aggressively targeting and collecting the same materials as are collected by the current program. To achieve this diversion rate, the City must set lofty recovery goals for all of the major materials. These diversion rates, while attainable, would require a vastly expanded collection system available to all businesses, in addition to strong incentives,

disincentives, and potential penalties for non-compliance. Proposed capture rates for each material group are shown in Table 14 below.

Table 14: Recovery Scenario A: Max Out Target Materials

<i>Material Group</i>	<i>Target Capture Rate</i>	<i>Recovery (tons/yr)</i>
Cardboard	95.0%	17,898
Containers	75.0%	6,181
Electronics	6.6%	91
Food/Organics	2.4%	362
Mixed Paper	90.0%	22,126
Other	5.4%	1,342
Scrap Metal	50.0%	2,227
Yard Waste	91.9%	6,000
TOTAL	54.2%	56,226

Recovery Scenario B: Aggressive Capture with New Programs

The recovery goals set under Scenario A are very ambitious and may be impossible to achieve, even in a mature, comprehensive program. This is due to near 100-percent capture-rate goals for target materials such as corrugated cardboard. Recovery Scenario B exceeds over 50% diversion using a combination of aggressive capture of current materials and supplementary capture through additional programs. Central to this strategy is the addition of an ambitious food/organics collection and composting program. Target diversion rates for Scenario B are included in the table below.

Table 15: Recovery Scenario B: Aggressive Capture with New Programs

<i>Material Group</i>	<i>Capture Rate</i>	<i>Recovery (tons/year)</i>
Cardboard	80.0%	15,072
Containers	50.0%	4,120
Electronics	10.0%	138
Food/Organics	30.0%	4,464
Mixed Paper	75.0%	18,438
Other	10.0%	2,485
Scrap Metal	50.0%	2,227
Yard Waste	91.9%	6,000
TOTAL	51.0%	52,943

IV-B: PROGRAM DESIGN KEYS

Commercial recycling rates are not nearing their potential due in part to a lack of economical collection services, but also due to lack of incentives to participate. Program success in Ann Arbor ultimately will be defined as the achievement of at least 50% diversion of waste from landfills.

Achievement of a high diversion rate requires attention to a number of program design keys, including:

Access to service: All businesses must have the ability to participate, through the provision of comprehensive, citywide collection services (municipally and/or privately provided.)

Convenience: Recycling, composting, and other diversion programs must be at least as convenient to use as disposal. This includes consideration of internal and external collection systems.

High Participation: Businesses in general need some incentives and/or mandate to participate. Equally important is knowledge about how to participate, gained through comprehensive education and promotion.

Flexibility: A comprehensive collection system design must take into account a range of service needs for small, medium, and large businesses. Variables include volumes of material needing pick-up, space constraints, frequency of pick-up, and container styles.

When designing or expanding recovery programs, it is important to understand how waste and recyclables are generated and handled by businesses. Collection services can then be designed based on a set of specific business needs.

Sector-based Recovery: This approach assumes that certain types or “sectors” of businesses have similar waste streams and service needs. For example, restaurants have a higher percentage of food waste than other commercial establishments, which needs to be collected more frequently due to sanitation concerns. Financial, insurance and similar service businesses generate high volumes of office paper, and in some cases, these types of businesses have special needs around handling of confidential documents. Container and space needs can also be addressed by evaluating estimated generation and composition of recyclables by sector. Finally, outreach and education programs can be designed to reach specific target business sectors. The most common type of sector-based program involves restaurants and bars, and other similar businesses that generate food waste. Typical business groupings or classifications include: retail and wholesale; office environments (communication, transportation, financial institutions, real estate, business and professional services); restaurants, bars, grocery; automotive supply, repair; medical, health facilities; institutions (schools, nursing homes); manufacturing.

Size of Business: Small businesses typically have unique space limitations, and the relatively small quantity of waste generated presents challenges around economic recovery options. Medium and larger businesses may have the challenge of limited space for additional containers, but present more complex issues around arranging for internal collection systems.

Geographic Area: Businesses in general tend to be clustered in groups, such as downtown areas, strip malls, or industrial parks. This helps to make collection routes more efficient, particularly if a common system of container types can be employed.

Ownership Structure: Businesses that own their own buildings generally make their own refuse collection arrangements, making it easier to also coordinate recycling collection services. Businesses who are tenants may make their own arrangements or rely

on the property owner to do so. Some tenant businesses may be located in multi-tenant buildings that share a single refuse collection arrangement. Single tenant businesses sometimes share a single dumpster or refuse service provider. These varying ownership arrangements can make it challenging to enforce mandatory participation requirements, or to monitor where contamination may be coming from. In some cases, however, clustering of businesses helps concentrate materials collected for recycling, making pick-up more economical.

IV-C: COLLECTION APPROACHES

To recover the volume of material identified earlier in this section, a combination of collection system approaches are recommended and described below.

Fiber Recycling Dumpster

Businesses with the available space and significant generation could use a recycling dumpster, similar to those currently employed on the City’s own dumpster recycling routes. These containers would be primarily aimed at those locations generating large amounts of cardboard. Bagged or loose paper (mixed office paper, newspaper, magazines, junk mail) could be collected in the dumpster along with the cardboard, provided the appropriate processing requirements can be achieved. By far, dumpster service is the most cost-effective approach to collection, however, not all businesses can accommodate a 6 or 8-cubic yard dumpster.

RRSI assumes that 80% of the “new” cardboard collection and 50% of the additional mixed paper collection would come from these dumpsters. Assuming that these containers are collected 2 times per week and are 90% full when collected, the number of additional dumpsters required under each scenario is detailed in the table below.

<i>Scenario</i>	<i>Additional Dumpsters</i>
A: Max Out Target Materials	191
B: Aggressive Capture with New Programs	146

Note that multiple businesses in close proximity, such as a strip mall, could share a single container, so more than one business may be served by each container. In addition, these assumptions reflect only material captured beyond current programs.

Container Recycling Dumpsters

Certain businesses that generate a large amount of containers and with the available space for an additional dumpster could opt for a container recycling dumpster. These containers would be best suited for food service establishments and hotels. Such a container would be visually distinct from a fiber recycling dumpster to avoid cross-contamination. Again, dumpster service is the most cost effective method of collection, but only a fraction of city businesses would generate a sufficient volume of containers to warrant such a container.

RRSI assumes that 20% of the additional container collection will be accomplished by these dumpsters. Assuming these containers were 8 cubic yards in size and collected once per week, the number of containers required are listed in the table below.

<i>Scenario</i>	<i>Additional Dumpsters</i>
A: Max Out Target Materials	27
B: Aggressive Capture with New Programs	14

Curb Cart

Use of 95-gallon curb carts remains the most efficient approach for many smaller businesses. Carts also can accommodate a wide variety of materials collected in a two-stream commingled system similar to the current curb cart system. Two types of color-coded curb carts would be made available to businesses. One cart color would be designated for fibers (cardboard, boxboard, paper, etc.) and another designated for containers (glass bottles, aluminum and steel cans, plastic bottles, etc.)

This option would be the best for businesses with lower generation or limited space. In these cases, curb carts are also the best option for collection of mixed containers, so businesses with recycling dumpsters generating a small volume of containers could also use some curb carts for containers. RRSI assumes that these carts would account for 5% of the additional mixed paper, 20% of the additional cardboard, and about 80% of the mixed containers collected under a new or expanded commercial recycling program. The projections shown below also assumes that these carts are collected once weekly and are, on average, 80% full when collected.

The number of additional curb carts required under each capture-rate scenario is shown in the table below. Please note that the totals above assume one collection per week. Increased collection frequency would reduce the number of carts needed.

<i>Scenario Name</i>	<i>Container Curb Carts</i>	<i>Fiber Curb Carts</i>	<i>Total Curb Carts</i>
A: Max Out Target Materials	4,832	8,465	13,297
B: Aggressive Capture with New Programs	2,416	4,232	6,648

As shown in the table above, Scenario B would require 6,648 additional curb carts. This amounts to about two additional carts for every business in Ann Arbor. Servicing all of these additional carts would require about 2.5 to 3 side-load compacting trucks operating 5 days per week. For comparison purposes, there are currently about 650 curb carts in use by businesses citywide.

Drop-off station

Ann Arbor businesses may currently use the drop-off station to recycle all materials collected in the curb cart program and some additional materials, including polystyrene, wood, bulk items, and electronics. Use of the drop-off center is not as convenient as a municipal collection system and, therefore, would require the dedication of employees or financial incentives to increase its use. Education programs informing business owners

and employees of services available at the drop-off station and a fee structure that encourages recycling would help to increase recovery at the drop-off station.

Curbside (residential routes)

Small businesses participating in the residential curbside program will be largely unaffected by changes to the commercial recycling programs. Servicing such small businesses intermixed with residential buildings is most efficiently accomplished by the current curbside program. Again, increased education about the availability of this service option would stimulate some additional recovery.

Special Services

Food and Organics Composting

Compostable organics other than yard waste make nearly one seventh of the entire commercial waste stream. This is a large untapped resource for increasing recovery. Food waste composting programs have been successful in cities as large as San Francisco and pilot programs are ongoing locally at the University of Michigan.

A successful organics composting program would require frequent collection, perhaps three times or more per week. Organic materials including green wastes from florists and greenhouses, and food waste, soiled paper and waxed cardboard from restaurants, groceries, bakeries, nursing homes, hospitals, and microbreweries. This material can be collected in containers of 40 or 64 gallons, but generally requires semi-automated lifting/tipping capabilities on the collection vehicle. This material would then be composted, assuming the appropriate permits and equipment would be in place.

This report establishes a 30% capture goal for food and other organics, or 4,464 tons per year. If restaurants filled an average of five containers per pickup, only 75% of the 288 restaurants and bars in the city would need to be participating in this program to achieve this diversion goal. This would leave significant room for future expansion with the remaining restaurants, groceries, florists, nursing homes, and microbreweries.

Electronics Waste

Concern is ever growing regarding safe electronics waste disposal. While electronics waste currently represents only a small portion of commercial waste generation, the amount of waste electronics material generated is expected to grow exponentially over the next decade. The drop-off station currently accepts small quantities of waste electronics, for a fee. Aggressive capture programs could provide periods of free collection or annual curbside or “milk run” collection events for the business sector.

IV-D: PROCESSING CAPACITY

Material Recovery Facility

The recently adopted Ann Arbor Solid Waste Plan Update set goals for increasing commercial recycling that require processing of as much as 20,000 to 30,000 additional

tons of commercial corrugated cardboard containers and mixed paper each year (assuming all “new” recovery was directed to the MRF). Goals for additional residential recycling add another 6,000 tons each year. At present, the MRF is currently not equipped to handle any significant commercial recycling and is already limited in its ability to handle additional residential tons.

The existing Ann Arbor Material Recovery Facility and Transfer Station (MRF/TS) was completed in 1994 and has been in successful operation since then. The facility's existence has enabled increased material recovery during that time as well as additional solid waste collection and disposal flexibility through transfer capability. As with many similar facilities after eight to ten years of operation the Ann Arbor MRF/TS is due for an update.

Originally, the transfer station portion of the MRF/TS was designed with "selected load" sorting capability that allowed OCC-rich loads of commercially generated solid waste to be “positively sorted”. In other words, OCC and other paper were pulled from a conveyor line before the remaining waste was deposited directly into the transfer compactor. The positive sort requirement of this line makes it inefficient for use in sorting clean loads of commercial recyclables.

At the same time the City of Ann Arbor is considering expanding its commercial recovery programs, the MRF facility operator, FCR, has suggested that the Transfer Station portion of the facility needs to be re-evaluated in order to make it more efficient for load out and truck movement. Discussions with FCR reveal that their preferred approach would be to relocate the transfer component of the operation to another new building and to reconfigure the current transfer area (approximately 25% of the existing MRF/TS area) to accommodate commercial recyclable processing.

Fundamentally the trade-off between transfer space and commercial load sorting appears to work well from both a facility programming and operating perspective. In addition, FCR has discussed the need to upgrade other portions of the existing MRF/TS in order to deal with less critical issues. These include container line oriented items like, simplification of the glass processing system, addition of density separation, and installation of an eddy current separator for mechanical sorting of aluminum cans. Some basic long-term facility maintenance needs (e.g. floors, tip walls, scale, and insulation) have also been identified as priorities for work if the larger efforts are undertaken.

The timing for the proposed adjustments in the MRF/TS operating capabilities and capacity are highly appropriate for a facility of this age and experience. With the changes in the marketplace for both services and recovered materials changes like the ones briefly discussed in this document will significantly benefit the entire Ann Arbor community.

Compost Facility

The potential for collection and recovery of commercial organic wastes suggest that some facility changes will be needed in that area as well. In addition it is possible that one of the sites proposed for the new transfer station building will be on an area that currently is

used for composting. Together these might require that the City adjust its current approach to composting.

The addition of commercial organic materials to the compost facility will require additional permitting with the State of Michigan Department of Environmental Quality. These efforts will require documentation of the current activities and plans for the new activities to be included as part of an application for permit. Permitting is likely to take a number of months, perhaps as much as a whole year, to completely resolve.

Development of a new site will affect permitting but will also require discussion with relevant local units of government. Currently the entire composting facility, while located on the old Ann Arbor landfill site, is located within Pittsfield Township. Consultation and agreement with Pittsfield Township will be a requirement of any composting site changes or changes in incoming material.

The adjustments in operations and possible site reconfiguration proposed for the compost facility will enable Ann Arbor to broaden the organic waste recovery services that it can bring to both its citizens and the major partner, the University of Michigan. These changes will enable the entire program to progress in terms of creating greater total waste recovery for the overall program.

IV-E: REGULATORY, POLICY AND INCENTIVE APPROACHES

Achieving the type of diversion rate proposed in Ann Arbor for the commercial sector likely cannot be achieved through service expansion alone. Most municipalities that have sought to increase commercial recovery have employed a range of supporting incentive programs, regulations and technical support in order to maximize participation and diversion.

The approaches described here may be applied as requirements or incentives for waste generators (businesses) or as a means to stimulate service expansion by the private sector. Some examples are included below, with additional detail provided in Attachment C.

Disposal Restrictions. Disposal of certain materials such as construction and demolition debris, corrugated cardboard or office paper can be controlled through differential tip fees or selective material bans such as fluorescent tubes or electronics components.

In Orange County, NC, an extensive recycling program is partly driven by a cardboard disposal ban. As a result of a local ordinance that has been adopted Countywide, most area businesses have corrugated collection provided separately, typically by private firms. Recent waste sort data following implementation of the ban indicates that less than 2% of the remaining waste stream is corrugated cardboard. Orange County's recycling services include an extensive collection program for glass from bars/restaurants.

Waste Hauler Licensing. Licensing of private sector solid waste management activities provides an opportunity for a uniform regulatory system. Typically, a municipality or county requires waste haulers to meet minimum requirements in offering solid waste or recycling collection services. Collection service specifications can address frequency of

service, materials collected, and preparation requirements, and level of educational support. Specifications can include providing the "opportunity to recycle," using volume-based fee structures, and transfer of waste or recyclables to designated facilities. Other requirements may include guarantees of access to small haulers and recyclers, reporting and data tracking requirements, insurance and environmental protection provisions and, possibly, cooperation in collection of a surcharge applied to solid waste processed by a facility. Hauler licensing is also increasingly used to create financial incentives. In some communities, haulers pay a reduced licensing fee when target recovery rates are exceeded.

In Fairfax County, Va., waste haulers are required to provide and maintain recycling systems for all customers, including commercial businesses. This approach is combined with a mandatory participation requirement stating businesses employing 200 or more individuals or who generate 100 tons of solid waste annually must recycle the "principal recyclable material" (PRM) generated in that business.

Mandatory Participation. Mandatory programs are often associated with curbside recycling, but increasingly are applied to the commercial sector. Businesses may be required to prepare annual recovery plans, report on volumes of material recycled, or indicate what service provider is used. In some programs, a "trigger" is applied to certain sized businesses, indicating recycling requirements based on the volume of waste produced. Some communities elect to specify which materials must be recycled, and this requirement is often targeted to sector specific businesses.

The State of Pennsylvania P.A 101 mandates residential and commercial recycling. In Gilbertsville, PA, a local ordinance requires that all commercial businesses recycle and provide documentation to the City recycling coordinator yearly. A drop-off facility is aggressively promoted and operated by the City for businesses every second and fourth Wednesday and Saturday of each month.

The City of Austin, TX requires all businesses employing 100 or more people to recycle at least two types of recoverable material. Commercial businesses contract for waste hauling and the hauler is expected to provide the business with documentation of recycling activities to be presented to the City.

Sector or Material Based Requirements: Mandatory participation by businesses or provision of services by the private sector is sometimes imposed by type of business sector, or by type of materials, as the following examples suggest.

In Gainesville, FL, generators of construction wastes are required to recycle construction and demolition debris and to also contract with a franchisee (approved hauler) that has obtained a registration to collect recyclable materials. Waste haulers will soon be required to reach a 30% recycling goal or the company cannot operate in the City.

In Atherton, CA, the City requires a \$50.00 deposit (per ton) of expected waste generated from a building project. Contractors must prove that they have recycled at least 50% of the waste or the City is entitled to retain \$50.00 for each ton below the 50% goal.

The City of Berkeley, California provides weekly (if needed) collection of organics including food waste. Participants receive a 20% discount off of the current refuse rate and waste haulers are paid by the county to collect material. Program participants include supermarkets, bakeries, breweries, florists, institutions, and restaurants.

Contracting for Services/Franchising: Municipalities can use private sector service contracts as a means to allow better control over service features. Longer-term contracts may enable the service provider to provide lower pricing and are also better structured to enable private sector service providers to seek any required bank financing for capital equipment. Lack of coordinated services may make it difficult for a hauler to establish cost-effective routing. By coordinating a consistent approach, local governments can improve operational efficiencies and cost effectiveness of private sector services. Some municipalities choose to “zone” or sub-divide by area, thus creating collection franchises. This can allow for competition, or multiple service providers from the private sector.

Economic Incentives. Special economic incentives may also be implemented. These can include differential tip fees, variable rate user fees (PAYT), or reduced fees for waste haulers through licensing or exclusive contracting/franchising.

A weight-based system of waste collection and billing in Oakland Park, FL provides documented confirmation of time, location, and weight of dumpster in pounds. Smaller businesses utilize 96-gallon curbcarts. Businesses pay a minimum base service fee plus the cost of disposal based on actual weight. There is a minimal monthly fee for recycling services. Fully automated collection equipment is used, including an information management program.

Commercial Recycling collection in Thousand Oaks, CA is offered at a rate of 30 percent of the cost of a trash bin. The program includes economic incentives to customers to meet a 25 percent recycling rate. Furthermore, the exclusive franchised hauler is required to achieve a 30 percent recycling rate on an average for all accounts. Contracts are negotiated so haulers are paid for every ton recycled rather than amount landfilled.

The City of Monrovia, CA reduces the nonexclusive commercial service agreement fees proportionate to the amount of waste diverted from a landfill. For example, franchise fees are 16 percent for haulers diverting 24 percent or less, 12 percent if haulers divert 25 – 49 percent from the landfill and only 8 percent if 50 percent or more is diverted from the landfill.

Facility Designation. Hauler licensing or other flow control arrangements can require the waste generators or haulers to take material only to facilities that are formally designated by the licensor to receive that material. Exercised to its fullest powers, this would provide for delivery only to one designated facility. Non-exclusive facility licensing arrangements rely on open market competition, where haulers/generators have the option to choose between a potentially unlimited number of competing facilities that meet minimum operating parameters. Solid waste facilities typically need a minimum volume of materials to operate economically, gain good market leverage (important in the sale of recyclables), and have sufficient margins to operate within environmental

rules/regulations and still provide for profitable operation that ensures long-term service provision.

IV-F: OUTREACH AND EDUCATION APPROACHES

Achieving a 50 per waste reduction and recycling rate is unlikely without the support of a sweeping outreach and education effort. High visibility promotional activities surrounding roll-out of new collection systems and policy changes are needed, as well as ongoing information exchange, data collection, technical assistance and training opportunities.

Business assistance programs: Examples of programs that employ training and technical assistance to reduce waste include: material exchange programs; hands-on problem solving pilots or demonstration projects on material reuse or difficult to recycle materials; Jobs Through Recycling training initiatives; business information networks; and waste reduction audit programs.

Information Exchange: Pro-active networking activities can include: web-based "Where to recycle and reuse" alpha listings; service provider list-serve postings; and material reuse, recycling and exchange directories. Overall these efforts will be promoting local and regional opportunities for recovery, including specialty programs such as the Scrap Box, RAA Reuse Center, Food Gatherers, and others.

Buy Recycled and "Recyclable": Efforts to get businesses to both buy recycled content products, and specify that packaging and products be "recyclable" or reusable will help stimulate market demand. The City could adopt a "preferable products" designation program or public sector purchasing targets.

Market Development Initiatives: A number of approaches can be aimed at expanding local markets for recyclable materials. These include training programs for Chambers of Commerce and Economic Development professionals regarding business attraction and expansion programs focused on bringing end-markets or recycled-based manufacturing to the area.

Take-Back and Producer Responsibility Programs: Opportunities for product take-back programs are increasing. These programs capture a range of materials from electronics, to batteries, to tires and many other products. Programs rely heavily on active outreach and training support.

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V: STRATEGIES FOR COMMERCIAL RECYCLING

Assuming that adequate processing capacity for commercial recyclables is developed at the MRF, the City's primary challenge will be developing a collection system to move targeted recyclables from individual businesses throughout the City to the MRF. Section IV described a variety of approaches for accomplishing this, with the most significant variable being the degree of reliance on private versus public collection systems.

The following strategies provide for a range of involvement by the City in development of the collection system for commercial recyclables. This varies from significant involvement by the City in collection on one end of the spectrum and a limited involvement at the other end.

A key factor affecting the decision on public and private roles is funding. Evaluation of the strategies examines the expected cost to the City and the expected role of private recycling service providers. An underlying theme in the evaluation is that businesses are highly motivated to pay for hauling solid waste away from their establishments, as an assumed cost of operations, yet frequently are not motivated to pay for hauling recyclables away, viewing this as something that should "pay for itself". Both the strategies and the evaluation focus on what is the most effective way to involve the private sector in servicing the collection requirements of the commercial sector for both solid waste and recyclables.

V-A: STRATEGIC OPTIONS FOR THE CITY

The following three strategic options vary in the level of commercial recycling service provided by the City.

- C. **Comprehensive Commercial Recycling:** In this strategic option, the City would provide a recycling opportunity to all commercial establishments in the City. All businesses would be given a container system for outside storage of their recyclables, either a set of curbside totes, one or more curb-carts, shared access to an 8 cubic yard recycling dumpster or their own recycling dumpster. Containers would be serviced one or more times a week depending on need. Each business would select the container system and service level that matched their expected generation of recyclables. Large businesses with unusual recycling service needs would be accommodated through additional containers or pickups for fee and also have the option to contract with others for that service. The primary recyclable materials targeted for the program would be cardboard, mixed office paper, mixed containers/scrap metal, and food waste. All materials collected by the City or City contractors would be delivered to the City's MRF. There would be some regulatory requirements in a city ordinance to require participation by businesses.

- D. **Basic Commercial Recycling:** In this strategic option, the City would provide a limited recycling opportunity to all commercial establishments in the City. A basic level of service would be defined and offered to the business. An example would be one curbside pickup each week per business. Businesses that were able

to coordinate their service could combine their service allocation and convert it to an 8 cubic yard dumpster serviced once per week. Businesses with larger recycling needs could receive a larger container or more frequent service for fee and would also have the option to contract with others for that service. The primary recyclable materials targeted for the program would be cardboard, mixed office paper, mixed containers/scrap metal, and food waste. All materials collected by the City or City contractors would be delivered to the City’s MRF. There would be some regulatory requirements in a city ordinance to require participation by businesses.

- E. **Targeted Commercial Recycling:** In this strategic option, the City would provide recycling services to targeted sectors, such as multi-family, the DDA area and for special materials such as the food waste. All remaining recycling would be provided by the private sector, driven by a mix of regulations and incentives incorporated into a city ordinance that would likely include such tools as a disposal ban for certain recyclables, required access to recycling, and licensing for waste haulers to require certain recycling services.

V-B: EVALUATING OPTIONS – COSTS AND FUNDING

Cost is a key factor in evaluating the three options and the level of collection infrastructure for recycling cardboard, mixed paper and mixed bottles/cans is the significant variable in determining cost differences between each approach.

An additional 24,700 to 33,250 tons of these materials would need to be collected and recycled each year to achieve the targeted recovery rate, depending on whether or not food waste is successfully piloted. In the following analysis of the three options, the City’s expected share of the cost in collecting these materials is shown at high levels of recovery for each option.

Table 16: Comparison of City Costs for OCC, Mixed Paper and Mixed Container Collection

<i>Cost Category</i>	<i>Option A Comprehensive Recycling</i>	<i>Option B: Basic Recycling</i>	<i>Option C: Targeted Recycling</i>
Tons Collected	29,300	14,150	2,931
Service Cost	\$2,086,629	\$1,098,618	\$286,035
Container Amortization/Yr	\$138,700	\$69,438	\$13,889
Processing	\$351,758	\$175,8791	\$35,176
TOTAL COSTS	\$2,577,087	\$1,343,935	\$335,100
COST PER TON	\$87.92	\$91.70	\$114.32

The average cost per ton is a combination of the more efficient lower cost dumpster collection system at \$35 to \$83 per ton and the more expensive curb-cart collection system at \$140 per ton.

There are four basic methods to fund the cost of expanded commercial recycling:

- D. **Dedicated Millage:** The City’s dedicated millage for solid waste and recycling services is collected from all taxable parcels. This is how the current city provided commercial refuse and recycling service is paid for. A portion of this millage could be used to fund expanded commercial recycling. This millage is capped by state law. Expenditures beyond this cap require some other source of funding or other program cuts.
- E. **Municipal Service User Fees:** The City has the ability to bill for additional services with a fee schedule. This billing can be arranged in conjunction with other billing systems already in operation within the city such as utilities or property taxes, or set up as a separate bill payment system. Pre-payment for services is standard practice. These types of user fees are collected on a very limited basis right now for additional commercial refuse pickups provided by the City as well as for pickup of bulky goods from single-family residential units and multi-family apartment units.
- F. **Private Hauler User Fees:** Some commercial recycling is provided on a limited basis within the City by private waste haulers and paid for by user fees charged by those haulers. While these commercial recycling services have been available for some time for cardboard, only a very limited number of businesses have arranged for and paid for them. Reliance on this approach would require a system of regulations and incentives to motivate service procurement.
- G. **Private Recycler Payments:** Commercial establishments within the City with highly valued recyclables, such as a larger printing operation, may actually be paid for their paper, when markets are good. This would be expected to continue no matter what system is selected by the City, but will only recover the best recyclables from a small number of establishments.

The following chart compares the three options on the level of reliance each would place on the four types of funding systems just described.

**Table 17: Options Comparison
Reliance on Funding Systems**

	<i>Option A Comprehensive Recycling</i>	<i>Option B: Basic Recycling</i>	<i>Option C: Targeted Recycling</i>
Millage	High	Medium	Low
Municipal User Fees	Medium	High	Low
Private Hauler User Fees	Medium	High	High
Private Recycling Payments	Low	Low	Low

As the table indicates, Option A, Comprehensive Commercial Recycling will require significant millage funding, some reliance on municipal user fees as well as private

hauler user fees for additional services. Option B, with some millage support required, places higher emphasis on user fees. Option C, with low millage impact, requires a high level of reliance on private hauler user fees.

Reliance on private hauler user fees requires that demand for services be created and that service providers make significant investments to supply that demand. Based on experience in other communities as shown in the case studies, this will require some type of enforceable program that includes regulations and incentives, developed through a strong ordinance.

The reliance on the millage will require shifting funds away from other programs, one possible approach being to transition commercial refuse service to a municipal user fee and private hauler based user fee system, freeing up about \$500,000 per year in collection and disposal costs that could then be shifted to commercial recycling.

V-C: EVALUATING OPTIONS – STRENGTHS/WEAKNESSES

Table 18 identifies evaluation criteria that each option is then rated for, on a low-medium-high scale. Evaluation criteria with a strong option marked with an additional “S”. Similarly, evaluation criteria that are particularly weak are marked with an additional “W”.

**Table 18: Options Comparison
Evaluation Criteria**

	<i>Option A Comprehensive Recycling</i>	<i>Option B: Basic Recycling</i>	<i>Option C: Targeted Recycling</i>
ORGANIZATIONAL			
Builds on existing management capacity	High S	High S	Low
Builds on existing human resource capacity	High S	High S	Low
Builds on existing contracting capacity	High S	High S	Low
Requires ordinance/bans/incentives	Medium	High	High
No additional staff required	Low W	Medium W	High S
Strong public sector role	High	High	Medium
Strong private sector role	Low	Medium	High
Accommodates data collection/tracking	High	High	Low
TECHNICAL			
Guarantees achievement of 50% recovery	High S	Medium W	Medium W
Guarantees tons to expanded MRF	High S	Medium	Low W
Protects investment in expanded MRF	High S	High S	Medium W
Captures collection economies of scale	High S	Medium	High
Builds on existing collection infrastructure	High S	High S	Low
Accommodates phased expansion	High	High	Low
FINANCIAL			
Solves the “why pay for recycling” issue	High S	Medium	Low W
Moves refuse to user pay/pay as you throw	High S	Medium	Medium
Provides fair distribution of millage benefits	High	High	Low
Leverages private sector investment	Low W	Medium	High S
Supports testing and piloting of systems	High	High	Medium

As Table 18 shows, Ann Arbor’s historical strength in solid waste and recycling services is the long track record of public involvement in service organization and service provision. The strong marks for Option A demonstrate how Option A builds on this already developed infrastructure.

The guarantee of delivery to an expanded MRF, designed to handle the larger volumes of commercial recyclables, is another key area of strength for Option A. This protects both the existing and future investments that will be made in the MRF, the centerpiece for recycling in the region.

Any steps that support the MRF expansion are also strong steps supporting regional growth in recycling. During the period that Ann Arbor's MRF has developed and operated two other recycling facilities in the area have expanded and then closed and a third has sharply limited its material to large industrial accounts. Only one other local recycling facility, the publicly owned Western Washtenaw Resource Recovery Authority recycling facility in Chelsea, has grown and performed as well as the Ann Arbor MRF. Supporting expansion of the MRF with a strong collection program is the best step that can be taken right now for regional recycling.

V-D: IMPLEMENTATION ACTION STEPS

The analysis shows that 50% recovery in the commercial sector is achievable and that the resources required, while significant, are within reach. Certainly the level of effort required and the approaches being considered are no different in scale and proportion to the original effort that resulted in the 50% diversion performance already achieved in the residential sector.

However, there are still many questions that remain to be answered before final choices are made on the strategic options covered in this implementation plan. Following are recommended implementation action steps that reflect these uncertainties while at the same time setting into motion those longer lead-time steps that are necessary for the goal of 50% commercial recovery to be reached on a timely basis.

Most of the steps that can be immediately taken have already been considered and included in the five-year Solid Waste Plan Update. Recommendations for immediate action include:

1: MRF Expansion for Commercial Paper Processing (in 5-year plan):

The MRF is the centerpiece for achievement of the 50% diversion goal. Expansion to handle commercial recyclables must be completed before any significant increase in commercial recycling can take place. It is also clear that the overall financial performance of the MRF and Transfer Station can be improved with a combination of increased tonnage, efficiency improvements, and changes to waste transfer systems.

Work must proceed immediately on MRF/TS upgrade conceptual design, cost opinions, siting and permitting requirements, project feasibility assessment, and implementation planning. Most important of these steps is identifying and securing the necessary capital funds for the expansion, which requires a comprehensive understanding of its costs and benefits. This process must be undertaken with the City's current MRF/TS operator, FCR, as provided for in the long-term construction and operating contract the city maintains with this private firm.

2: Near Term Upgrade of Commercial Recycling Collection (in 5 year plan)

The analysis of current recycling routes indicates that expanding the existing front load dumpster route to a five-day per week program would lower unit costs, increase capacity, and give the City valuable experience in route efficiencies, essentially a trial of a full scale five day per week collection program. This step can include testing of data

collection systems, program outreach approaches, business-recruiting methods and the 6 cubic yard versus 8 cubic yard recycling dumpster systems.

This effort should include selective expansion of the curbside system; again with the goal of having a complete five day per week curbside route from which more detailed performance based expansion plans can be developed. This route would provide the added benefit of building recycling activity with generators that eventually will need the expanded services of the long-term program.

3: Expand “Municipal User Fee” Services and Administrative System (in 5-year plan):

A key to success of any of the options is the viability of municipal user fees as a means of offering “on request” services that increase the recycling effort and increase funding at the same time. Needed steps include: a) streamlining a pre-pay service request system, b) developing the ability to deliver the requested service on time, with quality, and cost effectiveness, c) contracting with a preferred dumpster supply/maintenance firm to eliminate the barrier that dumpster acquisition and upkeep has been to increased recycling and solid waste services, and d) contracting with a preferred “in-building” recycling system organization supplier to help businesses develop effective collection systems for recyclable material within their building. This process should include routine surveying of users to determine the most customer friendly approaches. All of these systems, once they are set up and debugged so that they operate efficiently, will further the success of any of the approaches that are finally chosen for commercial recycling.

4: Proceed with Food Waste Pilot and Compost Site Development/Expansion:

The viability of food waste as a recyclable/compostable needs to be further evaluated. If it can be cost effectively collected and composted, then it will significantly reduce the recovery that is needed of cardboard, mixed paper and mixed containers. There are significant technical and regulatory questions that must be clarified, followed by final feasibility analysis and implementation planning. The length of this process means that steps must be taken immediately if this approach is to be viable during the five-year planning period.

5: Campaign to Improve Ability to Benchmark Current Status and Track Progress:

The projections and estimates provided in this report vary in levels of accuracy. Some are very hard numbers backed up by scale weights at the MRF and route-by-route detail. Others are projections based on estimates of numbers of dumpsters in place, how frequently they are picked up, how full they are and what recyclables are inside. All that has been done represents a good starting point but over time it is both important and possible to significantly improve the accuracy of this data. Steps should be taken to continuously collect data by generator type and sector through surveying, pilot testing and data reporting efforts.

6: Outreach and Education:

Efforts to build momentum within the business sector are needed so that businesses are ready to both support the expansion and to participate when the collection systems are phased in and then fully rolled out.

These outreach and education campaigns need a consistent theme, a common “branding identity” for the campaign, and a “phase by phase” structure so that target audiences know how step 1 is leading to step 2, etc.

7: Collection Program Design:

Finally, the choices need to be made on how to develop the commercial recycling collection infrastructure as described in either Option A, B, or C. This will require evaluation of the issue of providing refuse collection on a user fee basis, the role of how to motivate private businesses to incentivize them to recycle, the implications of public and private sector roles in system operation, the role of contracting, franchising and hauler licensing strategies, the ordinance/rules/regulations that will be needed, and the technical details and procurement of equipment and services as the final choice on collection approach is made.

Expanding the MRF and compost facility will take 12 to 36 months depending on the need for changes in the refuse transfer operation. With careful planning the collection system can be ramped up and quickly brought to high levels of performance during the third through fifth year of the five-year plan update period. Moving forward on these recommended action steps as soon as possible will allow the 50% commercial recovery goal to be reached in the five-year planning period.

APPENDIX A: METHODOLOGY AND ASSUMPTIONS

Calculation Methodology

Waste generation data for each sub-commercial sector in Ann Arbor was determined using the following process:

Employment data was obtained from the following sources.

- All private-sector employment is itemized by the North American Industrial Classification System (NAICS). The most recent data for the City of Ann Arbor, from the 1997 Economic Census, was analyzed. This data is available on the World Wide Web at <http://www.census.gov/epcd/ec97/metro0/M0440.HTM> and is contained in Table 21 later in this appendix.
- Employment by the University of Michigan and the University of Michigan Health Systems in Ann Arbor were obtained from the Public Relations departments of these respective organizations.
- Employment by Federal, State, and Local Government in the City of Ann Arbor was obtained from a composite of the *Southeast Michigan Council of Governments Community Profiles for Ann Arbor and Washtenaw County* (available at <http://www.semecog.org>), the *Local Government Public Employment and Payroll Data* provided by the U.S. Census Bureau (available at <http://www.census.gov/govs/www/apeloc00.html>), and *Information on Public Schools and School Districts in the United States* published by the U.S. Department of Education (available at <http://nces.ed.gov/ccd/pubagency.html>).

Each employment classification was assigned to a sector category based on the waste generation characteristics of like-business types. Each of these categories and the NAICS codes assigned to them may be viewed in the attached pages labeled “Waste Generation Category Assignments.”

Each of the aforementioned categories was assigned a generation rate in pounds per employee per day (referring to a 365-day year) and a waste composition. The generation rates and compositions were determined by Resource Recycling Systems, Inc. and are based on a wide range of sources including, but not limited to, solid waste audits performed by RRSI in other communities; California Integrated Waste Management Board audits and database; the Ohio Department of Natural Resources; and benchmarking studies from other municipalities. Generation rates assigned to each category are included in the attached pages labeled “Waste Generation Category Data.”

For each category, the total number of employees was multiplied by the generation rate to determine a generation total for that category. This total was then multiplied by each factor in the waste composition for that category to determine the amount of each waste material generated by that category. For additional clarification, these formulae are included below.

Annual waste generation for each category (tons/year):

$$[\text{NumberOfEmployeesInCategory}] \times [\text{PoundsPerEmployeePerDay}] * 365 / 2000$$

Annual generation of a specific waste material (tons/year):

$$[\text{AnnualWasteGeneration}] \times [\text{PercentComposition}]$$

The total waste generation and the generation in each waste category was totaled across all categories to produce a total waste generation and composition for the City of Ann Arbor. A summary of the above results is included in Table 20.

Generation Rates

The per employee generation rates use to estimate waste generation for each sector are included in Table 19 below.

Table 19: Commercial Sector Waste Generation Rates

<i>Category</i>	<i>Generation Rate</i>	<i>Waste Composition Group</i>
Accommodation	7.1	Hotel
Arts, Entertainment and Recreation	5.75	Services
Automotive parts stores	10	Retail-Automotive
Building & Garden Equipment Stores	8.5	Retail
Computer & Electronics Manufacture	12	Manufacturing Hi-tech
Educational Services	4.1	Services
Electronics and appliance stores	8.5	Retail
Fabricated Metal Product Manufacture	16.4	Manufacturing
Food and beverage stores	10	Retail
Foodservices and Drinking places	15	Food
Gasoline stations	10	Retail-Automotive
Government	4.1	Government
Health Care and Social Assistance	7	Hospital
Manufacturing	16.4	Manufacturing
New Car Dealers	10	Retail-Automotive
Other Professional Services	5.75	Services
Other Retailers	5.75	Retail
Other Services	5.75	Services
Printing	8.5	Printing
Public Schools	4.1	Services
Retail Trade	10	Retail
University of Michigan	2.375	Institutional
University of Michigan Hospital	3.5	Hospital
Wholesale Trade	8.5	Wholesale

Waste Compositions

Waste compositions for each commercial sector shown in Table 19 are detailed in Table 20.

Table 20: Waste Composition Divisors

Material Group	Material	Employment Sector													
		Food	Government	Grocery	Hospital	Hotel	Institutional	Manufacturing	Manufacturing Hi-tech	Printing	Retail	Retail-Appliance	Retail-Automotive	Services	Wholesale
Cardboard	Cardboard	25.00%	11.00%	21.00%	11.00%	8.00%	11.00%	13.00%	13.00%	13.00%	23.93%	22.00%	21.00%	17.00%	30.00%
Containers	Aluminum	0.80%	4.00%	0.50%	4.00%	2.00%	4.00%	1.00%	1.00%	1.00%	0.50%	2.00%	0.50%	0.50%	0.20%
Containers	Amber Glass	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	0.55%	0.50%	0.55%	0.83%	0.50%	1.00%	0.30%	1.00%
Containers	Clear Glass	3.00%	3.00%	3.00%	3.50%	2.00%	3.50%	1.00%	1.00%	1.00%	2.75%	1.00%	3.00%	2.00%	3.00%
Containers	Clear HDPE	0.10%	1.00%	0.50%	1.00%	0.50%	1.00%	1.00%	1.00%	1.00%	0.33%	0.50%	0.50%	1.00%	0.10%
Containers	Colored HDPE	0.10%	0.10%	0.50%	0.10%	2.00%	0.10%	1.00%	1.00%	1.00%	0.33%	0.50%	0.50%	1.00%	0.10%
Containers	Green Glass	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	0.55%	0.50%	0.55%	0.93%	0.50%	1.00%	0.50%	1.00%
Containers	PET	0.10%	1.00%	0.30%	1.00%	0.50%	1.00%	1.00%	1.00%	1.00%	0.33%	0.50%	0.30%	1.00%	0.10%
Containers	Steel/Tin Cans	1.00%	0.50%	1.00%				0.50%	0.50%	0.50%		0.50%	1.00%	0.50%	
Electronics	Computers	0.40%	0.40%	0.50%	0.40%	0.40%	0.40%	0.40%	1.00%	0.40%		0.50%	0.50%	0.40%	
Electronics	CRTs/Displays		0.40%	0.50%	0.40%	0.20%	0.40%	0.40%	1.50%	0.60%		1.00%	0.50%	0.40%	
Electronics	Electronic Equipment	0.50%	1.00%	0.50%	1.00%	0.40%	1.00%	0.50%	5.00%	0.50%	0.50%	5.00%	0.50%	0.80%	0.50%
Food/Organics	Food Waste	16.60%	9.00%	15.00%	9.00%	10.00%	9.00%	2.30%	2.00%	2.30%	14.38%	2.00%	15.00%	5.70%	10.60%
Food/Organics	Other Organics	1.00%	3.50%	2.00%	3.50%	8.50%	3.50%	6.00%	2.00%	6.00%	2.38%	1.00%	2.00%	2.00%	1.90%
Food/Organics	Soiled Paper	2.40%		4.00%				1.00%	1.00%	1.00%			4.00%	1.00%	
Food/Organics	Waxed OCC	1.00%	0.50%	4.00%	0.50%		0.50%						4.00%	0.50%	1.00%
Mixed Paper	Books		0.40%		0.40%		0.40%			2.00%				1.00%	
Mixed Paper	Boxboard	4.30%	5.00%	5.00%	5.00%	2.10%	5.00%	2.00%	2.00%	2.00%	4.33%	1.00%	5.00%	2.10%	3.70%
Mixed Paper	Card Stock							0.50%	0.50%	0.50%					
Mixed Paper	Kraft Paper	0.00%						0.50%	0.50%	2.00%					
Mixed Paper	Magazines	6.00%	4.00%	2.00%	4.00%	4.30%	4.00%	1.60%	1.60%	1.60%	6.00%	0.50%	2.00%	3.00%	4.00%

		<i>Employment Sector</i>													
<i>Material Group</i>	<i>Material</i>	<i>Food</i>	<i>Government</i>	<i>Grocery</i>	<i>Hospital</i>	<i>Hotel</i>	<i>Institutional</i>	<i>Manufacturing</i>	<i>Manufacturing Hi-tech</i>	<i>Printing</i>	<i>Retail</i>	<i>Retail-Appliance</i>	<i>Retail-Automotive</i>	<i>Services</i>	<i>Wholesale</i>
Mixed Paper	Mixed Office	7.60%	6.00%	6.00%	6.00%	8.50%	6.00%	2.00%	4.00%	15.00%	8.40%	5.00%	6.00%	8.60%	7.00%
Mixed Paper	Newsprint	4.20%	4.20%	1.00%	4.20%	12.00%	4.20%	0.50%	0.50%	1.00%	4.90%	1.00%	1.00%	5.60%	3.70%
Mixed Paper	Other Mixed Paper			1.00%				2.00%	2.00%	2.00%		2.00%	1.00%		1.00%
Mixed Paper	Phone Books		0.50%		0.50%	1.00%	0.50%	0.50%	0.50%	0.50%				0.50%	
Mixed Paper	Tissue paper			1.00%				0.50%	0.50%	0.50%	0.50%	0.50%	1.00%		
Mixed Paper	White Office Paper	2.10%	4.60%	2.00%	4.60%	2.50%	4.60%	2.00%	2.00%	10.00%	2.25%	2.00%	2.00%	4.00%	0.50%
Other	Bulky Items		2.00%	3.00%	2.00%	1.00%	2.00%	4.00%	4.00%	4.00%		5.00%	3.00%	1.00%	
Other	Durable Plastic Items	0.50%	1.00%	1.00%	1.00%		1.00%	4.00%	4.00%	2.00%		4.00%	1.00%	2.00%	
Other	Lumber-Wood Waste							1.00%	1.00%	1.00%					
Other	Other Construction Waste		1.50%	1.00%	1.50%		1.50%	1.50%	1.50%	1.00%	0.50%	0.50%	1.00%		2.00%
Other	Other Glass							0.50%	1.00%	0.50%					
Other	Other Inorganics	0.50%	1.40%	3.20%	1.40%	5.00%	1.40%	15.70%	18.00%		1.78%	10.00%	3.20%	11.00%	0.90%
Other	Other Plastic	2.10%	12.00%	2.00%	12.00%	5.00%	12.00%	9.00%	8.90%	5.00%	2.50%	9.00%	2.00%	6.00%	2.70%
Other	Pallets	1.00%		1.00%		2.00%		3.00%	3.00%	3.00%	1.00%	5.00%	1.00%	3.00%	2.00%
Other	Plastic Film	5.10%	5.00%	3.50%	5.00%	1.00%	5.00%	1.00%	1.00%	2.00%	4.33%	1.00%	3.50%	1.60%	6.60%
Other	Polystyrene	0.90%	0.50%	1.00%	0.50%	0.60%	0.50%	1.00%	1.00%	1.00%	0.85%	4.00%	1.00%	1.00%	1.40%
Other	Rubber	0.50%	0.50%	1.30%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	1.27%	1.00%	1.30%	0.50%	0.50%
Other	Sludge							5.00%		5.00%					
Other	Textiles	3.60%	3.00%	1.00%	3.00%	4.00%	3.00%	1.50%	1.00%	1.50%	3.00%		1.00%	1.50%	4.00%
Scrap Metal	Ferrous Scrap	1.00%	5.00%	1.00%	5.00%	4.00%	5.00%	3.00%	3.00%	2.00%	1.00%	5.00%	1.00%	1.00%	2.00%
Scrap Metal	Other Metal	1.60%	1.00%	1.70%	1.00%	2.00%	1.00%	6.00%	5.00%	3.00%	1.70%	2.00%	1.70%	2.00%	1.50%
Yard Waste	Yard Waste	5.00%	5.00%	6.00%	5.00%	8.00%	5.00%	1.00%	1.00%	1.00%	8.50%	4.00%	6.00%	10.00%	7.00%

NAICS Data

Included in Table 21 is the complete listing of all employment data used in determining solid waste generation for each employment sector. Most data was obtained from the United States Census Bureau 1997 Economic Census. Numbers marked with an asterisk were obtained through other sources listed in the Calculation Methodology.

Table 21: NAICS Employment Data for Ann Arbor

NAICS Code	Description	Establishments	Employees
3	Manufacturing	131	4330
323	Printing & related support activities	26	685
3231	Printing & related support activities	26	685
32311	Printing	22	663
332	Fabricated metal product mfg	12	768
3329	Other fabricated metal product mfg	4	750
33299	All other fabricated metal product mfg	4	750
332991	Ball & roller bearing mfg	3	750
334	Computer & electronic product mfg	24	803
336	Transportation equipment mfg	9	1750
3363	Motor vehicle parts mfg	7	1750
339	Miscellaneous mfg	19	563
42	Wholesale trade	174	1767
421	Wholesale trade, durable goods	130	1106
4211	Motor vehicle & motor vehicle parts & supplies whs	9	60
42112	Motor vehicle supplies & new parts whsle	8	60
42114	Motor vehicle parts, (used) whsle	1	10
4213	Lumber & other construction materials whsle	5	60
42132	Brick, stone, & related construction materials whs	1	10
4214	Professional & commercial equipment & supplies whs	39	312
42142	Office equipment whsle	5	60
42143	Computer & computer peripheral equipment & softwar	17	130
42144	Other commercial equipment whsle	2	60
42145	Medical, dental, & hospital equipment & supplies w	11	35
4215	Metal & mineral (except petroleum) whsle	6	20
42151	Metal service centers & offices	4	10
4216	Electrical goods whsle	21	375
42161	Electrical apparatus & equip, wiring supp, & const	7	89
42162	Electrical appliance, television & radio set whsle	3	10
42169	Other electronic parts & equipment whsle	11	175
4217	Hardware, & plumbing & heating equipment & supplie	8	66
4218	Machinery, equipment, & supplies whsle	27	312
42183	Industrial machinery & equipment whsle	17	224
42184	Industrial supplies whsle	5	60
4219	Miscellaneous durable goods whsle	12	60
42191	Sporting & recreational goods & supplies whsle	9	32
422	Wholesale trade, nondurable goods	44	661
4221	Paper & paper product whsle	4	14
4222	Drugs, & druggists' sundries whsle	2	175

NAICS Code	Description	Establishments	Employees
42221	Drugs, & druggists' sundries whsle	2	175
4224	Grocery & related products whsle	12	175
42243	Dairy products, (except dried or canned) whsle	2	60
42248	Fresh fruit & vegetable whsle	3	60
42249	Other grocery & related products whsle	6	60
4226	Chemical & allied products whsle	8	10
4227	Petroleum & petroleum products whsle	1	60
42272	Petroleum & petroleum prod whsle (exc bulk station)	1	60
4229	Miscellaneous nondurable goods whsle	15	175
42299	Other miscellaneous nondurable goods whsle	9	175
44	Retail trade	647	9645
441	Motor vehicle & parts dealers	31	642
4411	Automobile dealers	11	375
44111	New car dealers	10	358
441110	New car dealers	10	358
441229	All other motor vehicle dealers	1	10
4413	Automotive parts, accessories, & tire stores	18	375
44131	Automotive parts & accessories stores	11	175
441310	Automotive parts & accessories stores	11	175
44132	Tire dealers	7	60
441320	Tire dealers	7	60
442	Furniture & home furnishings stores	46	447
4421	Furniture stores	19	215
44211	Furniture stores	19	215
442110	Furniture stores	19	215
4422	Home furnishings stores	27	232
44221	Floor covering stores	8	38
442210	Floor covering stores	8	38
44229	Other home furnishings stores	19	194
442291	Window treatment stores	3	11
442299	All other home furnishings stores	16	183
443	Electronics & appliance stores	33	355
4431	Electronics & appliance stores	33	355
44311	Appliance, television, & other electronics stores	16	175
443111	Household appliance stores	5	60
443112	Radio, television, & other electronics stores	11	175
44312	Computer & software stores	14	136
443120	Computer & software stores	14	136
44313	Camera & photographic supplies stores	3	60
443130	Camera & photographic supplies stores	3	60
444	Building material & garden equipment & supplies de	28	451
4441	Building material & supplies dealers	25	375
44412	Paint & wallpaper stores	5	60
444120	Paint & wallpaper stores	5	60
44413	Hardware stores	7	111
444130	Hardware stores	7	111
44419	Other building material dealers	13	255

NAICS Code	Description	Establishments	Employees
444190	Other building material dealers	13	255
4442	Lawn & garden equipment & supplies stores	3	60
44422	Nursery & garden centers	3	60
444220	Nursery & garden centers	3	60
445	Food & beverage stores	81	1500
4451	Grocery stores	45	1146
44511	Supermarkets & other grocery (except convenience)	27	1059
445110	Supermarkets & other grocery (except convenience)	27	1059
44512	Convenience stores	18	87
445120	Convenience stores	18	87
4452	Specialty food stores	21	249
4453	Beer, wine, & liquor stores	15	105
44531	Beer, wine, & liquor stores	15	105
445310	Beer, wine, & liquor stores	15	105
446	Health & personal care stores	44	508
4461	Health & personal care stores	44	508
44611	Pharmacies & drug stores	15	346
446110	Pharmacies & drug stores	15	346
4461101	Pharmacies & drug stores	15	346
44612	Cosmetics, beauty supplies, & perfume stores	4	60
446120	Cosmetics, beauty supplies, & perfume stores	4	60
44613	Optical goods stores	17	106
446130	Optical goods stores	17	106
44619	Other health & personal care stores	8	60
446191	Food (health) supplement stores	4	60
447	Gasoline stations	32	229
4471	Gasoline stations	32	229
44711	Gasoline stations with convenience stores	15	105
447110	Gasoline stations with convenience stores	15	105
44719	Other gasoline stations	17	124
447190	Other gasoline stations	17	124
448	Clothing & clothing accessories stores	153	1525
4481	Clothing stores	90	1171
44811	Men's clothing stores	15	60
448110	Men's clothing stores	15	60
44812	Women's clothing stores	34	375
448120	Women's clothing stores	34	375
44813	Children's & infants' clothing stores	7	63
448130	Children's & infants' clothing stores	7	63
44814	Family clothing stores	15	564
448140	Family clothing stores	15	564
44815	Clothing accessories stores	7	60
448150	Clothing accessories stores	7	60
44819	Other clothing stores	12	175
448190	Other clothing stores	12	175
4482	Shoe stores	30	194
44821	Shoe stores	30	194

NAICS Code	Description	Establishments	Employees
448210	Shoe stores	30	194
4482101	Men's shoe stores	3	10
4482102	Women's shoe stores	7	40
4482103	Children's & juveniles' shoe stores	2	10
4482104	Family shoe stores	12	71
4482105	Athletic footwear stores	6	57
4483	Jewelry, luggage, & leather goods stores	33	160
44831	Jewelry stores	30	175
448310	Jewelry stores	30	175
44832	Luggage & leather goods stores	3	60
448320	Luggage & leather goods stores	3	60
451	Sporting goods, hobby, book, & music stores	75	1401
4511	Sporting goods, hobby, & musical instrument stores	42	476
45111	Sporting goods stores	23	195
451110	Sporting goods stores	23	195
4511101	General-line sporting goods stores	6	66
4511102	Specialty-line sporting goods stores	17	129
45112	Hobby, toy, & game stores	9	183
451120	Hobby, toy, & game stores	9	183
45113	Sewing, needlework, & piece goods stores	4	17
451130	Sewing, needlework, & piece goods stores	4	17
45114	Musical instrument & supplies stores	6	81
451140	Musical instrument & supplies stores	6	81
4512	Book, periodical, & music stores	33	925
45121	Book stores & news dealers	20	808
451211	Book stores	17	750
4512111	Book stores, general	12	750
4512112	Specialty book stores	1	10
4512113	College book stores	4	175
451212	News dealers & newsstands	3	60
45122	Prerecorded tape, compact disc, & record stores	13	117
451220	Prerecorded tape, compact disc, & record stores	13	117
452	General merchandise stores	9	1750
4521	Department stores (excl leased depts)	6	1750
4521000	Department stores (incl leased depts) ##	6	100000
45211	Department stores (excl leased depts)	6	1750
452110	Department stores (excl leased depts)	6	1750
4521100	Department stores (incl leased depts) ##	6	100000
4521101	Conventional department stores (excl leased depts)	2	750
4521102	Discount or mass merchandising dept stores (excl I	2	375
4521103	National chain department stores (excl leased dept	2	750
45299	All other general merchandise stores	3	175
452990	All other general merchandise stores	3	175
4529902	Catalog showrooms	1	175
453	Miscellaneous store retailers	94	750
4531	Florists	13	135
45311	Florists	13	135

NAICS Code	Description	Establishments	Employees
453110	Florists	13	135
4532	Office supplies, stationery, & gift stores	44	374
45321	Office supplies & stationery stores	8	109
453210	Office supplies & stationery stores	8	109
4532101	Stationery stores	2	10
4532102	Office supplies stores	6	175
45322	Gift, novelty, & souvenir stores	36	265
453220	Gift, novelty, & souvenir stores	36	265
4533	Used merchandise stores	16	93
45331	Used merchandise stores	16	93
453310	Used merchandise stores	16	93
4539	Other miscellaneous store retailers	21	175
45391	Pet & pet supplies stores	6	61
453910	Pet & pet supplies stores	6	61
45392	Art dealers	4	16
453920	Art dealers	4	16
45399	All other miscellaneous store retailers	11	60
454	Nonstore retailers	21	259
4541	Electronic shopping & mail-order houses	9	133
45411	Electronic shopping & mail-order houses	9	133
454110	Electronic shopping & mail-order houses	9	133
4542	Vending machine operators	4	60
45421	Vending machine operators	4	60
454210	Vending machine operators	4	60
4543	Direct selling establishments	8	60
45439	Other direct selling establishments	8	60
454390	Other direct selling establishments	8	60
5112	Software publishers	39	1750
51121	Software publishers	39	1750
511210	Software publishers	39	1750
512	Motion picture & sound recording industries	14	175
5121	Motion picture & video industries	13	175
51213	Motion picture & video exhibition	5	60
513	Broadcasting & telecommunications	18	750
514	Information services & data processing services	14	1750
5141	Information services	7	375
51419	Other information services	7	375
514191	On-line information services	7	375
5142	Data processing services	7	750
51421	Data processing services	7	750
514210	Data processing services	7	750
53	Real estate & rental & leasing	147	1414
531	Real estate	119	1193
5311	Lessors of real estate	35	179
53111	Lessors of residential buildings & dwellings	19	145
531110	Lessors of residential buildings & dwellings	19	145
53112	Lessors of nonresidential buildings (except miniwa	10	19

NAICS Code	Description	Establishments	Employees
531120	Lessors of nonresidential buildings (except miniwa	10	19
5312	Offices of real estate agents & brokers	40	189
53121	Offices of real estate agents & brokers	40	189
531210	Offices of real estate agents & brokers	40	189
5313	Activities related to real estate	44	825
53131	Real estate property managers	38	794
531311	Residential property managers	28	669
531312	Nonresidential property managers	10	125
532	Rental & leasing services	25	175
5322	Consumer goods rental	17	150
53223	Video tape & disk rental	11	128
532230	Video tape & disk rental	11	128
54	Professional, scientific, & technical services	621	6371
541	Professional, scientific, & technical services	621	6371
5411	Legal services	130	622
54111	Offices of lawyers	122	576
541110	Offices of lawyers	122	576
5411101	Offices of lawyers (except legal aid societies)	122	576
54119	Other legal services	8	46
541191	Title abstract & settlement offices	7	60
5412	Accounting, tax return prep, bookkeeping, & payrol	61	862
54121	Accounting, tax return prep, bookkeeping, & payrol	61	862
541211	Offices of certified public accountants	37	375
541213	Tax return preparation services	4	10
541214	Payroll services	3	375
541219	Other accounting services	17	175
5413	Architectural, engineering, & related services	124	1963
54131	Architectural services	34	175
541310	Architectural services	34	175
54133	Engineering services	78	1336
541330	Engineering services	78	1336
54138	Testing laboratories	11	382
541380	Testing laboratories	11	382
5414	Specialized design services	24	72
54141	Interior design services	9	60
541410	Interior design services	9	60
54143	Graphic design services	13	44
541430	Graphic design services	13	44
5414301	Graphic design services (except commercial art & m	13	44
5415	Computer systems design & related services	94	932
54151	Computer systems design & related services	94	932
541511	Custom computer programming services	51	522
541512	Computer systems design services	36	387
5415121	Computer systems integrators	11	240
5415122	Computer systems consultants (except systems integ	25	147
5416	Management, scientific, & technical consulting ser	112	808
54161	Management consulting services	86	700

NAICS Code	Description	Establishments	Employees
541611	Administrative management & general management con	42	352
541612	Human resources & executive search consulting serv	24	60
541613	Marketing consulting services	14	126
54162	Environmental consulting services	10	65
541620	Environmental consulting services	10	65
54169	Other scientific & technical consulting services	16	43
541690	Other scientific & technical consulting services	16	43
5417	Scientific research & development services	29	710
54171	R&D in the physical, engineering, & life sciences	26	750
541710	R&D in the physical, engineering, & life sciences	26	750
5417101	R&D in the physical & engineering sciences	20	543
5418	Advertising & related services	22	156
54181	Advertising agencies	11	99
541810	Advertising agencies	11	99
5419	Other professional, scientific, & technical servic	25	246
54191	Marketing research & public opinion polling	9	189
541910	Marketing research & public opinion polling	9	189
54192	Photographic services	12	60
541921	Photographic studios, portrait	7	60
56	Administrative & support & waste management & reme	174	4084
561	Administrative & support services	167	4029
5611	Office administrative services	25	444
56111	Office administrative services	25	444
561110	Office administrative services	25	444
5613	Employment services	27	2021
56132	Temporary help services	19	1891
561320	Temporary help services	19	1891
5614	Business support services	25	296
56143	Business service centers	13	175
561431	Private mail centers	5	60
561439	Other business service centers (including copy sho	8	175
5615	Travel arrangement & reservation services	25	177
56151	Travel agencies	21	126
561510	Travel agencies	21	126
5616	Investigation & security services	6	88
56162	Security systems services	3	60
5617	Services to buildings & dwellings	42	934
56172	Janitorial services	35	918
561720	Janitorial services	35	918
5619	Other support services	16	60
56199	All other support services	11	60
561990	All other support services	11	60
562	Waste management & remediation services	7	55
61	Educational services	33	243
611	Educational services	33	243
6115	Technical & trade schools	4	10
61151	Technical & trade schools	4	10

NAICS Code	Description	Establishments	Employees
6116	Other schools & instruction	20	199
61162	Sports & recreation instruction	6	21
611620	Sports & recreation instruction	6	21
61169	All other schools & instruction	6	60
611691	Exam preparation & tutoring	3	60
62	Health care & social assistance	305	2913
621	Ambulatory health care services	249	2361
6211	Offices of physicians	89	834
62111	Offices of physicians	89	834
621111	Offices of physicians (except mental health specia	66	800
621112	Offices of physicians, mental health specialists	23	34
6212	Offices of dentists	89	492
62121	Offices of dentists	89	492
621210	Offices of dentists	89	492
6213	Offices of other health practitioners	49	188
62131	Offices of chiropractors	12	31
621310	Offices of chiropractors	12	31
62132	Offices of optometrists	6	50
621320	Offices of optometrists	6	50
62133	Offices of mental health practitioners (except phy	16	26
621330	Offices of mental health practitioners (except phy	16	26
62134	Offices of physical, occup, & speech therapists &	9	60
621340	Offices of physical, occup, & speech therapists &	9	60
6216	Home health care services	11	765
62161	Home health care services	11	765
621610	Home health care services	11	765
623	Nursing & residential care facilities	10	216
6233	Community care facilities for the elderly	5	60
62331	Community care facilities for the elderly	5	60
624	Social assistance	46	336
6241	Individual & family services	11	60
62419	Other individual & family services	9	60
624190	Other individual & family services	9	60
6244	Child day care services	34	289
62441	Child day care services	34	289
624410	Child day care services	34	289
71	Arts, entertainment, & recreation	43	533
711	Performing arts, spectator sports, & related indus	14	60
713	Amusement, gambling, & recreation industries	28	498
7139	Other amusement & recreation services	23	375
71394	Fitness & recreational sports centers	15	380
713940	Fitness & recreational sports centers	15	380
72	Accommodation & foodservices	344	8266
721	Accommodation	56	1024
7211	Traveler accommodation	24	880
72111	Hotels (except casino hotels) & motels	22	750
721110	Hotels (except casino hotels) & motels	22	750

NAICS Code	Description	Establishments	Employees
7211101	Hotels (except casino hotels) with 25 guestrooms o	14	750
7211102	Hotels with less than 25 guestrooms	1	10
7211103	Motels	5	72
7211104	Motor hotels	2	10
7212	RV (recreational vehicle) parks & recreational cam	2	10
72121	RV (recreational vehicle) parks & recreational cam	2	10
721214	Recreational & vacation camps (except campgrounds)	2	10
7213	Rooming & boarding houses	30	175
72131	Rooming & boarding houses	30	175
721310	Rooming & boarding houses	30	175
722	Foodservices & drinking places	288	7242
7221	Full-service restaurants	111	4059
72211	Full-service restaurants	111	4059
722110	Full-service restaurants	111	4059
7222	Limited-service eating places	141	2484
72221	Limited-service eating places	141	2484
722211	Limited-service restaurants	108	2107
722213	Snack & nonalcoholic beverage bars	33	377
7223	Special foodservices	15	172
7224	Drinking places (alcoholic beverages)	21	527
72241	Drinking places (alcoholic beverages)	21	527
722410	Drinking places (alcoholic beverages)	21	527
81	Other services (except public administration)	168	1129
811	Repair & maintenance	80	506
8111	Automotive repair & maintenance	48	327
81111	Automotive mechanical & electrical repair & mainte	28	169
811111	General automotive repair	18	94
811112	Automotive exhaust system repair	5	60
811118	Other automotive mechanical & electrical repair &	2	10
81112	Automotive body, paint, interior, & glass repair	10	72
811121	Automotive body, paint, & interior repair & mainte	8	60
8111211	Paint or body repair shops	8	60
81119	Other automotive repair & maintenance	10	86
811191	Automotive oil change & lubrication shops	5	60
8112	Electronic & precision equipment repair & maintena	9	60
81121	Electronic & precision equipment repair & maintena	9	60
8114	Personal & household goods repair & maintenance	20	110
81141	Home & garden equipment & appliance repair & maint	4	34
81143	Footwear & leather goods repair	3	60
811430	Footwear & leather goods repair	3	60
81149	Other personal & household goods repair & maintena	10	60
811490	Other personal & household goods repair & maintena	10	60
8114904	Garment repair & alteration services	9	60
812	Personal & laundry services	88	623
8121	Personal care services	58	303
81211	Hair, nail, & skin care services	50	264
812112	Beauty shops	47	175

NAICS Code	Description	Establishments	Employees
81219	Other personal care services	8	39
8123	Drycleaning & laundry services	17	175
81231	Coin-operated laundries & drycleaners	5	60
812310	Coin-operated laundries & drycleaners	5	60
8123102	Coin-operated laundries & drycleaning stores	5	60
81232	Drycleaning & laundry services (except coin-operat	12	124
812320	Drycleaning & laundry services (except coin-operat	12	124
8123202	Drycleaning plants	12	124
8129	Other personal services	11	175
81292	Photofinishing	5	60
81293	Parking lots & garages	2	60
812930	Parking lots & garages	2	60
81299	All other personal services	4	10
812990	All other personal services	4	10
8129909	All other miscellaneous personal services	4	10
881*	RRSI-Public Schools	63	928
882*	RRSI-University of Michigan	1	24059
883*	RRSI-University of Michigan Hospital	1	15388
884*	RRSI-Government	n/a	4131

APPENDIX B: COST PROJECTIONS

The following table shows background calculations and assumptions used in generating cost projections for Scenarios A, B and C in Section V of the report.

Table 22: Cost Projections

<i>Cost Comparison</i>	<i>Option A</i>	<i>Option B</i>	<i>Option C</i>
Tons Dumpster	1,589	7,945	15,890
Tons Curbscart	1,342	6,712	13,423
Total Tons	2,931	14,657	29,313
# of New Dumpsters	32	160	318
# of Dumpster Lifts/wk	63	318	638
Tons/Dumpster Route/Yr	3750	4725	6750
# Routes	1	2	3
Dumpster Route Cost	\$ 110,475	\$ 110,475	\$ 110,475
Dumpster Service Cost	\$ 110,475	\$ 220,950	\$ 331,425
Annual Cost of Dumpsters	\$ 2,694	\$ 13,468	\$ 26,769
#of curbscart lifts/week	1,330	6,649	13,297
Cost per curbscart Lift/Mo	\$11.00	\$11.00	\$11.00
Curbscart Service Cost	\$ 175,560	\$ 877,668	\$ 1,755,204
Annual Cost of Curbscarts	\$ 11,196	\$ 55,970	\$ 111,931
Cost per Ton for Processing	\$ 12.00	\$ 12.00	\$ 12.00
Cost for Processing	\$ 35,176	\$ 175,879	\$ 351,758
Total Service Cost	\$ 286,035	\$ 1,098,618	\$ 2,086,629
Amortization of Containers	\$ 13,889	\$ 69,438	\$ 138,700
Processing	\$ 35,176	\$ 175,879	\$ 351,758
Total Cost	\$ 335,100	\$ 1,343,935	\$ 2,577,087
Net Cost per Ton	\$ 114.32	\$ 91.70	\$ 87.92
Dumpster Cost	\$ 113,169	\$ 234,418	\$ 358,194
Dumpster Processing	\$ 19,068	\$ 95,339	\$ 190,677
Total Dumpster Cost	\$ 132,236	\$ 329,757	\$ 548,871
Dumpster Cost/Ton	\$ 83.22	\$ 41.51	\$ 34.54
Curbscart Cost	\$ 186,756	\$ 933,638	\$ 1,867,135
Curbscart Processing	\$ 1,354	\$ 6,724	\$ 13,435
Total Curbscart	\$ 188,110	\$ 940,362	\$ 1,880,571
Curbscart Cost/Ton	\$ 140.14	\$ 140.11	\$ 140.10

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APPENDIX C: CASE STUDIES

FOOD WASTE AND ORGANICS RECYCLING

Alameda County, California

Program Description:

The State of California, in general, has many very progressive environmental initiatives. The State has mandated aggressive recycling diversion rates and communities are monetarily rewarded for reductions in landfill disposal and increases in recycling rates. It is not unusual for a community to document a 50 percent – 60 percent recycling rate.

In the case of Alameda County, (which boasts a recycling rate of 64 percent), local businesses are provided with an opportunity to change from an “all-garbage” collection program to a “garbage and composting” collection program in order to receive a 20% discount off the current refuse rate for the food waste portion of the collection service. Daily collection of the food waste and organics is provided if needed.

Alameda County set aside 1.5 million dollars in September, 2001, to fund the food waste collection program until September 2003. The funds were obtained from the host fees generated from the landfill. The County receives \$1.34 per ton. Currently the program has utilized \$25,000.00. Waste haulers are paid \$25.00 per ton for the collection and transportation of food waste to a compost site. Collection and transportation to a compost facility is cheaper than collection and disposal to the landfill by approximately \$15.00 per ton.

Waste haulers are responsible for educating the business owners as well as providing educational and promotional material. Curbcarts, as well as 1.5 yard front-load containers are being used as collection containers. In some cases, plastic biodegradable bags are placed in the curbcarts to prevent a build-up of food waste residue.

Current materials collected can include, waxed cardboard, food scraps, flowers, unpainted wood scraps, and paper napkins and wrappings (exclude meat and meat products).

The food waste and organics collection service is currently being utilized by supermarkets, bakeries, breweries, florists, and restaurants.

Currently, approximately 40 businesses are participating in the program.

Attachments:

- Alameda County Commercial Waste Composition
- Alameda County Roll-off Waste Composition
- Alameda County Jurisdictions Waste Diversion Rates
- Alameda County Commercial Refuse Rates

MANDATED COMMERCIAL BUSINESS RECYCLING ORDINANCE

Gilbertsville, Pennsylvania

Program Description:

The State of Pennsylvania Public Act 101 requires that municipalities set some type of recycling standards in an effort to reduce waste going to landfills.

Gilbertsville, Pennsylvania is a subscription-based community. The City has developed a PAYT program (operated by local waste haulers) for small business in addition to operating a drop-off program four days per month in an effort to reduce the financial burden of recycling for the smaller businesses. Larger commercial businesses must contract recycling services through an independent waste hauler.

40-gallon bags are sold for \$2.00 per bag and bulky waste stickers sell for \$5.00.

Leaf and yard waste collection is seasonal and also PAYT.

All businesses are required to report the amount the type and amount of material recycled yearly. Businesses not complying with reporting mandates are sent a letter from the City attorney. Fines are rarely issued.

The drop-off program is very organized. Businesses are registered and type and amount of material is documented and entered into a database.

A community survey indicates that that the average weight of the 40-gallon trash bag is 21.5 pounds. Participation in the PAYT program averages 90 percent and the curbside recycling program participation is 97 percent. Recycling diversion rate is determined to be 37 percent from curbside program and 43 percent overall.

The program is operated solely from the sale of the waste bags.

Attachments:

- Annual Commercial Recycling Report
- Douglas County Solid Waste Ordinance
- Sample Letter Explaining Program
- Sample Letter Requesting Compliance

MANDATED RECYCLING ORDINANCE

Fairfax County, Virginia

Program Description:

Fairfax County is a subscription-based community. Waste haulers must be licensed in order to do business in the County. Waste hauling companies are required to provide and maintain recycling systems for all customers including residential, commercial businesses, and multi-family housing.

Elements of the program include source separation, collection, and transportation of all recyclable materials. Annual reports detailing sector (residential, commercial, multi-family), material type, and amount must be submitted by the waste hauler.

The mandatory ordinance also requires that commercial businesses employing 200 or more employees or companies that generate 100 tons of solid waste annually must recycle the principal recyclable material (PRM) that comprises the waste stream. For example, offices would be expected to recycle paper or corrugated cardboard and automotive-based companies would be required to recycle scrap metal.

Attachments:

Recycling Program Requirements
Recycling System Plan Worksheet

WEIGHT-BASED PLUS SERVICE COLLECTION PROGRAM

Oakland Park, Florida

Program Description:

Municipal crews using fully automated collection systems collect waste and recyclables in the City of Oakland Park, Florida. Initially, a representative from the Solid Waste Department will visit the facility requesting Dumpster/ curbside service in order to determine what size container will be required. At that time, a waste assessment is also completed to assist the business with developing a recycling collection plan.

Weekly collection of Dumpsters costs \$62.31 and disposal fees are based on a tipping charge of \$83.78 per ton. Waste is taken to and processed at the waste-to-energy facility.

96-gallon curbside carts are generally used by smaller businesses and cost \$26.26 for bi-weekly collection.

Recycling fees for all businesses costs \$2.04 monthly.

The weight-based system of collection provides documented confirmation of time, location, and weight of waste (in pounds). The “on-board” computer stores the net weight and information is downloaded into the main computer terminal at the end of each day. At the end of each month, the utility account is summarized and then billed to the customer.

Recycling and diversion rates information was requested.

MANDATORY SECTOR/ MATERIAL SPECIFIC RECYCLING

Gainesville, Florida

Program Description:

The City of Gainesville, Florida is a subscription-based municipality. However, waste haulers must be licensed in order to collect waste and recyclable material in the community.

Commercial generators such as office building, institutions, retail stores, hotels and motels, and restaurant and bars are required to recycle white paper and corrugated cardboard.

Generators of construction materials, including builders and developers, are required to recycle construction and demolition debris. The generators are also required to utilize a registrant that includes a commercial franchisee who has obtained a registration to collect recyclable material.

Failure to separate recyclable material from solid waste except in very small amounts will result in fines to the generator, waste hauler, or both.

Documentation may be required from a City-designated individual as proof of participation recycling and also delivery to an approved recycling facility.

Attachments:

Mandatory Recycling Ordinance

HAULER INCENTIVE PROGRAM

Thousand Oaks, California

Program Description:

As in the City of Alameda County, California, incentives and initiatives in Thousand Oaks to promote waste reduction is great.

The City reported a diversion rate of 66 percent in 1999. The percentage included 12,388 tons of recyclables and 17,320 tons of green waste through city-sponsored residential and commercial programs. The City's budget to operate these programs costs approximately \$700,000.00 - \$800,000.00 per year.

The City retains three exclusive waste haulers and many non-exclusive waste haulers. Two exclusive franchise waste haulers provide service to two sections of the residential sector. One exclusive franchise hauler provides service to the commercial sector. Non-exclusive franchise haulers provide temporary or short-term services such as dumpster rental.

Commercial businesses pay a flat rate of \$102.75 per month for one 3-yard container emptied one time weekly. Businesses receive a recycling container at 30 percent of the cost of the waste container. Businesses will receive an additional 10 percent reduction in the bill if 25 percent of the total tips are for recycling. The solid waste management fee is 8.25 percent of gross revenues and the franchise fees are 5 percent of gross revenues.

Another important opportunity in the fee area is the City's "transfer fee". In 1998, when ownership of a waste hauling company changed, the City received 1.5 million dollars.

A program to be implemented in the fall of 2002 will require that all waste haulers reach a certain diversion goal (35 percent for example) in order to operate in the City. It is hoped that this requirement will encourage waste haulers to be more proactive in assisting businesses to recycle.

Attachments:

Hauler Franchise Agreement/ Contract

MATERIAL BAN INITIATIVE

Orange County, North Carolina

Program Description:

The City of Chapel Hill together with Orange County contract with a company called Waste Industries to collect curbside recyclables from residences and small businesses in the towns of Carrboro, Chapel Hill, and Hillsborough.

A local ordinance has been adopted Countywide that bans corrugated cardboard from being disposed of in the landfill. As a result, most area businesses have corrugated collection provided separately, typically by private firms. Recent waste sort data indicate that less than 2% of the waste stream is corrugated cardboard.

Orange County has contracts with Orange Community Recycling (OCR), a private company, to collect recyclables from six staffed Orange County operated drop-off sites as well as four other non-staff municipal drop-off sites, and some commercial buildings including CH-Carrboro Town Offices. OCR's recycling services include an extensive collection program for glass from bars/restaurants. OCR also collects food waste from a number of area restaurants for delivery to the compost facility.

Tonnage delivered to local recycling facilities includes newspaper, magazines, white paper, mixed paper, corrugated cardboard, aluminum cans, steel cans, plastic, and glass. Most material is collected source separated. Waste Industries and Orange Community Recycling operate private recycling facilities that process the material.

Orange County and its member communities have adopted a solid waste plan that would increase the current recovery rate of 61% by the year 2006. Part of this aggressive initiative would be accomplished with development of a material recovery facility.

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