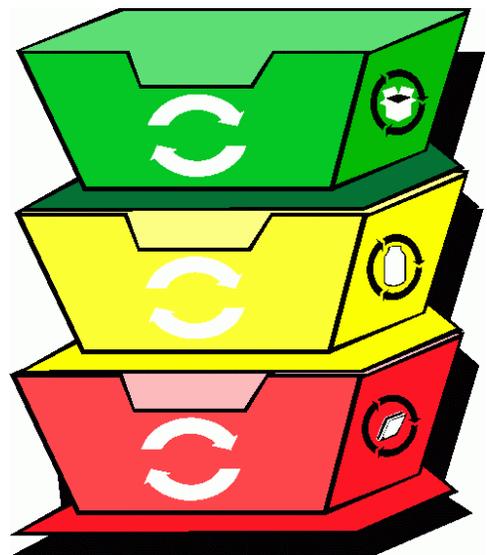


Clark County

Curbside Recycling

Feasibility Study



**CLARK COUNTY
CURBSIDE RECYCLING
FEASIBILITY STUDY**

FINAL REPORT

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CLARK COUNTY CURBSIDE RECYCLING FEASIBILITY STUDY

EXECUTIVE SUMMARY

INTRODUCTION

Clark County and their municipal partners are at a crossroads with their curbside recycling program. The recycling collection program in the unincorporated areas needs to be re-bid soon, which provides an opportunity to change the collection method. At the same time, the collection contractor has been informed that the current style of stacking recycling bins will no longer be available (although their current stockpile of bins will last through 2007). Many other programs in the Pacific Northwest and throughout the nation have converted to “single-stream” or other new approaches, raising the question as to how Clark County and their cities might benefit from that type of approach. The county’s processing contract provides for upgrading the recycling processing system in the near future, and this provides an opportunity to review the future collection system to ensure an effective fit. Altogether, these factors present an opportunity to make changes in the recycling program and to potentially re-design the entire system.

This report was prepared to address the design of the recycling system in Clark County. This study was conducted by a team of environmental and economic consulting firms: Green Solutions, Environmental Practices, Entrix, and Sound Resource Management Group.

OVERVIEW OF THE ANALYSIS

This study conducted two basic types of research:

1. **Benchmarking:** the performance of recycling programs in other areas similar to Clark County were researched for comparison (benchmarking) purposes. The Green Solutions Team researched other recycling programs that use a variety of collection methods, including:
 - (a) three-bin systems, such as used currently in Clark County;
 - (b) single-stream programs, where all materials are placed into one recycling container; and
 - (c) dual-stream programs, where two containers are used (typically one for glass and one for all other materials).

Two areas for each of these three approaches were researched and compared to Clark County’s programs. This comparison, and this study in general, only addresses the curbside programs for single-family homes in the urban areas (the cities and urban growth areas) of Clark County. In addition to collecting data on those areas, additional areas (“case studies”) were also researched to address specific issues.

2. Public Input: focus groups and phone surveys of Clark County residents were conducted to test customer satisfaction with the current program and their interest in alternative approaches. Six focus groups were held in Clark County to discuss and define the community’s opinions on recycling and convenience. In addition, 600 households participated in a telephone survey to further explore the customers’ views.

RESULTS

Program Performance: Table E-1 summarizes the results of the research of comparable areas. Three of the areas researched conduct their collections every other week, which reduces the collection costs but also reduces the amount of materials collected. In the bottom row of the table, the figures for those three areas were adjusted to provide an estimate of the amount of material that would be collected if the collections were conducted weekly.

Table E-1: Summary of Results for the Benchmarked Programs

Parameter	Clark County	Bellingham	Renton	Bellevue	Pierce County	Eugene	Tacoma
Type of Program	Three-bin	Three-bin	Three-bin	Single-Stream	Single-Stream	Dual-Stream	Dual-Stream
Start Date	1992	1989	1989	2004	2005	2004	1998
Subscription Basis ¹	Optional	Mandatory	Mandatory	Optional	Optional	Optional	Mandatory
Frequency	W	W	W	W	EOW	EOW	EOW
Size of Recycling Containers	3 – 11 gallon bins ²	3 - 14 gallon bins	3 - 14 gallon bins	32, 64 or 96 gallon cart	45, 64 or 96 gallon cart	95-gallon cart and 14-gal. bin	30, 60, or 90 gal. cart and 14 gal. bin
Average Income	\$53,752	\$45,139	\$55,720	\$87,120	\$54,972	\$49,933	\$37,879
Recycling Diversion Rate	25.9%	29.9%	20.4%	28.0%	NA	26.3%	17.6%
Waste Generation Rate, lb/HH/year	2,769	2,091	2,995	3,633	NA	2,767	3,483
Amount Collected, pounds/HH/year	716	625	610	1,035	524	728	611
Adjusted Amount, pounds/HH/year	716	625	610	1,035	691	961	807

Notes: W = weekly, EOW = every other week, lb = pounds, HH = household.

1. For the subscription basis, “mandatory” means that residents are required to subscribe to garbage collection services (with recycling offered as part of that service), not that residents are required to recycle.

2. Clark County recycling containers are 11.2 gallons in the urban areas and 18 gallons each in the rural areas (and collections are every other week in the rural areas).

As can be seen in Table E-1, the recovery rates for the three-bin programs are very similar, at 610 to 716 pounds per household per year. Bellevue's recovery rate is the highest, at 1,035 pounds per household per year, but their waste generation (3,633 pounds per household per year) is also the highest, indicating the impact of income level (Bellevue's average income is the highest of the areas researched) and other demographic factors. The dual-stream program in Eugene is the next highest program in terms of tonnages collected per household (once adjusted for weekly collection), and their recovery rate is almost as good as Bellevue's (Eugene's recovery is 93% of Bellevue's 1,035 figure). Tacoma's program also does well, especially since their program is mandatory (all residents are required to have garbage collection services and recycling is included with that). Results for both Tacoma and Pierce County are likely reduced by difficult demographic factors, including lower income levels for Tacoma (meaning many residents are struggling with more basic needs) and the rural nature of many parts of Pierce County.

Case studies are included in this study to explore specific impacts on the quantity and quality of collected materials. These studies address the impact of collection frequencies, landfill bans, and the performance of long-term single-stream collections as well as newly-converted single-stream programs.

Focus Groups: Six focus groups involving 51 residents from urban areas of Clark County were convened to discuss the citizens' motivation for recycling and to determine their preferences for potential future programs.

Based on the discussions at the focus groups, the major reasons for participating in recycling programs are:

- a moral obligation to protect the earth and the future.
- it is required by another family member or they are setting an example for others.
- it is included in their garbage bill and so they feel that they may as well participate.
- it lowers their garbage bill or their garbage can was full.

When asked which approach would be their preferred method:

- 62% chose a single-stream program.
- 28% chose a dual-stream program.
- 8% chose a single-stream program without glass.

Only one participant preferred the existing system, all other factors being equal. Giving up the opportunity to recycle glass curbside was so unpopular, however, that keeping the existing three-bin system was preferred by 62% if a new recycling program meant losing curbside glass collection.

Phone Surveys: Based on 600 surveys of households in urban areas of the county:

- 76% recycle a lot, 20% recycle some; 4% recycle little or none.
- 51% of the “recycle a lot” group do it because it is easy.
- 22% recycle for the environment.
- 58% would prefer using a cart (assuming no cost increase).
- 29% prefer the status quo.
- 79% would prefer to keep the current system over giving up curbside recycling of glass.

The results of the focus groups and phone surveys are slightly different for the question about giving up curbside collection of glass, but in both cases a clear majority would prefer to keep the current system rather than give up the opportunity to easily recycle glass.

CONCLUSIONS AND RECOMMENDATIONS

The big question faced by recycling programs currently is what to do with glass. There are no easy answers to this question. Glass is causing problems for the recycling of other materials, it is expensive to collect and handle, and the market value for it is very low or even negative (i.e., it costs money to have someone accept it for recycling). On the other hand, the public expects to be able to recycle it, and a big-picture perspective on the environmental value of recycling glass puts it in a more positive light.

The glass is especially a problem when mixed with the other materials (such as in a single-stream recycling program), but the public likes the convenience of being able to put all materials into a large cart with wheels. Simple rules and other convenience factors lead to more people recycling more materials.

Costs are also a consideration. Dual-stream and single-stream programs have lower collection costs but higher processing costs. Any change in the current recycling system in Clark County will lead to large expenses for new collection containers, vehicles and processing equipment. The recycling system in Clark County, however, is at a good point for making such investments. The County’s recycling contract needs to be re-bid soon, and the processing equipment used for most of the county’s recyclables (the processing system at West Van Material Recovery Center) is in need of upgrading and modifications anyway.

Based on the findings of this study, the dual-stream approach appears to offer the best combination of convenience to the participants, collection and processing costs, tonnages collected, and market value for the collected materials. This system should collect glass in a separate, smaller container, and all other materials can be commingled in a larger container. The container used for the commingled materials in this approach should be a 96-gallon cart with wheels and a lid, but 64-gallon and possibly smaller carts should also be available on request. The container for the glass should be an open bin that is 14 or 18 gallons, or possibly the bins used currently for the recycling program could be used for the glass.

SECTION ONE INTRODUCTION

OVERVIEW

This report analyzes the results of Clark County's current curbside recycling program and compares its performance to other recycling programs in the Pacific Northwest. The results of the focus groups and phone surveys that were conducted for this project are also discussed in this report.

This study was conducted by the environmental consulting firm Green Solutions, with assistance from Environmental Practices, Entrix, and Sound Resource Management Group.

BACKGROUND

Clark County and their municipal partners are at a crossroads with their curbside recycling program. On one hand, Clark's current recycling programs are stable and providing good results, but on the other hand there is the question about how they might be able to boost participation and recycling tonnages up to the next level. Many programs in the Pacific Northwest and throughout the nation have converted to "single-stream" or other new approaches, raising the question as to how Clark County and their cities might benefit from that type of approach. The cities of Camas and Washougal have indicated that they are very interested in moving to a cart-based recycling system due to concerns related to windy weather.

Provisions of the regional transfer and disposal contract allow for upgrading the processing system capabilities in the near future and this suggests a need to review the current and future collection strategies to ensure an effective fit. At the same time, the collection contractor has been informed that the current style of stacking recycling bins will no longer be available (although their current stockpile of bins will last through 2007). Altogether, these factors present an opportunity to make changes in the recycling program and to potentially re-design the entire system.

To address these questions, the Green Solutions Team researched other recycling programs that use a variety of collection methods in order to compare the performance of these different approaches. Focus groups and phone surveys were also conducted to determine customer satisfaction with the current program and their interest in alternative approaches.

This comparison, and this study in general, only addresses the curbside recycling programs for single-family homes in the urban areas (the cities and urban growth areas) of Clark County. Curbside recycling is also available in the rural areas of the county, although the program operates somewhat differently in those areas.

SECTION TWO

COMPARISON TO OTHER PROGRAMS

INTRODUCTION

The primary task of this project was to collect data from other areas for benchmarking purposes. Comparing the results from different programs in other areas can help highlight the reasons for higher or lower amounts of recyclables collected. The first step in this process was to select the other areas for benchmarking purposes, and then next to collect data on their performance.

SELECTION OF OTHER PROGRAMS FOR BENCHMARKING

The goal of this part of the study was to choose other areas that are as similar to Clark County (and its cities) as possible, in terms of demographics and recycling program design (collection frequency, types of materials collected, etc.), in order to allow direct comparisons for benchmarking purposes. Demographic factors such as household income and education levels are known to influence participation in recycling programs, but quantifying the impact of those influences is not practical due to the need to conduct extensive surveys and in-depth statistical analysis. Hence, differences between how Clark County and the other programs operate were instead minimized to the extent possible. To further minimize demographic differences, only areas in Washington and Oregon were chosen for benchmarking purposes. Programs in other states (especially in California and the Midwest) were considered, but eventually it was decided to stay within the Pacific Northwest for comparable areas.

Collection frequency and other program design factors are known to influence participation and tonnages recycled. In the case of collection frequency (weekly versus every other week), every effort was made to find areas with comparable demographics that also had weekly collections (most of Clark County has weekly collection), but finding perfect matches for each type of collection system wasn't possible. Some areas with every-other-week collections had to be used for benchmarking purposes. For this factor, however, the impact of weekly versus every-other-week collections can be estimated and adjustments were made to provide comparable results.

The final list of areas used for benchmarking purposes is shown in Table 1. Table 2 shows the materials collected in Clark County and in the other areas used for benchmarking purposes.

The rest of this section provides more information on the benchmarked programs, including garbage collection costs and waste diversion rates. It should be noted, however, that too much emphasis should not be put on the differences in garbage collection rates. The rates for garbage collection services can be affected by the embedded costs for recycling and for other activities, and can also be affected by the degree of subsidies between residential and commercial costs (commercial rates often subsidize residential rates to some degree). Rate information is primarily shown to demonstrate the amount of potential financial incentive for residents to reduce costs through recycling, rather than to reflect actual differences in costs.

Table 1: Areas Examined for Benchmarking Purposes

City/Area	Population	Average Household Income	Collection Frequency	Collection Methods and Materials	Comments / Notes
Local Area					
Clark County (including Vancouver)	403,800	\$53,752	W / EOW	3 bins (containers, newspaper, mixed paper), plus cardboard, oil, scrap metal, AF and HH batteries.	
Vancouver alone	157,500	\$41,636	W		
Areas using three-bin system (typically newspaper, glass and cans in separate bins, with other materials such as cardboard placed next to bins)					
Bellingham	74,500	\$45,139	W	3 bins (containers, newspaper, mixed paper), plus cardboard, oil, scrap metal, and vehicle batteries.	Residents pay \$7 for new or replacement bins, this may be reducing participation.
Renton	55,800	\$55,720	W	3 bins (containers, newspaper, mixed paper/cardboard).	
Areas using single cart (all materials in one container, with or without glass being collected curbside)					
Bellevue	117,100	\$87,120	W	All materials, inc. glass, in 32-, 64- or 96-gallon cart, plus small electronics/appliances and clothing on the side.	Program changed a few years ago (June 2004).
Pierce County	557,100 (exc. Tacoma and Ruston)	\$54,972	EOW	Glass collected through drop-off bins, all other materials in a single cart.	Program only recently implemented (carts delivered February through May, 2005) but has good data.
Areas with dual-stream systems (commingled materials in one container, glass and/or other materials in separate bin)					
Eugene	144,500	\$49,933	EOW	Glass in separate bin, plus oil and AF next to bin.	
Tacoma	195,900	\$37,879	EOW	Cart for commingled, glass and batteries (bagged) in separate bin.	Wide variety of materials accepted in cart.

Notes: Population figures are 2005 estimates and the average household incomes are from the 2000 census.
 Abbreviations: W = weekly, EOW = every other week, HH = household, AF = antifreeze.

Table 2: Materials Collected by the Benchmarked Programs

	Clark County	Bellingham	Renton	Bellevue	Pierce County	Eugene	Tacoma
Type of Program:	Three-bin	Three-bin	Three-bin	Single-Stream	Single-Stream	Dual-Stream	Dual-Stream
<u>Recyclable Materials</u>							
Paper:							
Cardboard ¹	x	x	x	x	x	x	x
Gift Wrap	x	x	x	x	x	x	x
Magazines/Catalogs	x	x	x	x	x	x	x
Mixed Paper	x	x	x	x	x	x	x
Newspaper	x	x	x	x	x	x	x
Polycoated ²	x	no	x	x	some	x	x
Shredded Paper	x	x	no	x	x	x	x
Telephone Books	x	x	x	x	x	x	x
Plastics:							
#1 bottles	x	x	x	x	x	x	x
#2 bottles, clear	x	x	x	x	x	x	x
#2, colored	x	x	x	x	x	x	x
Bottles 3-7	x	x	x	x	x	x	x
Tubs	no	no	no	x	no	x	x
Plastic bags	no	no	no	x	no	no	x
Other Plastic Film	no	no	no	x	no	no	no
5-Gallon Buckets	no	no	no	x	no	no	no
Glass Bottles:							
All 3 Colors Mixed	x	x	x	x	no		x
3 Colors Separated					no	x	
Metals:							
Aerosol Cans	x	no	x	no	no	no	x
Aluminum Cans	x	x	x	x	x	x	x
Tin Cans	x	x	x	x	x	x	x
Scrap Metal ³	x	x	no	x	no	no	no
Other:							
Antifreeze	x	no	no	no	no	no	no
Appliances (small)	no	some	no	x	no	no	no
Batteries, Car	no	x	no	no	no	no	no
Batteries, Household	x	no	no	no	no	no	x
Clothing	no	no	no	x	no	no	no
Electronics (small)	no	no	no	x	no	no	no
Motor Oil	x	x	no	no	no	x	no
Organics Collection Program							
Yard Debris	x	x	x	x	x	x	x
Food Waste	no	x	no	x	no	no ⁴	no
Compostable Paper	no	x	no	x	no	no ⁴	no

- Notes:
1. Cardboard typically must be flattened and in pieces smaller than 3' by 3'.
 2. Polycoated paper generally includes milk cartons and similar boxes, frozen food packaging, and juice boxes. For Pierce County, milk cartons are the only type of polycoated paper accepted.
 3. Scrap metals are generally required to be less than 2' in any direction, less than 35 pounds total, and with little or no non-metal contaminants.
 4. Food waste and compostable paper are collected every-other-week in a small test area in the City of Eugene.

The waste diversion rates shown in several of the tables are based on the total amount of wastes (garbage, recyclables and yard debris) generated in an area by the single-family homes only. In one case, an area could not report one of these figures (Pierce County for the amount of yard debris) and so the diversion rates, both the waste diversion rate in general and the recycling diversion rate, could not be calculated for that area because the total amount of waste generated is unknown. Yard debris figures for the other areas may be higher than normal for the past few years due to relatively warm and wet weather as well as other factors. If the amount of yard debris is unusually high, then the overall waste diversion rates shown in this report may be difficult to sustain in the future.

THREE - BIN PROGRAMS

Clark County

The three-bin system used in Clark County was initiated in 1989 as a pilot program, and then it went countywide in 1992. The recycling collection system is similar throughout most of the cities and urban areas of the County, and the separation requirements have been in place since the beginning of the program. The program guidelines request that materials be set out with:

- newspaper in one bin;
- mixed paper in a second; and
- all containers (plastic bottles, glass, tin cans, aluminum cans, aerosol cans, milk cartons and juice boxes) in a third bin.

The bins are manually loaded onto one truck that is divided into three compartments. Cardboard is also collected curbside, but is supposed to be placed near the bins, not in them. Motor oil, antifreeze, batteries and scrap metal are also accepted by the recycling program by being placed next to the bins, and these are collected with the same truck.

These materials are collected by Waste Connections, Inc. in most of the county. Waste Control, Inc. collects garbage and recyclables in Woodland, only part of which is in Clark County. Recyclable materials collected by Waste Connections are delivered to the processing facility operated by Columbia Resource Company (CRC, a division of Waste Connections) at the West Van Material Recovery Center. The drivers empty each compartment of the truck into different bays at the facility, thus keeping the streams separate.

Newspapers are typically shipped directly to market without processing (although on a rare occasion the newspaper is run across the sort line to remove contaminants). The mixed waste paper is typically run across the sort line to remove non-paper contaminants (which are either added to the correct recycling stream or discarded, depending on the material). The containers have a multi-tiered mechanical and manual sorting system that produces separate streams of glass, tin, aluminum, milk jugs, pop bottles, milk cartons and drink boxes, colored HDPE bottles, and all other plastic bottles.

Table 3 shows residential garbage collection and recycling rates in Clark County, including the municipalities and the urban growth area (UGA) for the county. Not shown in the table are Washougal, which structures their rates somewhat differently, Woodland and the rural unincorporated areas of Clark County. Washougal's rates are \$15.90, \$11.66 and \$8.80 per month for weekly, every-other-week and monthly collection of a 40-gallon cart (excluding tax but including the cost of recycling). Garbage collection is optional in Battle Ground and the Clark County UGA, but mandatory in the other cities. Subscription to recycling services is included with the garbage rates for Vancouver, Washougal and Clark County UGA residents but it is optional for the other cities and for the rural areas of the county.

Table 3: Residential Garbage Rates in Clark County

Cart Size ¹	Collection Frequency	Monthly Charges, 2006 (without recycling)				
		Battle Ground	Camas	Ridgefield	Vancouver	Clark County ²
32-gallon	Once monthly	\$4.51		\$5.60	\$6.17	\$4.51
20-gallon	EOW	\$7.28			\$8.23	\$7.28
20-gallon	Weekly	\$9.55		\$9.17	\$10.29	\$9.55
32-gallon	EOW	\$8.29	\$9.25	\$9.15	\$10.29	\$8.29
32-gallon	Weekly	\$12.08	\$14.12	\$11.01	\$13.72	\$12.08
64-gallon	EOW				\$13.72	
64-gallon	Weekly	\$17.52	\$18.95	\$16.82	\$27.44	\$17.52
96-gallon	Weekly	\$25.90	\$25.70	\$22.65	\$41.16	\$25.90
Recycling ³	Weekly	\$3.07	\$2.90	\$2.59	\$2.63	\$3.07

Notes: Costs shown above do not include taxes or extra charges that may apply.

1. Depending on the service area, the 64-gallon and 96-gallon service levels may consist of carts that are approximately that size, or may be based on the corresponding number of 32-gallon cans.
2. Rates shown for Clark County are for the urban growth area.
3. Recycling costs are normally either included (embedded) in the garbage rates (for Vancouver, Washougal and Clark County UGA) or are optional (Battle Ground, Camas and Ridgefield). Rates are not shown for rural Clark County, Washougal or Woodland.
EOW = every-other-week collection.

The number of single-family households in the cities and other areas of Clark County are shown in Table 4.

The breakdown of the sorted materials recovered from the single-family curbside program is shown in Table 5. The two types of glass shown in Table 5 include whole glass bottles, which are sorted by color and sold to markets that make new bottles, and broken glass that contains a mixture of colors and is suitable primarily for construction applications.

The results of Clark County's curbside recycling program are summarized in Table 6. The first three rows of Table 6 show the total population figures for Clark County (i.e., all areas of the county). Subsequent rows in the table show data that is only for the urban areas of the county.

Table 4: Number of Single-Family Homes in Clark County

Parameter	Single-Family Households, 2005
Cities:	57,851
Battle Ground	4,526
Camas	5,745
La Center	797
Ridgefield	1,057
Vancouver	41,413
Washougal	3,886
Woodland (part)	45
Yacolt	382
Unincorporated Areas:	64,173
Clark County, Urban Growth Area	42,436
Clark County, Rural Area	21,737
Total	122,024

Table 5: Composition of Material Recovered from Single-Family Households in Clark County

Material	Percentage Recovered (by weight)	Recovered Amount by Household, lb/HH/month
Paper:	73.43%	43.82
Cardboard	8.26%	4.93
Milk Cartons, Drink Boxes	0.15%	0.09
Mixed Paper	36.79%	21.95
Newspaper	28.23%	16.85
Metals:	3.61%	2.15
Aluminum Cans	0.89%	0.53
Tin Cans	2.72%	1.62
Plastic:	4.42%	2.63
PET Bottles	2.15%	1.28
HDPE Bottles, natural	1.13%	0.67
HDPE Bottles, colored	1.14%	0.68
Glass:	12.28%	7.33
Glass Bottles	5.79%	3.46
Broken Glass	6.49%	3.87
Other:	NA	NA
Motor Oil and Scrap Metal	0.84%	0.50
Rejects	5.41%	3.23
Total	100.0%	59.68

Notes: Percentage figures are from the 2006 West Van Allocation Study. Recovered amounts are based on those percentages, 79,082 garbage customers in the urban area, and 28,316 tons per year from the urban area curbside recycling program.

Table 6: Recycling Program Performance in Clark County

Parameter	Clark County, 2005
Total Population, 2005 ¹	391,500
Total Households, 2005 ¹	156,200
Total Single-Family Homes, 2005 ²	122,024
Number of Garbage Accounts, Dec. 2005, Urban Areas only (A)	79,082
Number of Recycling Accounts, Urban Areas only, Dec. 2005	74,727
Annual Curbside Recycling Tonnage, Urban Areas only, 2005 (B)	28,316 tons
Pounds Recycled per Household per Year, Urban Areas only, (B*2000/A)	716 lb/HH/yr
Annual Waste Tonnage (C) ³	56,470 tons
Annual Yard Debris Tonnage (D)	24,708 tons
Single-Family Diversion Rate [(B+D)/(B+C+D)]	48.4%
Single-Family Recycling Rate [B/(B+C+D)]	25.9%

- Notes:
1. From the Washington State Office of Financial Management (OFM).
 2. From Clark County's Solid Waste Data Report (see also Table 4).
 3. Annual waste tonnage was calculated based on the single-family portion of Clark County's waste stream (32.8%, from the 2003 Waste Composition Study), times the 2005 waste stream (265,690 tons), and then prorated for the number of garbage accounts in the urban areas (64.8% of the single-family households).

Bellingham

Bellingham, the largest city in Whatcom County, Washington, has had residential curbside recycling service since 1982 in many neighborhoods and citywide since 1989. Their three-bin system collects:

- newspaper in one bin,
- mixed paper in a second, and
- bottles and cans in a third bin.

Cardboard and brown paper bags are collected when flattened and stacked next to the recycling bins. Motor oil is collected when placed in a sealed non-breakable container such as a milk jug. A maximum of 35 pounds of scrap metal per pickup is collected if it is 24 inches long or less. Several years ago the city discontinued collecting household batteries and added plastic bottle collection. Collection of household batteries was initially begun when Recomp's solid waste

composting facility experienced difficulty in meeting metals standards, and it was later discontinued due to its high cost when the composting facility closed and there was no longer a compelling reason to divert batteries.

Yard debris is collected every other week in a 60-gallon cart. The yard debris program also began accepting food waste and compostable paper as of June 1, 2005. Acceptable food waste includes fruit and vegetable scraps, meat, fish, dairy, paper cartons (milk, frozen food, etc.), paper napkins and plates, pizza boxes, deli takeout containers, and coffee filters and grounds. The yard debris/food waste collection program costs an additional \$8.00 per month.

Garbage collection rates in Bellingham are established by city ordinance. Services are provided by Sanitary Service Company and its subsidiary, Recycling Services, Inc. Garbage collection is mandatory in the sense that everyone must pay for it, and the cost of the recycling program is embedded in the cost for garbage collection. Rates are shown in the following table.

Table 7: Residential Garbage Rates in Bellingham

Container Size	Collection Frequency	Cost of Garbage Service
32-gallon can	Monthly	\$5.70
60-gallon cart	Weekly	\$26.92
	EOW	\$14.70
	Monthly	\$8.22
	Weekly	\$40.21
90-gallon cart	EOW	\$23.25
	Monthly	\$14.36

Notes: The above figures do not include taxes, but do include the cost of recycling.
Only a monthly rate is offered for the 32-gallon can.

Recyclables are collected weekly in Bellingham using manually-loaded Eager Beaver trucks. Sanitary Service Company (SSC) takes the recyclables to Northwest Recycling, which is a material recovery facility (MRF) that is independent of SSC. SSC provides each new customer with instructions for setouts. This two-page letter is shown in Appendix A. Whatcom County distributes a quarterly newsletter to all customers, and an example of a recent newsletter is also shown in Appendix A.

The results of Bellingham’s curbside recycling program are summarized in Table 8. No changes to the Bellingham program are anticipated in the immediate future.

Table 8: Recycling Program Performance in Bellingham

Parameter	Bellingham, 2005
Total Population, 2005 ¹	72,320
Total Households, 2005 ¹	32,751
Total Single-Family Homes, 2005 ²	21,750
Number of Garbage Accounts, Dec. 2005 (A)	17,693
Number of Recycling Accounts, Dec. 2005	17,693
Annual Curbside Recycling Tonnage, 2005 (B)	5,533 tons
Pounds per Household per Year (B*2000/A)	625 lb/HH/yr
Annual Waste Tonnage (C)	12,219 tons
Annual Yard Debris Tonnage (D)	750 tons ³
Single-Family Diversion Rate [(B+D)/(B+C+D)]	34.0%
Single-Family Recycling Rate [B/(B+C+D)]	29.9%

- Notes:
1. From the Washington State Office of Financial Management (OFM).
 2. Number of single-family households was estimated based on the total number of households for 2005 and the Census 2000 breakdown for the percentage (66.4%) of single-family homes (1-4 units).
 3. Tonnage shown for yard debris (750 tons) includes some food waste and compostable paper.

Renton

The City of Renton provides a three-bin recycling program to their single-family homes through a combined garbage/recycling contract with Waste Management. The collection frequency is weekly (same day as garbage collection). The program is mandatory in the sense that everyone must pay for it, as they must subscribe to garbage collection services and the cost of the recycling program (and weekly yard waste collection) is embedded in the cost for garbage collection. The rates for residential service are shown in Table 9.

Table 9: Residential Garbage Rates in Renton

Garbage Service Level	Monthly Garbage Charge
Mini-can (20 gallons)	\$6.40
1 32-gallon can	\$13.44
2 32-gallon cans	\$27.75
3 32-gallon cans	\$41.63

Note: The above figures do not include taxes, but do include recycling costs.

As can be seen in Table 9, the rates in Renton are linear. Linear rates help to encourage recycling more than rates that are based strictly on cost-of-service calculations.

The three bins used for the recycling program in Renton are for:

- newspapers and inserts;
- mixed paper, including cardboard; and
- bottles and cans (glass, plastic and metal).

The recyclable materials are collected by Waste Management and taken to their processing facility, the Cascade Recycling Center, in Woodinville (about 25 miles away). The Cascade Recycling Center was built in 2003 at a cost of \$22 million. The facility is located on a property that is 6.25 acres and includes:

- an 82,000 square foot building, of which 52,200 square feet is the tipping floor and processing area;
- eight loading docks;
- separate Mettler-Toledo scales for inbound and outbound traffic;
- conveyors and screens by CP Manufacturing, California;
- bunkers with walking floors that feed into balers; and
- various other pieces of equipment such as a magnetic belt, air classifiers, eddy current classifiers and balers.

The Cascade Recycling Center has a design capacity of 28 tons per hour for residential single-stream, 20 tons per hour for commercial mixed fiber and 10 tons per hour for construction and land clearing debris. The construction debris is processed in a separate part of the facility. For residential and commercial materials, the incoming recyclables are pushed onto an in-floor conveyor, which carries them past a load leveler, then to a pre-sort conveyor where garbage and bulky items are manually removed. After that, a combination of screens and other equipment separates paper and the other materials. Glass is purposely broken, then screened out, run past an air classifier to remove shredded paper, and then marketed as a road aggregate substitute. The Cascade Recycling Center was one of four facilities in the Puget Sound region examined in a recent study for King County (see the “Processing Issues” section near the end of this chapter).

Table 10 summarizes the recycling program performance for Renton for 2005.

Table 10: Recycling Program Performance in Renton

Parameter	Renton, 2005
Total Population, 2005 ¹	56,840
Total Households, 2005 ¹	26,580
Number of Garbage Accounts, Dec. 2005 (A)	13,354
Number of Recycling Accounts, Dec. 2005	13,354
Annual Curbside Recycling Tonnage, 2005 (B)	4,075 tons
Pounds per Household per Year (B*2000/A)	610 lb/HH/yr
Annual Waste Tonnage (C)	9,486 tons
Annual Yard Debris Tonnage (D)	6,435 tons
Single-Family Diversion Rate [(B+D)/(B+C+D)]	52.7%
Single-Family Recycling Rate [B/(B+C+D)]	20.4%

Note: 1. From the Washington State Office of Financial Management (OFM).

SINGLE – STREAM PROGRAMS

Single-stream recycling refers to programs that collect all materials in one container, also known as “commingled” recycling. One of the single-stream programs researched for this report includes glass in the mixture of recyclables (Bellevue), and the other (Pierce County) collects glass through drop-off sites distributed throughout the county.

Bellevue

The City of Bellevue started their curbside recycling program in 1989 using a three-bin system typical of programs at that time. They began a new single-stream recycling program on June 28, 2004 after significant research and an extended bidding process. The new recycling program is part of a combined contract that also includes yard debris and garbage collection. For single-family households (buildings with one to four units), recycling collections are now conducted using a 96-gallon blue wheeled cart (32- or 64-gallon carts are also available). Garbage, recyclables and yard debris are all picked up on the same day of the week, every week, and all three are fully automated (unless the customer is using their own garbage cans). Subscription to garbage or recycling service is not mandatory in the City of Bellevue, although the subscription rate for garbage collection services is very high for an optional program (an estimated 80% of the single-family households subscribe to garbage services). In addition, up to 99% of the households that subscribe to garbage collection are also subscribing to curbside recycling (although this figure is based on the number of households that did not return the recycling cart after all garbage customers were given the carts).

In addition to switching the recycling program from a three-bin approach to single-stream, the new contract:

- expanded plastic collection to include all types of plastic bottles and containers (it was previously types 1 and 2 only);
- added electronics, small appliances and clothing (these materials are to be bagged separately, unless too large for bagging, and placed next to the collection cart);
- changed yard debris collection to weekly (it was previously every other week); and
- added food waste to the yard debris collection program.

A complete listing of the materials collected by the Bellevue program is shown in Table 2.

In September and October, 2005, several loads of recyclables were sampled and tested for the composition of the materials being collected. The results of these tests are shown in Table 11.

Table 11: Composition of Bellevue Recyclables

Material	Single-Family	Multifamily	Commercial
Paper:	75.5%	78.5%	93.3%
Cardboard	14.0%	17.6%	69.4%
Polycoated	1.2%	1.2%	0.1%
Mixed Paper	35.8%	33.9%	18.1%
Newspaper	24.5%	25.9%	5.7%
Metal:	2.9%	2.0%	0.5%
Aluminum Cans	1.2%	0.9%	0.1%
Tin Cans	1.5%	0.9%	0.4%
Scrap Metal	0.2%	0.2%	0.01%
Plastics:	6.4%	5.8%	1.4%
Bottles #1 and #2	4.0%	3.5%	0.6%
Other Containers	1.0%	0.8%	0.2%
Bags and Film	1.4%	1.5%	0.6%
Buckets	0.0%	0.0%	0.0%
Glass Bottles	12.3%	9.2%	0.9%
Garbage	2.8%	4.4%	3.9%
TOTALS	100.0%	100.0%	100.0%

Note: All figures are percent by weight.

Analysis by Bellevue staff has concluded that the contract has resulted in increased recycling and organics tonnages, and decreased garbage volumes. Comparing the first full year of the new program (July 2004 through June 2005) to the previous year (July 2003 to June 2004), single-

family garbage tons decreased from 19,952 tons to 18,535 tons, a decrease of 7.1%. The increase in recycling was even larger (15.7%), from 12,057 tons to 13,946 tons. Significant increases in plastics and polycoated paper contributed to the overall increase in recycling. Bellevue staff also feel that the collection of small appliance and electronics has been successful, with hundreds of computer monitors, TVs and other appliances being collected. The program collected 70.5 tons of these items during its first year (5.9 tons per month).

On the multifamily side, however, there was little change. Garbage increased 2.8% from 14,295 tons to 14,701 tons while recycling decreased slightly (1.5%) from 2,377 to 2,340 tons. The decrease in recycling continues the slight downward trend that has occurred over the past few years for the multifamily customers in Bellevue. Recycling collections from multifamily buildings are conducted using the same blue carts used for single-family (64- or 96-gallon carts), or dumpsters one to eight cubic yards in size, or 10 to 40 cubic yard roll-off containers, depending on the preferences and needs of the apartment owner or manager.

The possibility of increased contamination of recyclables was a concern during the city's consideration of single-stream recycling. Commingled recycling did result in an increase in contaminants collected by the single-family program, but not at unacceptably high amounts. Under the three-bin system, the average contamination rate was 1.9%. During the first year of the new commingled recycling program, the contamination rate averaged 2.95%. Total contaminants for the year were 412 tons, but overall recycling increased by 1,900 tons.

The single-family customers in Bellevue are saving money over previous years because of increased recycling and lower rates. The combination of downsizing and the lower rates offered by the new contract at all residential service levels has generated significant cost savings for customers. Downsizing of container sizes and service levels is saving Bellevue residents \$50,000 annually. The new package of services has resulted in many people shifting to the mini-can, Bellevue's smallest level of service. Mini-can usage increased by 34% from 3,350 subscribed customers at the end of 2003 to 4,496 subscribers at the end of June 2005. Concurrently, every other service level decreased. The total number of customers over all service levels increased by 350. The trend in recent years had been for customers to shift their can size upwards to larger containers, but customers have reversed this trend and have been downsizing their garbage containers since the new contract was implemented. The downsizing of garbage levels seems to be the result of increased recycling participation.

Current rates for garbage collection services in Bellevue are shown in Table 12. Residents are not required to subscribe to garbage collection, and they may also use their own garbage can if they do subscribe. Allied Waste will provide a cart for garbage at no charge and charges are slightly less for their cans (since collection costs are lower when households use a cart designed for automated collection). Containers for recycling and yard debris (one per household) are provided as part of the garbage service. Only weekly service is available (no every-other-week or monthly service is provided), but a mini-can level of service is provided for those households that produce less garbage.

The recyclable materials are collected by Allied Waste Services (see Figure 1) and taken to the Rabanco Recycling Center in Seattle (about 15 miles away). The carts are collected using an

Table 12: Residential Garbage Rates in Bellevue

Garbage Service Level	Monthly Garbage Charge	
	Private Can	Hauler's Can
Mini-can (20 gallons)	\$8.60	\$8.60
1 32-gallon can	\$15.44	\$15.38
1 64-gallon cart (or 2 cans)	\$21.21	\$21.16
1 96-gallon cart (or 3 cans)	\$26.10	\$24.27
Recycling Only		\$3.79
Yard Debris Only		\$5.90

Note: The above figures do not include taxes, but do include recycling costs.

automated truck. The additional materials allowed by Bellevue's recycling program (small appliances, clothing and electronics) are collected using a separate truck that is sent out in response to a call from the customers or from the driver of the recycling truck. These materials are consolidated at Allied Waste's office/truck facility in Bellevue and then sent to markets or picked up by other recycling companies when a full load is accumulated.

Figure 1: Recycling Collections in Bellevue



Photo courtesy of Allied Waste Services.

Allied Waste reports that the recycling program is doing well and that there are no specific problems collecting or processing Bellevue’s recyclable materials. One problem that they are having with several of the recycling programs, however, is litter and other issues caused by shredded paper at the processing facility. Because of these problems, Allied Waste is asking customers to bag shredded paper in clear plastic bags (so that the paper can be identified and the bags emptied at the processing facility) or to place small amounts in the yard debris carts. Their market for the yard debris, Cedar Grove Composting, prefers only small amounts of shredded paper due to the contamination (such as shredded plastics and other non-compostable materials) carried by it.

Other issues experienced by Puget Sound MRFs in general are addressed by the 2006 Material Recovery Facility Assessment prepared for King County. The Rabanco Recycling Center was one of four facilities in the Puget Sound region examined by this study (see the “Processing Issues” section near the end of this chapter for more information).

The following table summarizes the recycling program performance for Bellevue for 2005.

Table 13: Recycling Program Performance in Bellevue

Parameter	Bellevue, 2005
Total Population, 2005 ¹	115,500
Total Households, 2005 ¹	52,120
Total Single-Family Homes, 2005 ²	33,720
Number of Garbage Accounts, Dec. 2005 (A)	26,683
Number of Recycling Accounts, Dec. 2005	26,397
Annual Curbside Recycling Tonnage, 2005 (B)	13,805 tons
Pounds per Household per Year (B*2000/A)	1,035 lb/HH/yr
Annual Waste Tonnage (C)	16,910 tons
Annual Yard Debris Tonnage (D)	17,752 tons
Single-Family Diversion Rate [(B+D)/(B+C+D)]	65.1%
Single-Family Recycling Rate [B/(B+C+D)]	28.5%

- Notes:
1. From the Washington State Office of Financial Management (OFM).
 2. Number of single-family households was estimated based on the total number of households for 2005 and the Census 2000 breakdown for the percentage (64.7%) of single-family homes (1-4 units).

Pierce County

After much debate and citizen outreach, Pierce County eliminated glass from their curbside recycling programs in 2005. Recycling programs in Pierce County had previously used a three-bin approach with every-other-week collections. A set of three 14-gallon stacking bins were used

to collect newspaper, cans and glass, with mixed paper and cardboard collected if bagged and set next to the bins. Plastic bottles were collected only through drop-off sites. In early 2005, the recycling program was changed to a cart-based system and glass is no longer collected at the curb, but is instead being collected through central drop-off sites. This change does not affect the City of Tacoma, which operates their own garbage and recycling collection programs (see a later section for more details about Tacoma's program). The City of Ruston and the two military bases (McChord AFB and Fort Lewis) also have separate garbage and recycling programs (Ruston still uses a three-bin recycling program), and so are not included in the analysis for Pierce County. Altogether, 21 towns and cities (all except Tacoma and Ruston), as well as the unincorporated areas, are included in the program for Pierce County.

The actual implementation date of the new curbside system varied a bit depending on the area, but glass collections ceased in February 2005 and all areas were issued new carts by June 2005. The primary cart used in Pierce County is a 96-gallon cart with instructions imprinted on the lid (see Figures 2 and 3). This cart is serving the needs of more than 90% of the customers. Depending on the service area, only about 5-10% are using a smaller cart (65-, 45- or 32-gallon carts are available on request), or even continuing to use their three bins. The City of DuPont began with all 45-gallon carts due to outdoor storage restrictions and small garages, and this approach is reportedly reducing the amount of cardboard collected in that area. The haulers feel that the instructions printed on the lids of the carts have helped address recycling questions and reduce contamination, although the imprinted information has already begun to wear off (the haulers report that some of the colors are especially prone to washing off and so they are no longer spray-washing the lids).

The new program is collecting more of all materials except glass. The composition of the materials collected curbside is shown in Table 14.

Based on a comparison of nine months of the previous program (June 2004 through February 2005) to nine months of the new program (June 2005 through February 2006), Pierce County staff calculate that the new program is collecting from 69% to 191% (depending on the material) more paper and metal cans. Much of this increase apparently is the result of increased recovery from existing subscribers, but the haulers also report an increase in the number of customers. The haulers report a 5% increase in their overall customer base, and a 6.9% increase in the number of recycling customers.

Initially, there were about 30 sites collecting glass, including transfer stations, fire stations, haulers' offices, and other locations. Recently, however, one or two of the sites have been closed due to litter and the other problems that are common to drop-off sites (see Figure 4). Another problem with drop-off sites is the uncertainty of the source of the material. Clearly, some portion of the glass collected at the Pierce County drop-off sites is being generated by commercial and multifamily sources and so shouldn't be counted towards the performance of the curbside program, although the non-residential portion is probably relatively small. Some glass is probably also coming from outside of the Pierce County service area (such as from Tacoma or King County). More importantly, a significant portion of the glass is being delivered to the drop-off sites by residents who do not subscribe to curbside garbage and recycling services. For the figures used in this report, the amount of glass attributed to the curbside program has been

Figure 2: Recycling Cart used in Pierce County



Photo courtesy of Pierce County Solid Waste Division.

Figure 3: Label for Pierce County Recycling Cart



Photo courtesy of Pierce County Solid Waste Division.

Table 14: Composition of Curbside Materials in Pierce County

Material	Current Program				Previous Program	
	Curbside Collections Only		Curbside plus Glass Drop-Off Sites			
	Amount, lb/HH/mo ¹	% by Weight	Amount, lb/HH/mo ¹	% by Weight	Amount, lb/HH/mo ²	% by Weight
Paper:	39.72	90.3%	39.72	85.8%	21.64	79.4%
Cardboard	11.91	16.7%	11.91	15.9%	1.82	6.7%
Mixed Paper	20.44	46.5%	20.44	44.2%	12.91	47.4%
Newspaper	7.37	27.1%	7.37	25.7%	6.91	25.4%
Metals:	1.86	4.2%	1.86	4.0%	0.98	3.6%
Aluminum Cans	0.75	1.7%	0.75	1.6%	0.29	1.0%
Tin Cans	1.11	2.5%	1.11	2.4%	0.69	2.5%
Plastic	1.53	3.5%	1.53	3.3%	0	0%
Glass	NA	NA	2.27 ³	4.9% ³	4.25	15.6%
Garbage	0.88	2.0%	0.88	1.9%	0.39	1.4%
Total	44.00	100.0%	46.27	100.0%	27.26	100.0%

- Notes: 1. Recovered amounts per household are based on 142,631 garbage customers in May 2006.
 2. Recovered amounts per household for 2004 are based on 119,637 garbage customers in May 2004.
 3. Amount of glass for current program is based on an average of 162 tons per month of additional glass received at drop-off sites.

Figure 4: Drop-Off Container for Glass in Pierce County (Buckley Site)



decreased by the amount of glass that was already being collected at the transfer stations (58 tons per month in 2004) prior to the program conversion.

The contamination rate for the curbside materials in the new program is reported to be fairly low, at 2% typically with a high of 3% contamination one month. Observations of the glass drop-off sites found this material to be very clean, with only the occasional piece of paper product (such as 6-pack cartons) in the bins or non-recyclable material placed near the bins (such as can be seen in Figure 4).

Waste collection programs in Pierce County offer a reduced rate for households that make a commitment to participate in the recycling program. Those households that subscribe to garbage collection services and that sign up for recycling are charged \$1.00 less per can per month than the same level of service for households that do not sign up for recycling, although actual participation is not monitored (see Table 15).

Table 15: Residential Garbage Rates in Pierce County

Garbage Service Level	Collection Frequency	Monthly Charges			
		American Disposal	Murrey's Disposal	Pierce County Refuse	University Place Refuse
Recycling Only	EOW	\$5.85	\$5.85	\$5.35	na
Mini-can (20 gallons)	Weekly, with recycling	\$16.22	\$16.22	\$9.82	\$9.95
Mini-can (20 gallons)	Weekly, no recycling	\$17.22	\$17.22	\$10.82	\$10.95
One 32-gallon can	Weekly, with recycling	\$18.56	\$18.56	\$12.05	\$11.43
One 32-gallon can	Weekly, no recycling	\$19.56	\$19.56	\$13.05	\$12.43
One 32-gallon can	Monthly, with recycling	\$14.33	\$14.33	NA	\$5.87
Two 32-gallon cans	Weekly, with recycling	\$24.20	\$24.20	\$17.92	\$15.27
Two 32-gallon cans	Weekly, no recycling	\$26.20	\$26.20	\$19.92	\$17.27
Three 32-gallon cans	Weekly, with recycling	\$30.96	\$30.96	\$23.89	\$19.21
Three 32-gallon cans	Weekly, no recycling	\$33.96	\$33.96	\$26.89	\$22.21
Yard Debris	EOW	\$4.30	\$4.30	\$5.10	\$3.95/\$4.95

Notes: The above figures do not include taxes.

The haulers shown above are certificated haulers in the unincorporated areas of the county, and not shown are the two city contract areas, University Place and Fircrest. Murrey's Disposal is owned by Waste Connections and Pierce County Refuse is owned by Harold LeMay Enterprises.

All recycling services are every-other-week, and garbage services are as indicated in the collection frequency column.

Rates for four, five, and six cans of garbage per week are available but are not shown above.

With the new program, 93% of the garbage customers are signed up for recycling, which is up from 88% prior to the switch. The haulers report that 60 to 65% of the recycling customers set out their containers each time, but that many customers only need to set out the container once per month due to the larger container size.

The initial start-up expenses for the new program were \$1.67 per household per month, but the additional market revenues from the increased recycling tonnages (plus the avoidance of the cost of handling glass), has almost completely offset this amount. Residents are paying between \$0.29 and \$0.59 per month more for the new program.

Materials collected from Pierce County are processed primarily by SP Recycling and Tacoma Recycling. Both facilities accept the commingled materials from Pierce County collections, as well as source-separated materials collected from a variety of other sources. Recyclable materials handled by SP Recycling are currently either being baled and shipped to market (for source-separated materials) or transferred to their facility near Portland (for commingled

Table 16: Recycling Program Performance in Pierce County

Parameter	Pierce County, 2005
Total Population, 2005 ¹	557,100
Total Households, 2005 ¹	221,910
Total Single-Family Homes, 2005 ²	183,100
Number of Garbage Accounts, Dec. 2005 (A)	139,400
Number of Recycling Accounts, Dec. 2005	129,700
Annual Curbside Recycling Tonnage, 2005 ³	34,576 tons
Glass Drop-Off Tonnage, 2005 ^{3,4}	1,944 tons
Total Curbside and Glass Drop-Off Tonnage (B)	36,520 tons
Pounds per Household per Year Recycled (B*2000/A)	524 lb/HH/yr
Pounds of Glass Recycled per Household per Year	27.9 lb/HH/yr
Annual Waste Tonnage (C) ³	125,003 tons
Annual Yard Debris Tonnage (D)	NA
Single-Family Diversion Rate [(B+D)/(B+C+D)]	NA
Single-Family Recycling Rate [B/(B+C+D)]	NA

- Notes:
1. From the Washington State Office of Financial Management (OFM), excluding Tacoma and Ruston.
 2. Number of single-family households was estimated based on the total number of households for 2005 and the Census 2000 breakdown for the percentage (82.5%) of single-family homes (1-4 units and mobile homes).
 3. Tonnage figures for 2005 are from June 2005 through May 2006 (the first full year of the new program).
 4. Glass tonnage is based on an average of 220 tons per month (TPM) for the first 12 months of the new program, minus the 58 TPM previously delivered to transfer stations for a net 162 TPM, times 12 months.

materials). These materials are being handled at a new facility in Frederickson (southeast of Tacoma), and the commingled materials will be processed there when a new sorting line is installed. SP Recycling is currently accepting materials collected by LeMay Enterprises from their collection areas of Pierce County and will also accept materials collected by LeMay in Thurston County when that county switches to commingled recycling in 2007.

Tacoma Recycling processes the recyclable materials collected by Waste Connections from their areas of Pierce County. JMK Fibers, LLC also handles some of the materials from Pierce County programs.

One of the processors for Pierce County materials reports that there is still some glass in the commingled materials they receive, but an exact figure for that amount is not available. The collection crews have been working with their customers to eliminate glass from the curbside collection routes, and this may have contributed to the increase observed in the amount of glass being brought to the drop-off sites after the first eight months of the new program. Part of that increase could also be due to a lag time in accumulations of enough glass to warrant a trip to a drop-off site and also a delay caused by households needing to switch to a different system.

Table 16 summarizes the recycling program performance for Pierce County for 2005.

DUAL – STREAM PROGRAMS

The following two programs (Eugene and Tacoma) collect glass in one container and all other recyclables in a separate container.

Eugene

In 1984, the City of Eugene awarded contracts to several haulers to provide services in the city. Today, four of those haulers (Sanipac, Lane-Apex, Royal Refuse, and Countryside Disposal) are still doing business in Eugene and Lane County. In May 1990 they began the residential curbside recycling service. This program began collecting an extensive list (by then-current standards) of items: newspaper, cardboard, glass, tin, plastic milk jugs, and motor oil. Magazines and junk mail were added two years later. Over the years, additional types of plastic bottles and yard debris have also been added.

All four of the service-providers offer similar collection services; glass is collected separately and other materials are commingled. Sanipac requires the customer to separate the glass by color, but the other collectors do not. At a minimum, residential recyclable materials include cardboard, newspapers, magazines, scrap paper, glass, tin and aluminum cans, plastic tubs and bottles, and motor oil (see also Table 2). Additional materials can be added at the haulers' discretion.

Sanipac, Inc. serves 88% of the city's residential customers. In January 2004, they began collecting commingled recyclables in 95-gallon carts. Glass is collected using a 14-gallon bin, and is required to be divided by color and placed in separate bags (see Figure 5). The Oregon

Figure 5: Recycling Containers in Eugene



Photo courtesy of Eugene Recycling Program.

Department of Environmental Quality (DEQ) granted Sanipac a waiver to collect recyclables every other week because, among other reasons, the containers are large enough to accommodate the collected materials. Yard debris is collected on the alternating weeks and all of their carts are collected using automated trucks. The glass is collected manually by one driver with a separate truck and trailer.

The decision to move to automated collection every other week was motivated by a push towards efficiency. An added benefit has been fewer driver injuries. In preparation for the change in 2004, Sanipac purchased seven automated trucks and 56,000 carts. Tax credits were given to the supplier for increased efficiency and those credits were passed on to Sanipac. The company reduced the number of drivers by approximately 10%, going from 114 to 103 drivers. Sanipac takes their recyclables to their own MRF for reloading, then delivers the commingled recyclables to SP Recycling Corporation in Clackamas County, Oregon. Their glass goes directly from their MRF to Owens-Illinois in Portland. In the future, Sanipac would like to eliminate the separated glass and instead include it with the commingled materials. Their market will not accept in that manner, however, and so there is no immediate plan to implement this change.

Lane-Apex serves less than 8% of the Eugene's homes. For the weekly recycling collection services, they offer the option of a 65-gallon cart or a 14-gallon bin for the commingled stream. The containers are collected with side loader trucks, either manually for the bins or semi-automated for the carts, and all of their materials are taken to EcoSort, a MRF in Eugene.

Royal Refuse and Countryside Disposal Service share the remaining small percentage of the City's customers. These companies offer weekly collection of residential recyclables in 14-gallon bins provided by the haulers. The majority of their residential customers are multifamily.

Royal Refuse takes their recyclables to their own MRF, McKenzie Recovery. Records are not kept on the tonnage collected from residential versus commercial customers. The company specializes in commercial, industrial and multifamily. The majority of their fleet is front loaders.

The rates for services are composed of a collection fee and a disposal/system benefit fee. The collection fees are set by the Cities of Eugene and Springfield and are reviewed every two years. Collection is not mandatory in either city. The waste collection rates are a minimum and the haulers can charge up to 10% more. The fee structure is progressive so that the smaller waste can size is significantly less expensive than the larger containers (see Table 17). Residential rates include every-other-week collection for yard debris for all service levels except for the 21-gallon waste can size and the monthly 32-gallon customers.

Recycling participation results in a \$1.50 per month rebate. This is policed by the drivers, and about 98% of the residential customers receive the rebate.

Table 17: Residential Garbage Rates in Eugene

Garbage Service Level	Collection Frequency	Monthly Charge
Recycling only	Every Other Week	\$5.00
Mini-can (20 gallons)	Weekly	\$10.40
32-gallon can	Weekly	\$17.70
32-gallon can	Every Other Week	\$11.70
32-gallon can	Monthly	\$4.20
60-gallon cans	Weekly	\$31.95
90-gallon cans	Weekly	\$39.90

Note: The 20-gallon service and monthly service levels do not include yard debris collection, and subscription to every-other-week yard debris collection at those service levels is an additional \$3.20 per month. Charges shown for all service levels (except recycling only) are reduced by the \$1.50 rebate for recycling.

Since Sanipac is the primary hauler for residential customers in Eugene, much of the following information focuses on their operations. Approximately 42,500 tons of recyclable material and yard debris were collected during 2005 from residential and commercial customers in Eugene. Of that, 9,000 tons was from commercial generators. Approximately 18,150 tons of residential recycling, not including yard debris, were collected that year. All materials except for glass are taken to SP Recycling in Clackamas County, Oregon. This facility accepts a wide variety of mixed loads and has not rejected any from the City of Eugene due to contamination. SP Recycling’s facility is a highly automated process. They use a Bollegraaf turnkey system that includes Lubo screens. This complex system of conveyors and screens is staffed by ten sorters. The process begins with an elevated in-feed conveyor. There is a two-deck screening system with adjustable angled in-feeds. A flatter setting is used for a stream with more paper, and a more steeply angled setting is for a container-dominated load.

Each screening step results in “overs” (material that does not pass through the screen) and “unders” (material that passes through the screen), although some screens can also create more than two streams. In the first screen at the SP processing facility, the overs are large pieces of paper such as newspaper and cardboard. These are directed to a middle conveyor for further sorting. The unders go to a second deck with tighter spacing. Overs from this level are magazines, newspaper and other medium-sized papers. The unders include small paper, glass and containers, which fall to a transverse conveyor with a banana screen.

For the last step of the paper processing system, there are three parallel paper conveyors staffed by four sorters each. They remove film plastic, cardboard, boxboard, garbage, and containers. The “negatively-sorted” paper (i.e., the material that remains on the conveyor after the contaminants are removed) is delivered to top-loading trailers for transport to SP’s newsprint mill.

The container mixture is sorted manually (using three sorters) and mechanically into PET, natural HDPE, colored HDPE, aluminum, and steel (by magnet). The negatively-sorted material from this part of the processing system consists primarily of shredded paper and glass and is landfilled.

The fiber from this sorting facility is sent to SP Newsprint, which is owned by the same company as the MRF. Plastic is brokered to various markets. Metals markets vary between Calbag Metals, Metro Metals, and Schnitzer (steel only).

Table 18 summarizes the recycling program performance for Eugene for 2005.

Table 18: Recycling Program Performance in Eugene

Parameter	Eugene, 2005
Total Population, 2005 ¹	144,520
Total Households, 2005 ¹	60,820
Total Single-Family Homes, 2005 ²	45,620
Number of Garbage Accounts, Dec. 2005 (A)	33,500
Number of Recycling Accounts, Dec. 2005	32,930
Annual Curbside Recycling Tonnage, 2005 (B)	12,188 tons
Pounds per Household per Year (B*2000/A)	728 lb/HH/yr
Annual Waste Tonnage (C)	22,704 tons
Annual Yard Debris Tonnage (D)	11,448 tons
Single-Family Diversion Rate [(B+D)/(B+C+D)]	51%
Single-Family Recycling Rate [B/(B+C+D)]	26.3%

- Notes:
1. From www.dataplace.org.
 2. Number of single-family households was estimated based on the total number of households for 2005 and the Census 2000 breakdown for the percentage (75.0%) of single-family homes (1-4 units and mobile homes).

Tacoma

The City of Tacoma has provided municipal garbage collection services since 1929. In 1986, recycling drop-off centers were established at 38 elementary schools. In 1990, the city began providing curbside pickup of yard waste and recyclable materials in response to State legislation, customer demand and political will. Customers were initially provided with two 11-gallon bins. Newspaper was added later (1993) and customers were asked to place it in paper bags next to their bins. A 1995 study concluded that commingling would increase efficiency and participation. A survey conducted for that study found that customers thought sorting rules were confusing, and that many were not participating due to a lack of financial incentive.

A pilot program was begun in April 1996 to test commingling and a financial incentive. The pilot program allowed commingling of all materials except glass (i.e., similar to what Tacoma is currently doing), and provided a \$1.50 credit for not putting out garbage. The customers were allowed up to two credits per month. The results of the pilot program included:

- recycling setouts and tonnage almost doubled in the high-participation pilot area, and almost tripled in the low-participation area.
- only about 20% of the additional tonnage was from new materials (mixed waste paper, plastic bottles and cardboard).
- there were only 5% to 10% new subscriptions to recycling, and most of the additional tonnage came from existing customers.
- few people (only 10%) took advantage of the recycling credit. The recycling credit was also awkward to monitor, and so the city decided to go with smaller service levels instead.

The positive results of the pilot program led to the citywide implementation of commingling in the late 1990s. Since then, a few new materials have been added (such as plastic bags and all plastic bottles) and minor other changes have been made. Currently, the city continues to collect glass and batteries in a separate, smaller container, and all other materials in a large cart. The customer has a choice of 30-, 60- or 90-gallon carts for recycling, and 20-, 30-, 60- or 90-gallon carts for garbage. Subscription to garbage collection services is mandatory and recycling services are included with the garbage service, although a customer can lose their recycling service due to repeated abuses. Recycling costs are embedded in the garbage rates, and the current rates are shown below.

Table 19: Residential Garbage Rates in Tacoma

Garbage Service Level	Monthly Charge
Mini-can (20 gallons)	\$21.05
30-gallon can	\$28.15
60-gallon cans	\$39.35
90-gallon cans	\$52.15

Note: The above figures do not include taxes, but do include recycling costs.

Collections in Tacoma had been conducted on the same day for garbage, recycling and yard debris, but this was changed as of January 2007 in an attempt to reduce congestion from set-outs in alleys. Now, collections for yard debris and recycling are conducted on alternating weeks, but still on the same day as garbage collections. The city also recently began taking a stricter approach to extra garbage being placed out by households, and now requires that garbage cart lids be able to close completely or an extra charge (\$5.00) will be assessed.

Recycling collections in Tacoma are conducted with a two-compartment truck. All three colors of glass are collected together. The capacities of the compartments are 5 cubic yards for the glass compartment and 20 cubic yards for the commingled materials. City staff report that about one in four setouts include glass. Figure 6 shows one of these trucks dropping off the glass portion of the load at JMK Fibers, LLC.

Figure 6: Tacoma Recycling Truck dropping off Glass



Collection results for Tacoma includes material from small businesses that are serviced on the same routes as the single-family homes, and the figures shown in Table 20 have been adjusted slightly to account for these tonnages.

JMK Fibers processes the commingled materials from the City of Tacoma under a contract that provides a portion of the market revenues back to the city. For the City of Tacoma contract, the commingled portion is processed and marketed, while the glass portion is simply transferred to

Table 20: Composition and Market Value of Material Recovered from Single-Family Households in Tacoma

Material	Tonnages, 2005	Percentage Recovered (by weight)	Average Market Value, 2005 ¹
Paper:	12,528.5 tons	78.8%	
Cardboard ²	2,474.2 tons	15.6%	\$65/ton
Mixed Paper	5,585.7 tons	35.1%	\$38/ton
Newspaper ²	4,468.6 tons	28.1%	\$55/ton
Metals:	558.7 tons	3.5%	
Aluminum Cans	165.1 tons	1.0%	\$842/ton
Tin Cans	393.6 tons	2.5%	\$9/ton
Plastic:	724.4 tons	4.5%	
PET Bottles	262.1 tons	1.6%	\$195/ton
HDPE Bottles, natural	214.1 tons	1.3%	\$216/ton
Colored HDPE and 3-7	248.2 tons	1.6%	\$40/ton
Glass:			
Commingled Glass ³	1,540.4 tons	9.7%	- \$20/ton
Other:			
Batteries	NA	NA	NA
Rejects	431.7 tons	2.7%	NA
Total	15,895.4 tons	100.0%	

Notes: Information is from a year-end report by JMK Fibers, LLC.

1. The average market values shown here do not include the handling fee for glass (\$2.00 per ton) or the processing fee for other materials (\$23.65 per ton).
 2. Cardboard tonnages were reduced by 20% and newspaper tonnages were reduced by 15% to remove the estimated amount of paper from small businesses on the single-family routes.
 3. The market value of the glass is a negative figure because there is a charge to market it.
- NA = Not available. Batteries are not weighed separately, and the rejects have no market value.

the Fibres International glass processing facility in south Seattle. In 2005, the total market revenues for all of the recyclable materials from the City of Tacoma (17,449 tons) was \$928,536.77 and the processing costs were \$379,324.65, for a net payment to Tacoma of \$549,212.12 (or an average of \$31.47 per ton).

The JMK Fibers facility is located in the Port of Tacoma. In addition to the Tacoma materials, JMK Fibers also processes materials collected by Waste Management (including temporarily handling more of their material when their Woodinville facility was shut down to a week-long power outage in December 2006), Rabanco and from other sources.

The JMK facility handles about 4,500 tons per month altogether. They employ 15 sorters on a line where five workers first pull off the cardboard, plastic film and garbage. The material then passes over a “v-screen” to separate the remaining paper from the containers. The paper stream is sent down one conveyor where workers pull out contaminants to produce a “curbside #6” grade of newsprint. The containers are sent past other workers on a separate line, where a variety of materials are pulled off, including PET, HDPE, colored HDPE, injection-grade plastics, tin cans and other metals (using a magnetic separator) and aluminum cans (using an eddy current separator). They report that about 1% of Tacoma’s glass arrives mixed in with the commingled materials, which is a manageable amount but they are still looking for ways to avoid landfilling that (this glass is typically broken during processing and ends up in the rejects). Other problems they’ve experienced are typical of processing facilities, including dealing with contaminants such as diapers, “sharps” (syringes), and styrofoam.

A recent analysis by city staff concluded that glass collections are costing the city too much, and so glass may be removed from the curbside program in the near future. For the glass collected curbside last year (1,675 tons in the past 12-month period ending November 2006), the processing and marketing costs to the city were \$37,693 (\$22.50 per ton). Collection costs for the glass are also significant, and the need to manually empty glass bins is keeping the city from capitalizing on the efficiencies of the semi-automated system that can be used with the toter for the commingled materials. One of the conclusions of the city’s analysis was also that collecting glass is keeping the city from collecting more cardboard and other materials, due to staffing and operational limitations that are preventing them from distributing the numerous cardboard collection bins that are currently sitting in their storage yard. In other words, eliminating glass would allow the city to pursue more lucrative materials.

Table 21 summarizes the recycling program performance for Tacoma for 2005.

Table 21: Recycling Program Performance in Tacoma

Parameter	Tacoma, 2005
Total Population, 2005 ¹	198,100
Total Households, 2005 ¹	83,685
Number of Garbage Accounts, Dec. 2005 (A)	52,000
Number of Recycling Accounts, Dec. 2005	52,000
Annual Curbside Recycling Tonnage, 2005 (B)	15,895 tons
Pounds per Household per Year (B*2000/A)	611 lb/HH/yr
Pounds of Glass Recycled per Household per Year	59.3 lb/HH/yr
Annual Waste Tonnage (C)	54,000
Annual Yard Debris Tonnage (D)	20,655
Single-Family Diversion Rate [(B+D)/(B+C+D)]	40.4%
Single-Family Recycling Rate [B/(B+C+D)]	17.6%

Note: 1. From the Washington State Office of Financial Management (OFM).

OTHER STUDIES

Processing Issues

A recent study conducted for King County by Cascadia Consulting Group, the *2006 Material Recovery Facility Assessment*, examined the processing performance of four MRFs serving the Puget Sound area. The four facilities included in that study were:

- the Rabanco Recycling Center, operated by Allied Waste at 3rd and Lander in Seattle;
- the Cascade Recycling Center, operated by Waste Management in Woodinville;
- the Renton Reclamation Plant, operated by Smurfit-Stone in Renton; and
- Tacoma Recycling, operated by Waste Connections in Tacoma.

These four facilities were examined because they process mixed recyclables from King County and other sources in the Puget Sound area. Some of the local facilities not examined in this study include JMK Fibers in Tacoma (which handles the materials from the City of Tacoma and several other sources), the Weyerhaeuser plant in Kent (which handles primarily source-separated materials), the SP Recycling facility in Frederickson (which was still under development as that study was being conducted), and several smaller facilities.

The King County study concluded that the recyclable materials brought to these four MRFs contain an average of 7.2%¹ contamination. The residuals disposed by these MRFs is also about 7%, although the disposed residuals contain about 40% recyclable materials. In other words, the sorting processes used by the various MRFs are not 100% effective, and some contaminants remain in the sorted materials that are marketed while some of the recyclable materials are lost to the waste stream from these facilities, and these amounts are coincidentally almost equal. To illustrate this situation, if 1,000 pounds of typical recyclables were delivered to a MRF in King County, it would contain 72 pounds of contaminants. Of the 1,000 pounds delivered, about 930 pounds would be sent to recycling markets and 70 pounds would be disposed. The 930 pounds marketed would contain about 31 pounds of the contaminants, and the 70 pounds disposed would contain about 29 pounds of material that could have been recycled.

The King County study included results from sorting samples of four marketable products (newspaper, mixed paper, glass, and PET) from the processing facilities. Specific data on individual facilities is not available, but the average results from these tests are shown in Table 22.

¹ This study found significantly more contamination than other local studies conducted over the past few years for curbside programs, including Bellevue's recycling program (2.8%, see Table 11) and several tests of materials from curbside programs in unincorporated King County (0.9 to 2.4%). There is no clear explanation for this, although part of the difference is likely caused by different generators included in the mix tested in the King County study (see Table 11 for an indication of the higher amounts of contamination that can be found in recyclable materials from multifamily and commercial sources).

Table 22: Summary of Results from King County MRF Study

Parameter	Newspaper	Mixed Paper	Glass	PET
Acceptable Product	93.5 ¹	90.9	42.7	83.7
Other Recyclables ²	3.7	3.4	5.2	9.1
Marginal Recyclables	0.4	1.6	43.1	1.3
Contaminants	2.5	4.1	9.0	5.9

Notes: All figures are percent by weight.

1. Strictly defined, newspaper only makes up 51.3% of the material marketed as “newspaper,” with the remaining 48.7% contributed by other types of recyclable paper.
2. “Other recyclables” contains marginal recyclables made from a different material. In the newspaper column, for example, a marginally-recyclable material made from plastic is included in the “other recyclables” and the figure for “marginal recyclables” includes only paper-based products.

The amount of “acceptable product” for newspaper is shown as 93.5% but only half of this (51.3% of the “acceptable product”) is actually newspaper and the rest is various grades of recyclable paper that are tolerated by the end markets. For mixed paper, other types of recyclable papers that do not meet the definition for mixed paper actually make up more than one-third of the 90.9% shown for mixed paper. In the case of glass, the King County study defined broken glass as a marginally-recyclable material due to the inability to cost-effectively recycle the material back to glass bottles. Most of the broken glass in King County is currently being used for construction applications.

Significant conclusions and recommendations from the King County study include:

- glass, shredded paper and increasing amounts of non-recyclable plastics are adversely affecting MRF operations, creating higher levels of residuals, and are degrading product quality. Glass was cited as the largest problem for MRF operators, and glass shards are creating significant problems for paper mills and plastics processors.
- only slightly more than half of the incoming contaminants are removed and disposed, with the other half either marketed (some MRFs are able to recover and market durable plastics) or mixed with the recyclable products that are shipped out to markets.
- the amount of “lost recyclables” (materials that could be recycled but are not recovered) includes about 2% (2% of the total incoming materials) that ends up in the waste stream from the MRFs and a larger percentage that ends up in the wrong product (such as PET bottles included in newspaper sent to paper mills). Part of the lost recyclables in products shipped to foreign markets are recovered and recycled, but labor costs at domestic mills are too high to allow the manual sorting required to recover these materials.
- the study recommends that the haulers, processors and municipalities find a way to separate glass out of the single-stream recycling mix.

- the study recommends adoption of uniform recycling standards throughout King County, and greater public education efforts to reduce contamination levels.
- the study also recommends adoption of MRF performance standards to prevent the loss of recyclables in the disposed residuals and to reduce the amount of contaminants in the marketed products.

To summarize, the most significant of the above conclusions within the context of this report is the definitive statement that glass is a problem and that mixing of glass and other materials should be avoided.

Collection versus Processing Costs

Single-stream collections provide savings in collection expenses but also increase processing costs. A study completed in 2004 for the American Forest and Paper Association (AF&PA), *Single Stream Recycling – Total Cost Analysis*, by Jaakko Poyry and Skumatz Economic Research Associates, quantified the differences between dual-stream and single-stream collections. This study concluded that:

- savings in collection costs ranged from \$10 to \$20 per ton for single-stream programs.
- processing costs increased \$5 to \$15 per ton for single-stream programs.
- paper mills experienced an increase in processing costs of \$5 to \$13 per ton for material from single-stream programs.

This study concluded that single-stream collections caused a net increased cost of \$3 per ton for the system overall.

Collection Methods in Saint Paul, Minnesota

Another important study of curbside collection methods was completed in 2002 by Eureka Recycling. For that study, *A Comparative Analysis of Applied Recycling Collection Methods in Saint Paul*, pilot projects were conducted for five different curbside recycling methods in different neighborhoods of Saint Paul. The pilot project results were compared to a control group and to the existing curbside program. The five methods tested were:

- Scenario A: a source-separated approach using three 18-gallon bins and every-other-week collections (i.e., status quo approach but with additional public education to provide a level of promotion comparable to the other pilot projects).
- Scenario B: a dual-stream approach using two 18-gallon bins (one for paper and one for bottles and cans), with every-other-week collections.
- Scenario C: a dual-stream approach using two 35-gallon carts (one for paper and one for bottles and cans), with every-other-week collections.

- Scenario D: a dual-stream approach using two 18-gallon bins, plus a 35-gallon cart for “household organics” (food waste and non-recyclable paper), with weekly collections.
- Scenario E: a single-stream approach using one 60-gallon cart, with every-other-week collections.

All of the scenarios included glass, plastic bottles and cans in the appropriate bin or cart, and the grades of paper collected included newspaper, cardboard, and some types of mixed paper. The results of this study are shown in Table 23. The study concluded that the best approach for Saint Paul is dual stream collections using 18-gallon bins picked up weekly.

Table 23: Conclusions of Eureka Study for Saint Paul, Minnesota

Parameter	Baseline Route	Scenario A: Status Quo, with Education	Scenario B: Dual-Stream with Bins	Scenario C: Dual-Stream with Carts	Scenario D: Dual-Stream with Bins and Organics Cart	Scenario E: Single-Stream with Cart
Tonnage Collected, pounds/household/year	402	+6.2% (427)	+7.3% (431)	+32.8% (534)	+26.1% (507)	+20.8% (486)
Per-Ton Costs for:						
- collection		\$60	\$50	\$65	\$80	\$51
- processing		\$35	\$50	\$50	\$50/\$30 ¹	\$60
- market revenues		\$50	\$43	\$44	\$43/\$20 ¹	\$33
- net cost per ton		\$45	\$57	\$71	\$88	\$78
Material Lost in Processing ²		1% / 1.6%	6.4% / 10.8%	6.4% / 11.5%	7.5% / 11.0%	12.9% / 27.2%
Net Increase in Tonnages Collected / Marketed ²		+5.2% / +4.6%	+0.9% / -3.5%	+26.4% / +21.3%	+18.6% / +15.1%	+7.9% / -6.4%

- Notes: 1. Costs shown are for recyclables and organics separately.
 2. “Materials lost in processing” and “net increase in tonnages collected and marketed” shows two figures because the second figure includes mixed broken glass as a lost material (due to the lower-value markets for this material) and the first figure counts mixed glass as being recycled.

SUMMARY OF PROGRAM RESULTS

Program Performance

The basic data and results of the benchmarked programs are shown in Table 24. The figures shown for three of the areas in the bottom row of the table have been adjusted for the every-other-week collections that are used in those areas. The adjustment was made to provide a clearer comparison of program performance. The adjustment is based on the performance of

Table 24: Summary of Results for the Benchmarked Programs

Parameter	Clark County	Bellingham	Renton	Bellevue	Pierce County	Eugene	Tacoma
Type of Program	Three-bin	Three-bin	Three-bin	Single-Stream	Single-Stream	Dual-Stream	Dual-Stream
Start Date for Program	1992	1989	1989	2004	2005	2004	1998
Subscription Basis ¹	Optional	Mandatory	Mandatory	Optional	Optional	Optional	Mandatory
Frequency of Collection	W	W	W	W	EOW	EOW	EOW
Size of Recycling Containers	3 11-gallon bins ²	3 14-gallon bins	3 14-gallon bins	32, 64 or 96-gallon cart	64 or 96-gallon cart ³	95-gallon cart and 14-gal. bin	30, 60, or 90-gal. cart and 14-gal. bin
Recycling Diversion Rate	25.9%	29.9%	20.4%	28.0%	NA	26.3%	17.6%
Waste Generation Rate, pounds/household/year	2,769	2,091	2,995	3,633	NA	2,767	3,483
Amount Collected, pounds/household/year	716	625	610	1,035	524	728	611
Adjusted Amount, pounds/household/year	716	625	610	1,035	691	961	807

Notes: W = weekly, EOW = every-other-week.

1. For the subscription basis, “mandatory” means that residents are required to subscribe to garbage collection services (with recycling offered as part of that service), not that residents are required to recycle.
2. Clark County recycling containers are 11.2 gallons in the urban areas and 18 gallons in the rural areas.
3. For the Pierce County program, smaller containers (32 or 45 gallons) are available on special request.

Anacortes compared to Mount Vernon (see the next chapter), where weekly collections appear to be the main factor in a 32% increase in tonnages. In other words, the assumption is being made that if these three areas had weekly instead of every-other-week collections, their tonnages would be 32% higher.

As shown in Table 24, the single-stream program in Bellevue performs the best in terms of overall tonnage. Averaging the results of the two single-stream programs versus the dual-stream programs leads to a different picture. The average of Bellevue’s amount plus Pierce County’s adjusted amount is 863 pounds per household per year, and the average of Eugene’s amount plus Tacoma’s amount is slightly higher at 884 pounds per household per year.

Another general observation is that the two programs with the highest results in terms of pounds per household per year, Bellevue and Eugene, are opt-in programs. Furthermore, the four programs with the highest results also have the highest capacities for their collection containers.

It is interesting to see that the results for the three-bin programs are clustered fairly closely in the range of 610 to 716 pounds per year per household. All three of these programs can be considered to be “mature” programs, since they have all operated for 14 to 17 years using

basically the same approach that they began with. It should also be noted that the results for the three-bin programs might appear higher due to additional moisture in the paper fractions (the other programs use carts with lids that help keep rain out of the recyclables, although reportedly the materials in some areas still have significant amounts of moisture because many participants don't keep the lids shut).

The recycling diversion rates (the percentage of recycling versus the total waste generated by single-family households) is generally in line with the results for the amount recovered by household, with the exception of Bellingham and to a lesser extent Bellevue. Bellingham has the highest recovery rate on a percentage basis because they have the lowest waste generation rate (2,091 pounds per household per year). Bellevue's recycling diversion rate is still high, but the percentage figure is not as high relative to the other programs because their waste generation rate is also the highest in the group (at 3,633 pounds per household per year). The higher waste generation rate could be from a greater number of people per household, higher consumption due to higher income levels, and/or other factors. Finally, if Eugene's recovery rate were calculated on the basis of the projected results of weekly collections (961 pounds of recyclable materials per household per year), they would have the highest recovery rate on a percentage basis (about 33%).

Specific observations and conclusions include:

- Clark County's program performance is better than the other two three-bin programs. Clark County is likely collecting more material in part because the county's program takes a slightly broader range of materials. Demographic factors (including strong ethics and interest in recycling) are probably contributing, as well as the strong public education program in Clark County and the consistency of the recycling programs throughout the county.
- Bellevue's recycling performance seems almost too high to believe, at 1,035 pounds per household per year, but the performance of several neighboring cities helps to verify this result. Data for 2005 from King County's records indicates that the curbside programs in several other cities collected comparable amounts of material from single-family households: Clyde Hill - 937, Kirkland - 924, Lake Forest Park - 1,192, Medina - 985, Mercer Island - 1,123 and Redmond - 993 (all in pounds per household per year). Two cities in King County were extraordinarily high: Beaux Arts at 1,857 and Hunts Point at 2,431 pounds per household per year. Many of these areas, and especially Beaux Arts and Hunts Point, contain populations with high income and education levels. With an average annual household income of \$87,120, Bellevue is the highest income area included in the benchmarked cities (see Table 1).

Other factors that may be helping to boost Bellevue's recycling rate include:

- the recent change in the program and the additional publicity associated with it;
- the fact that subscription to garbage services is voluntary (thus the service essentially targets only the most interested residents, compared to areas where it is mandatory); and
- the broad range of materials accepted in the recycling program.

- Pierce County’s results are probably lower due to the inclusion of some very rural areas in the curbside recycling program, as well as the loss of part of the glass, but it’s interesting to note that the incentive-based rates used in the county apparently don’t do a better job of encouraging people to recycle.
- Eugene’s program is losing part of the recyclable materials to the container deposit system used in Oregon, and so their results would be slightly higher if those materials were counted as well. The container deposit system is estimated to be diverting at least 3 to 5% of the materials that are collected through other curbside programs. Clark County may also be losing deposit containers from their curbside program due to their proximity to Oregon.

On the other hand, Eugene’s tonnages may be benefiting from less-strict acceptance guidelines. Although exact figures are not available, Eugene’s contamination rate could be as high as 10% (versus 2% to 5% for the other benchmarked areas).

- Tacoma’s results are likely being reduced significantly by demographic factors, relative to the other programs. Tacoma has the lowest average household income of all of the benchmarked areas, and the city clearly includes some areas that are struggling with the “basics of life” more than other areas researched for this project. As a mandatory program, all single-family households in the city are counted as participants. Given these factors, Tacoma’s program is actually doing much better than indicated by the numbers alone.
- Pierce County is receiving fairly good participation with the glass drop-off system, but Tacoma is collecting more than twice as much glass curbside (59.3 pounds per household per year for Tacoma versus 27.9 for the Pierce County program). The glass explains about one-third of the difference between these two programs. Clark County is collecting even more glass, at 88 pounds per household per year².

Additional conclusions, and the recommendations of this study, are presented in Section Seven.

Recovery Rates by Material

Differences in the overall recycling rates for different types of recycling programs lead to the question as to what materials are being recycled more or less in each program. Table 25 addresses this question by comparing the composition of recyclables from the three areas that have good data on the breakdown of the materials being recycled from single-family homes: Bellevue, Clark County, and Tacoma. The data on pounds for household per year for Tacoma uses the figure adjusted for weekly collections (see Table 24), although the composition of their recyclables would probably shift slightly if the frequency of collections were changed.

On a percentage basis, the breakdown of materials is similar for all three areas, although Bellevue is clearly picking up additional amounts and types of plastics. In terms of pounds per household, Bellevue is picking up more materials in every category except tin cans and scrap metal. Clark County is collecting the lowest amount of cardboard, likely due to convenience

² Tacoma’s glass quantity increases to 78 pounds per household per year once adjusted for every-other-week collections (see Table 25).

Table 25: Composition of Residential Recyclables from Three Areas

Material	Bellevue		Clark County		Tacoma	
	% by Weight	Pounds per HH per Yr	% by Weight	Pounds per HH per Yr	% by Weight	Pounds per HH per Yr ¹
Paper:	75.5%	781	73.4%	526	78.8%	636
Cardboard	14.0%	145	8.3%	59	15.6%	126
Polycoated	1.2%	12	0.15%	1	na	na
Mixed Paper	35.8%	371	36.8%	263	35.1%	283
Newspaper	24.5%	254	28.2%	202	28.1%	227
Metal:	2.9%	30	3.6%	32	3.5%	28
Aluminum Cans	1.2%	12	0.89%	6	1.0%	8
Tin Cans	1.5%	15	2.7%	19	2.5%	20
Scrap Metal	0.2%	2	0.8%	6	na	na
Plastics:	6.4%	66	4.4%	32	4.5%	36
Bottles #1 and #2	4.0%	41	4.4%	32	4.5%	36
Other Containers	1.0%	10	na	na	na	na
Bags and Film	1.4%	14	na	na	na	na
Glass Bottles	12.3%	127	12.3%	88	9.7%	78
Garbage	2.8%	29	5.4%	39	2.7%	22
TOTALS	100.0%	1,035	100.0%	716	100.0%	807

Note: 1. Tacoma figures shown here have been adjusted (increased) to reflect weekly collections.

factors (i.e., the requirement to flatten cardboard and place it next to the bins is probably reducing participation for this material compared to the other two areas where larger containers are used). Clark County is also collecting the lowest amount of aluminum cans and plastic bottles, at least in terms of pounds per household per year, which could indicate “leakage” to the deposit program in neighboring Oregon.

Summary of Cost Data for Benchmarked Areas

Gathering detailed information on costs was a significant challenge for the benchmarked areas. In most cases, recycling costs are embedded with the cost of garbage collection services, and there simply was not a specific cost figure available for the recycling program. Hence, the cost for recycling could not be determined without conducting an audit of the city’s and hauler’s financial records, which was beyond the scope of this study. The cost data that could be collected included:

- for Clark County, the additional cost of recycling as shown in Table 3 is a fairly accurate assessment of the cost for the current recycling programs in Clark County and the cities.
- for Pierce County, some cost data is available because the collection program operates in a franchise (certificated) area regulated by the Washington Utilities and Transportation Commission (UTC).

In the case of Pierce County, the new system benefits from lower collection costs (due to the automated collections) and higher market revenues (any downgrading of paper grades due to commingling is offset by the elimination of glass to create a higher average per-ton value for the materials collected). The new system also required a significant capital investment in new trucks and carts, and part of the increased revenues are being retained by the haulers.³ The combination of these factors leads to a net increase in recycling program costs.

The initial start-up expenses for the new program in Pierce County was \$1.67 per month per customer. After credit for increased market revenues and increased efficiencies, the net additional cost to each customer is only \$0.29 to \$0.59 per month (depending on the company). Interestingly, the UTC has calculated (in their report to the legislature in February 2006) that the revenue-sharing arrangement is costing Pierce County customers \$0.47 to \$0.52 per month (this figure may be revised soon based on a review by the UTC of the commodity credit). In other words, without the revenue-sharing arrangement, Pierce County customers would not have experienced any increase in costs for the new recycling program versus the previous program, although presumably the revenue-sharing arrangement is leading to long-term benefits.

Another way to look at the recycling costs for the benchmarked and other programs is also made available thanks to the UTC's oversight of certificated haulers. In their capacity of reviewing and regulating rates in the certificate areas, the UTC periodically reviews the net costs for garbage, recycling and yard debris services provided by the certificated haulers. Net costs are calculated based on gross expenses, minus market revenues (for recycling only), plus disposal or processing fees (for garbage and yard debris), and plus a standard profit margin, with these net costs distributed over the assumed or actual customer base to provide a rate for each service level. An informal review of the net costs for curbside recycling and yard debris programs in the Puget Sound area was conducted by UTC staff in early 2006, and that data is shown in Table 26. Since this data is for the certificate (franchise) areas, which typically consist of areas that are partly or largely rural and thus have greater collection expenses due to the distance between customers, these costs are generally higher than costs incurred in cities and other more urban areas.

Comparisons to Other Areas

A brief search for data from other areas came up with the information shown in Table 27. Although it is difficult to draw conclusions from this data since no analysis has been conducted for demographic or other differences, it is interesting to see that the programs in Clark County compare favorably to other areas throughout the nation.

³ A recent change in state law allows certificated (franchise) haulers to retain up to 30% of the market revenues from recyclables, whereas in the past all of the market revenues were allocated to the customer by being used to reduce the net expense of the recycling program. The reasoning for the new revenue-sharing arrangement is that it provides a greater incentive to the haulers to maximize their market revenues. Furthermore, since the retained funds must be used in a pre-approved manner (pre-approved by the county and UTC) that benefits the recycling program, customers should also incur additional long-term benefits from recycling program improvements.

Table 26: Net Recycling and Yard Debris Costs, Puget Sound Franchise Areas

Certificated Hauler and Area	Recycling Collection Frequency	Net Recycling Cost	Net Yard Debris Cost
Three-Bin Programs:			
Sanitary Service, Whatcom County	Every Other Week	\$3.51	\$8.00
Rubatino, Everett	Weekly	\$3.80	\$8.90
Waste Management, Kitsap County	Every Other Week	\$2.23	\$6.75
Single-Stream without Glass:			
Harold LeMay Enterprises, Pierce County	Every Other Week	\$2.79	\$5.10
Murrey's Disposal, Pierce County	Every Other Week	\$2.57	na
Single-Stream with Glass:			
Eastside Disposal, King County (east of Lake Washington)	Weekly	\$4.91	\$5.80
Lynwood Disposal, Snohomish County	Every Other Week	\$4.21	\$6.17
Waste Management, King County	Every Other Week	\$5.67	\$10.20
Waste Management, Snohomish County	Every Other Week	\$4.90	\$6.17

Notes: Costs shown per household per month, and are current as of early 2006.

Table 27: Recycling Performance in Other Cities in the U.S.

Parameter	Suffolk County (Long Island), New York	Cambridge, Massachusetts	Kansas City, Kansas	Roseville, Minnesota
Population (2005)	1,474,930	100,135	144,210	32,080
Average Household Income (2000)	\$79,409	\$70,854	\$41,033	\$62,391
Type of Program	Two-bin	One bin plus separate paper	Single-stream, no glass	Three-bin
Frequency of Collection	Every Other Week	Weekly	Weekly	Every Other Week
Size of Recycling Container(s)	18 gallon bin	14 gallon bin + bagged paper	18 gallon bin	18 gallon bin
Amount Collected, pounds/household/year	875	482	710	698

SECTION THREE

CASE STUDIES

INTRODUCTION

In addition to the areas used for benchmarking, other areas were researched to address specific points. These “case studies” are in a unique position to highlight particular points such as the impact of mandatory participation (Seattle) and alternating weeks of collecting garbage and recyclables (Olympia).

The areas researched for specific aspects are:

Anacortes and Mount Vernon – as two of the longest running single-stream programs in Washington, these two cities provide a record of the longevity of the participation and tonnage increases that can be achieved from single-stream recycling.

Auburn – this city had only recently begun a curbside recycling program before converting it to single-stream, thus providing an opportunity to assess the “new-ness” factor and the impact of publicity.

Olympia – Olympia’s program consists of alternating weeks for garbage collection and curbside recycling, and so provides an opportunity to assess the results of this approach.

Seattle – Seattle’s recycling program bans recyclable materials from the waste stream, and so their results provide an assessment of the impact of this type of mandatory approach.

These programs are discussed in greater detail below. Basic data for these areas is shown in Table 28.

CASE STUDIES

Anacortes and Mount Vernon

In addition to being two of the first areas to convert to single-stream recycling in the Pacific Northwest, these cities are also somewhat immune to other influences due to their distance from larger urban areas and due to their division of responsibilities for garbage and recycling. Both cities have municipal garbage collection programs, but contract out for the recycling program.

The two cities have different contractors for recycling (Rabanco for Anacortes and Waste Management for Mount Vernon). Anacortes has weekly collection, and switched their program to single-stream collections in January 2003. Mount Vernon has had every-other-week curbside recycling since 1992 and was also previously using the three-bin system. That program was working well, but there were problems such as litter (from paper and other materials blowing out of the bins), so the city switched to single-stream collection in April 2003. They now use 64-

Table 28: Basic Data for the Case Study Areas

City/Area	Population	Average House- hold Income	Collection Frequency	Collection Method and Materials	Reason for Case Study
Anacortes	15,760	\$53,547	Weekly	All materials, including glass, in 64-gallon cart.	One of longer-running single-stream programs (since January 2003).
Mount Vernon	28,820	\$47,277	Every Other Week	All materials, inc. glass, in 64-gallon cart.	One of longer-running single-stream programs (since April 2003).
Auburn	44,980	\$48,283	Every Other Week	All materials, including glass, in 64-gallon cart, plus oil on the side.	City had only-recently implemented curbside recycling.
Olympia	43,330	\$40,846	Every Other Week	All materials, inc. glass, in 32-, 64-, or 96-gallon cart.	Impact of alternating garbage and recycling.
Seattle	571,500	\$64,510	Every Other Week	Cart for commingled, with glass and batteries (bagged) in separate bin.	Impact of mandatory recycling.

Notes: Population figures are 2004 estimates from www.dataplace.org, and household income figures are from the last census (1999).

gallon wheeled carts with lids. Anacortes also uses 64-gallon wheeled carts with lids. Both programs collect similar materials: newspaper, cardboard, milk cartons, juice boxes, frozen food boxes, junk mail, other paper, plastic bottles and tubs, glass bottles, metal cans, and scrap metal.

The programs in Anacortes and Mount Vernon are clearly defined and target primarily residential customers, although a few non-residential accounts in each city also participate. In 2005 in Anacortes, there were nine non-profit groups that participated in the recycling program. Mount Vernon’s program includes city offices, the library, the three fire stations and the police station. In Mount Vernon, only buildings with up to five units are defined as residential, and larger buildings (six and more units) must contract directly with Waste Management for recycling services.

As municipal programs, Mount Vernon and Anacortes are able to make the recycling program “mandatory” in the sense that all residents must pay for it as part of the garbage collection fee, but the cities are able to report their expenses more precisely than most other municipalities since the recycling collections are performed under a contract separate from garbage collections. The actual cost for the recycling program in Mount Vernon was \$274,735 in 2005 (or \$22,895 per month). In Anacortes, the total cost in 2005 was \$335,561. These are the fees paid to the collection contractors, and do not include the cities’ expenses for staff time, public education or other administrative overhead.

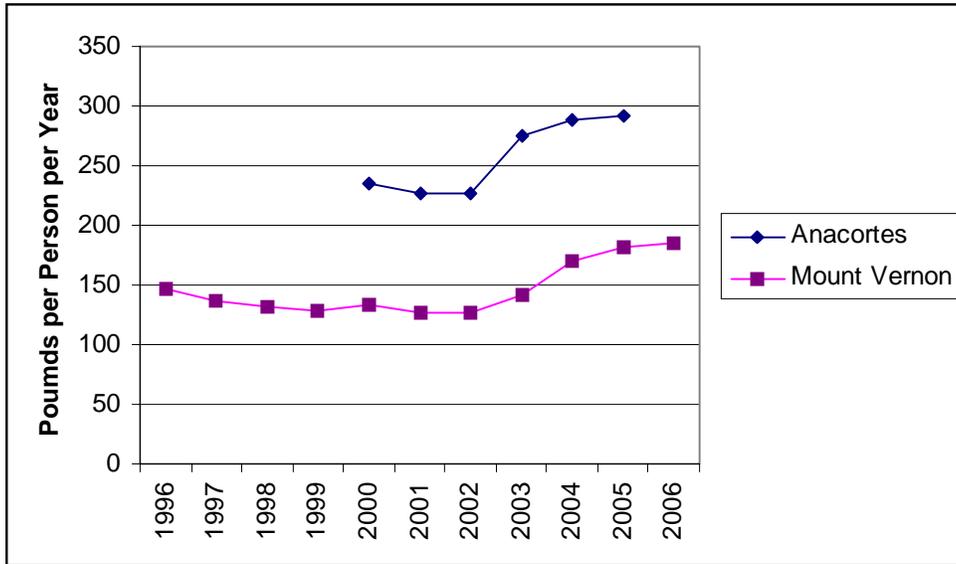
Table 29 and Figure 7 shows the recycling tonnages and rates (in pounds per person per year) for the two cities for the past ten years. As can be seen, the switch in program design in 2003 resulted in a significant increase in tonnages. That increase has not only been sustained for the past few years, but the upward trend shows that the full potential has not been reached yet.

Table 29: Historical Curbside Recycling Data for Anacortes and Mount Vernon

	Anacortes			Mount Vernon		
	Annual Tons	Population	Rate, lb/person/yr	Annual Tons	Population	Rate, lb/person/yr
1996	NA	12,841		1,728	23,536	147
1997	NA	13,180		1,677	24,430	137
1998	NA	13,534		1,639	24,954	131
1999	NA	13,917		1,628	25,439	128
2000	1,708	14,557	235	1,747	26,232	133
2001	1,681	14,840	227	1,677	26,460	127
2002	1,688	14,910	226	1,699	26,670	127
2003	2,080	15,110	275	1,910	27,060	141
2004	2,228	15,470	288	2,364	27,720	171
2005	2,294	15,700	292	2,571	28,210	182
2006	NA	16,170		2,650	28,710	185

Notes: Tonnages shown are for curbside recycling only. Total population is used in this table (instead of the number of single-family households as used in other tables of this report) because this is the most reliable data available for the ten-year period.

Figure 7: Historical Recycling Rates (in pounds per person per year) for Anacortes and Mount Vernon



Note: See Table 29.

Tonnage results shown in Table 29 can be translated to per-household figures for comparison purposes (see Table 30). The “number of recycling accounts” shown in Table 30 is assumed to be the same as the number of single-family households in each city, although as noted above a few non-residential accounts also participate in the recycling program. The similarity of the demographic and other factors for these two cities allows the assumption that the tonnage differences can be attributed primarily to the differences in collection frequency, although other factors (amount of publicity, quality of service, etc.) could also be influencing the participation rate.

As can be seen in Table 30, the weekly collections in Anacortes are netting 32% additional tons for recycling, although these additional tons come at a price. The additional cost of receiving twice as many collections, however, is not twice the cost (Anacortes’ costs per household are only 80% higher than Mount Vernon’s costs). Part of the increased cost for Anacortes is likely due to the fact that it is a smaller city and hence it benefits less from economies of scale. In addition, Anacortes’ costs are probably somewhat higher due to the fact the city is located off of the I-5 corridor (whereas Mount Vernon is on I-5), and the city is significantly farther away from recycling processing facilities than many of the other cities in the Pacific Northwest.

The increased tonnages collected in Anacortes helps to even out the cost differences. The cost per ton for Anacortes is only 37% higher than Mount Vernon.

Table 30: Recycling Program Performance in Anacortes and Mount Vernon

Parameter	Anacortes	Mount Vernon
Total Population, 2005	15,700	28,210
Total Households, 2005	7,044	10,408
Number of Recycling Accounts	5,935	8,400
Annual Recycling Tonnage, 2005	2,294 tons	2,571 tons
Pounds per Household per Year	651 lb/HH/yr	494 lb/HH/yr
Pounds per Person per Year (for total population)	292 lb/person/yr	182 lb/person/yr
Total Annual Cost	\$335,561/year	\$274,735/year
Cost per Household per Month	\$3.97/HH/mo	\$2.20/HH/mo
Cost per Ton	\$146.28/ton	\$106.86/ton
Tonnage Increase due to Weekly Collection, on a per-household basis	32%	

Note: Population data is from the Washington Office of Financial Management.

Auburn

The City of Auburn provides a somewhat unique opportunity to address one facet of making changes to a recycling program, which is the idea that there is typically an increase in recycling participation and tonnages simply due to the increased publicity and attention provided to a new program. For areas that have had curbside recycling programs for many years and that then switch to single-stream or other programs, the rolling out of a new program and the extensive publicity associated with it generally results in increased recycling participation and tonnages. This increase is in addition to the increases caused by greater convenience, more materials that can be recycled, and other factors, but generally the individual impacts of these various factors are not easy to quantify in the absence of time series data, survey data, and extensive statistical analysis.

In Auburn's case, however, the city had only recently implemented curbside recycling using a dual-stream approach before switching to single-stream at the insistence of their collection contractor. For many years before implementing curbside, Auburn employed a system of drop-off sites for collecting residential recyclable materials. Eventually, maintaining the system of drop-off sites became too difficult as one by one the sites were lost due to litter and other problems. There was also increasing pressure from residents for curbside recycling, and so in January 2002 the City began providing curbside recycling services through a combined garbage/recycling contract with Waste Management. As a well-publicized, new program, Auburn's participation rate for single-family homes was very good.

Then, as part of a regional push to convert all of the curbside programs to single-stream, Waste Management encouraged the city to switch to single-stream collections, and so the program was converted from a two-bin program (a 64-gallon cart with a lid and a 20-gallon bin) to a single-stream program (using only the 64-gallon cart) in November 2004 at no additional cost to the city. The following table shows the results of Auburn’s curbside recycling program before and after the switch. The following table examines variable time periods due to missing data for the months of January 2002 through September 2002 and October 2003 through December 2003, and because the switch to single-stream recycling was made partway through 2004.

Auburn’s cost for recycling cannot be easily determined because that cost is embedded in the garbage rates as a combined program, but per their contract with Waste Management the additional cost for changing from every-other-week recycling collections to weekly would be \$1.44 per month per single-family residence. That figure is for 2002 and would be adjusted annually by the Consumer Price Index.

As can be seen in Table 31, Auburn’s recycling performance started out fairly high, dipped slightly, and then rebounded somewhat when single-stream was instituted. This appears to provide evidence of the impact of the “new-ness” factor for recycling programs.

Auburn also collects one-gallon containers of waste oil with their curbside program, but the amount of material collected is minimal. Even with regular promotions, participation in curbside waste oil collections has been very low since it was begun in January 2002.

Table 31: Recycling Program Performance in Auburn

Demographics		
Total Population, 2005	47,470 people	
Number of Single-Family Households:		
2003	7,244 HH	
2004	7,495 HH	
2005	7,840 HH	
2006	8,770 HH	
Recycling Program Performance	Dual-Stream	Single-Stream
Recycling Tonnages;		
October 2002 – September 2003	2,744 tons	
January 2004 – September 2004	1,640 tons	
January 2005 – December 2005		2,679 tons
Recycling Results, pounds per month;		
October 2002 – September 2003	63.1 lb/HH/mo	
January 2004 – September 2004	48.6 lb/HH/mo	
January 2005 – December 2005		57.0 lb/HH/mo
Recycling Rate (average)	670 lb/HH/yr	683 lb/HH/yr

Note: Total population is from OFM, and the number of single-family households is based on number of accounts from the city’s billing department.

Olympia

The City of Olympia has a municipal collection program, and city employees collect all of the garbage, recyclables and yard debris in the city (except other recyclers also service commercial accounts in the city). Prior to 1998, the city provided single-family services Tuesday through Friday using four two-person crews for garbage and five one-person crews for recycling each week. Yard debris was (and is still) collected on Mondays every-other week. In the period 1998 through 2003, the city explored various options for crew and truck combinations and then began providing garbage and recycling collections in alternating weeks. This schedule allowed the city to provide residential services using seven one-person crews. In 2003, the city switched to automated collections and was able to further reduce manpower requirements to five one-person crews.

The alternating weekly schedule has been accepted well by Olympia residents. They have the option of signing up for weekly collection at an extra cost, but less than 1% of the residents have done that. Odors have not been a significant problem. Subscription rates for recycling have increased from 80-85% before the alternating schedule was implemented, to 95-98% currently.

Prior to 2003, the city used a split cart and divided truck for a dual-stream recycling program, with fibers in one compartment and cans/bottles in the other. Now the city collects all materials, including glass, in one container. Collected materials are delivered to a local processor (Pacific Disposal), but the materials are actually transferred to a processing facility near Portland, Oregon operated by SP Recycling. The city pays a processing fee but also gets back 70% of the market value of the recyclables, for a net cost to the city of \$15-20 per ton. These figures would be improved significantly if glass were not included in the mix, although then there would be other expenses (equipment, labor, fuel, etc.) from collecting glass separately.

The results of the program changes, first by switching to single-stream recycling and then by switching to the alternating weekly schedule, have bumped up the falling recycling rate to new levels (see Table 32 and Figure 8). Table 33 summarizes Olympia's current (2005) recycling program performance.

Figure 8: Historical Waste Diversion in Olympia

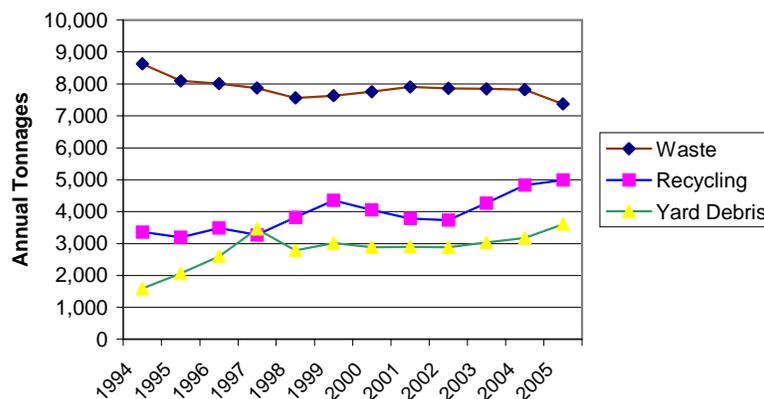


Table 32: Historical Waste Diversion Data for Olympia

	Annual Tonnages (All Residential) ¹			Diversion Rate	
	Waste	Recycling	Yard Debris ²	Total	Recycling Only
1994	8,629	3,360	1,586	35%	25%
1995	8,102	3,194	2,065	39%	24%
1996	8,011	3,491	2,601	43%	25%
1997	7,872	3,270	3,453	46%	22%
1998	7,569	3,819	2,786	47%	27%
1999	7,633	4,354	3,012	49%	29%
2000	7,754	4,055	2,894	47%	28%
2001	7,911	3,790	2,899	46%	26%
2002	7,865	3,736	2,879	46%	26%
2003	7,846	4,269	3,033	48%	28%
2004	7,823	4,834	3,170	51%	31%
2005	7,379	4,989	3,603	54%	31%

- Notes: 1. Includes multifamily tonnages because recycling for single-family and multifamily is collected in the same trucks as of 2004. In 2003, multifamily recycling contributed 9.7% of the total residential tonnages.
 2. Yard debris figures include a small amount from a drop-off site.

Table 33: Recycling Program Performance in Olympia

Recycling Program Performance	Olympia, 2005
Total Population, 2005	43,330 ¹
Total Households, 2005	20,257 ¹
Number of Single-Family Homes, 2005	14,200 ²
Number of Recycling Accounts (A)	14,200 ²
Annual Recycling Tonnage, 2005 (B)	4,490 tons ³
Pounds per Household per Year (B/A)	632 lb/HH/yr ³
Annual Waste Tonnage (C)	7,379 tons ⁴
Annual Yard Debris Tonnage (D)	3,603 tons ⁴
Diversion Rate [(B+D)/(B+C+D)]	54% ⁴
Single-Family Recycling Rate [(B+D)/(B+C+D)]	31% ⁴

- Notes: 1. From the Washington State Office of Financial Management (OFM).
 2. The number of recycling accounts is assumed to be the same as the number of single-family households, which was estimated based on the total number of households for 2005 and the Census 2000 breakdown for the percentage (70.1%) of single-family homes (1-4 units and mobile homes).
 3. Annual recycling tonnages were reduced by 10% to account for the tonnages from multifamily sources.
 4. These figures include multifamily recycling and waste tonnages.

Seattle

Seattle is one of the few cities in the nation that has adopted an ordinance banning recyclable materials from the waste stream. As of January 1, 2005, residents and businesses cannot place a significant amount (more than 10%) of recyclable materials in their garbage. Violators face having their garbage not picked up, and apartments and businesses may also be fined \$50 for their third violation. Enforcement of this requirement began January 1, 2006, and compliance has been good. Approximately 95% of the apartments and businesses inspected have been recycling correctly. For single-family homes, collection crews have only had to reject about 900 garbage cans for having excessive recyclables in the first six months of 2006, out of about 3.9 million cans collected.

The materials banned from residential garbage include cardboard, other paper, glass bottles, plastic bottles, aluminum and tin cans, and yard debris (yard debris has been banned for several years). For businesses, the banned materials are cardboard, other paper, and yard debris.

A recent analysis by city staff concluded that the ban has increased curbside recycling tonnages by more than 6%, and apartment recycling tonnages by more than 20%. These are, however, preliminary figures based only on the tonnages collected in the first half of 2006.

Based on curbside recycling tonnages of 65,413 tons in 2005 and an estimated number of single-family units of 169,600 households, Seattle's recycling rate was 771 pounds per household per year in 2005. This time period, however, is prior to the effective date of the disposal ban for recyclable materials. Hence, increasing this figure by the impact of the ban (6%, to provide a figure that can be compared to the other programs) yields a recycling rate of 817 pounds per household per year.

SUMMARY OF CASE STUDY RESULTS

The basic data and results of the case study programs are shown in Table 34.

Table 34: Summary of Case Study Programs

Parameter	Anacortes	Mount Vernon	Auburn	Olympia	Seattle
Type of Program	Single-Stream	Single-Stream	Single-Stream	Single-Stream	Dual-Stream
Frequency of Collection	W	EOW	EOW	EOW	EOW
Size of Recycling Container(s)	64-gallon	64-gallon	64-gallon	32, 64, or 96-gallon	Cart plus bin for glass
Amount, pounds/household/year	651	494	683	632	817
Adjusted Amount, pounds/household/year	651	651	902	834	1,078

Note: Adjustments were made in some figures to project the results if weekly (W) collections were conducted instead of every-other-week (EOW) collections.

As shown in Table 34, Seattle's program has the highest recovery rate per household, even before making the adjustments for the disposal ban and every-other-week collections. Other observations and conclusions include:

- Based on the analysis of the recycling programs in Anacortes and Mount Vernon, it appears that weekly programs are collecting 32% more tonnage per household than every-other-week programs.
- Anacortes and Mount Vernon appear to be maintaining their recovery rates over time, and in fact are still building up to their full potential.
- As discussed in more detail for the section dealing with Auburn's program, there is a clear benefit from implementing a new program just because it is new.
- It is unclear how much Olympia may be benefiting from the alternating weekly schedule for garbage and recycling, but both their total diversion (yard debris and recycling) and recycling diversion rates have increased since this system was implemented.
- Seattle's program is doing very well, but at least part of their success can be attributed to the urban nature and higher income levels in this area (relative to the other areas researched for this study).

SECTION FOUR FOCUS GROUP RESULTS

INTRODUCTION

Focus groups were conducted by Entrix, Inc. as part of this project in order to find out more about what Clark County residents like and dislike about the current program and possible new programs. Highlights of the focus group results are presented below and more information can be found in Appendix B.

METHODOLOGY

Participants for the focus groups were arranged through the services of Market Decisions Corporation (MDC), from Portland, Oregon. MDC randomly called garbage customers in the urban areas of the county (Battle Ground, Camas, Vancouver, Washougal, and the urban unincorporated area) to ask if they would attend one of the focus groups. Potential participants were first screened for:

- age (they had to be over 18 years old);
- area of residence;
- affiliation with market research, governmental agency or recycling/disposal company; and
- type of dwelling (single-family only).

Once potential participants had passed this initial screening step, MDC endeavored to recruit people that provided a mixture of ages, interest in recycling, education levels, income levels, children living at home, race and gender. Potential participants were also tested for their ability to articulate, and then were invited to attend one of the focus groups.

After the initial contact, participants were again called a few days before the day of the focus group to remind them of the date and location. A total of 64 people were initially recruited to attend the focus groups, but 20% of them were “no-shows” (which is about typical for this type of activity). Those that did show up were provided with a small amount of compensation (\$33) for their time, fuel costs and other expenses. Providing a small amount of compensation also helped to broaden the audience from just those people interested in recycling to a group that was more representative of the general population.

Entrix staff conducted the focus groups according to a discussion guide that had been prepared beforehand. Examples of carts were brought to the focus groups to demonstrate what the new recycling containers might look like. Six focus groups were conducted throughout Clark County in October 2006 and a total of 51 people participated in these groups (see Table 35).

Table 35: Dates and Participation for the Six Focus Groups

	Date	Target Areas	Number of Participants
Group 1	October 3, 2006	Orchards and surrounding areas	7
Group 2	October 5, 2006	Salmon Creek	9
Group 3	October 10, 2006	Battle Ground	11
Group 4	October 11, 2006	Downtown Vancouver	10
Group 5	October 12, 2006	Fisher’s Landing and Cascade Park	9
Group 6	October 18, 2006	Camas and Washougal	5
		TOTAL	51

FOCUS GROUP RESULTS

The focus groups began with questions and discussion about whether and why the participants currently recycle. Most of the participants stated that they recycle at least part of their materials, although they did so for a variety of reasons. The major reasons cited for participating in the recycling program were:

- because they felt a moral obligation to protect the earth, now and for future generations;
- because they were told to do so by another family member, or to set a good example for their children;
- because they were paying for it anyway as part of their garbage bill; and
- because they could cut down on the amount of their garbage bill, or because they didn’t have enough room in their garbage cans.

The fact that the curbside recycling service is convenient also factored into the above responses, as did the idea that the participants live (or grew up) in an area where curbside recycling is available and viewed as a normal practice.

Reasons cited for not participating, or not participating more fully, included:

- the amount of time and effort required;
- confusion about what materials could be recycled or how to prepare the materials; and
- frustration caused by notices received that they had been preparing materials improperly or having materials left behind by collection crews for what were perceived to be minor issues.

More questions were asked during the focus groups about the current system, including asking what people like and dislike, testing people's knowledge about what can be recycled, why sorting into three bins is required, and soliciting input on possible improvements. When asked about improvements, many of the focus group participants responded that they felt that there is room for improvement. Specific improvements mentioned included:

- more items accepted for recycling;
- better information;
- more frequent collections;
- use of a single bin; and
- use of bins with lids.

Examples of potential new recycling containers (64- and 96-gallon carts with wheels and lids) were shown to the focus groups and a series of questions were asked about how the participants might like to use the containers and new collection methods. The options presented at the focus groups for discussion and feedback purposes were:

Option A – a single large cart for all materials (single-stream method).

Option B – a large cart with glass in a separate bin to the side (dual-stream method).

Option C – a large cart with no curbside collection for glass (single-stream without glass).

When asked to compare the potential containers and collection methods, 90% of the participants felt that they would prefer Option A (single-stream recycling) to the current three-bin system. For the dual-stream method (Option B), 80% of the participants felt they would prefer the cart and a separate glass bin over the current three-bin system. For a single-stream system without glass collection (Option C), 62% of the participants stated they would prefer the existing three-bin system over losing the option to recycle glass through the curbside program. For Option C, 70% of the participants stated that they would discontinue recycling glass, while others admitted that glass might “accidentally” be placed in their recycling containers.

When asked which is their overall favorite option:

- 62% preferred the single-stream cart with glass included;
- 28% preferred the dual-stream option (glass in a separate bin to the side);
- 8% preferred the single-stream option with no curbside collection for glass; and
- only 2% (one participant) preferred the existing three-bin system.

CONCLUSIONS

The views of the attendees tended to differ depending on the areas of the county featured in the group, the different types of homes that people owned, and the income levels of participants. Overall, participants were pleased with the potential cart system alternative. Statements by the focus group participants indicate that the use of single compartment carts for recycling may increase both participation in the recycling program and the volume that each household will recycle. When presented with the option of glass excluded entirely from the program, however, people in general tended to prefer the current system to the cart system.

SECTION FIVE PHONE SURVEY RESULTS

INTRODUCTION

A phone survey was also conducted as part of this project. These surveys targeted single-family garbage customers in Vancouver and the other urban areas of Clark County. Altogether, 600 households were surveyed for information about their current recycling practices and preferences for changes to the recycling program.

Highlights of the survey results are presented below, and more information can be found in Appendix C.

METHODOLOGY

A total of 600 surveys were conducted by telephone in November 2006. Survey respondents were drawn at random from the customer population of four areas: the cities of Vancouver, Camas, and Washougal, and the remaining portion of Clark County that is within the urban growth boundary. Because the City of Vancouver was interested in data specifically for their residents, they provided additional funding for 400 surveys in their city, and the remaining 200 surveys were drawn from the rest of the county. Consequently, the results presented here are a weighting average based on population, so that the combined results provide a representative picture of countywide views.

Survey questions were developed in cooperation with the City of Vancouver and Clark County, and were designed to check the preferences identified through the focus groups (see Section Four of this report). The survey asked about current recycling efforts and community perceptions of potential changes to the recycling program.

SURVEY CONCLUSIONS

The results of the survey suggest that residents in Clark County appreciate the present three-bin recycling system, and support the idea of a new cart system with glass service to the side. Not many support the idea of a cart-based recycling system without the ability to recycle glass at the curb.

The survey of Vancouver and Clark County households concluded that:

- 76% of the respondents stated that they recycled “a lot,” another 20% stated they recycled “some,” and only 4% stated that they recycled little or none. College graduates were slightly more likely to recycle a lot (79%) and people in large households (four or more people) were

even more likely to recycle a lot (87%). In one-person households, only 45% claimed to recycle a lot.

- two-thirds (66%) of the 4% who stated they recycled little or none stated that they did not recycle because they did not have much to recycle.
- 51% of the people who stated that they recycle some or a lot said that the most appealing aspect of the program was that it is easy to use. 22% of those who stated that they recycle some or a lot said that doing something good for the environment was the aspect they liked most about the current program. The third most popular response to this question was reducing the amount of garbage (14%).
- given the option of a new program using a cart (at no additional cost) with glass placed in a separate bin next to the cart, 58% of the current recyclers said they would prefer this approach, 29% said they would prefer to continue using the 3-bin system, and 13% didn't know which they would prefer. The people who were least likely to want the new cart were people over 60 years old and one-person households.
- given the option of a new program using a cart (at no additional cost) but without glass collection, 79% of the respondents stated that they would prefer to continue using the current three-bin system.

More details on the phone survey, including specific comments received, are shown in Appendix C.

PREVIOUS SURVEYS ON SOLID WASTE AND RECYCLING

Other surveys were recently conducted in Vancouver and Clark County on waste collection and recycling services, and highlights from those surveys are provided below.

Previous Survey in Vancouver

In November 2004, 400 phone surveys of residential customers were conducted in Vancouver, Washington. This survey asked questions about the level of satisfaction that residents felt about garbage collection and recycling services in general, about the city's role in the system, and about the performance of the two service-providers (Waste Management still provided service in part of the city at that time). The conclusions of this survey include:

- 77% of the survey participants were satisfied with the garbage and recycling services, and only 8% were dissatisfied (others had neutral feelings or no opinion).
- 94% of the respondents considered reliability of pickups to be the most important factor for garbage and recycling services.
- 72% felt that the availability and variety of container sizes and service rates is an important element of the garbage and recycling services, and 64% were satisfied with the currently-available choices.

- 90% felt that their household had been provided with adequate information about how to prepare recyclables for curbside collection.
- 72% felt the current curbside recycling system was easy and convenient, and only 10% felt it was not easy or convenient.
- 51% felt that they would prefer a simpler curbside recycling system using a cart, and 35% felt they would prefer to continue using the three-bin system.
- 36% wished to recycle one or more additional items, including plastics or plastics containers (16%), styrofoam (7%), plastic bags (4%), solvents or other hazardous wastes (4%), paints (4%), bulky items (4%), and a variety of other materials.

Previous Survey in Clark County

In May and June 2005, 600 phone surveys of residential customers were conducted in Clark County. The surveys were divided into three categories (200 phone surveys each): UGA residents with recycling, rural residents with recycling, and rural residents without recycling. Highlights of this survey include:

- 89% of the survey participants were satisfied with the garbage and recycling services. Slightly more of the rural residents with recycling were satisfied (94%) than UGA residents (85%).
- 98% of the respondents considered reliability of pickups to be the most important factor for garbage and recycling services.
- for those households that were using the curbside recycling service, 82% felt it was easy and convenient and only 5% felt that it was not easy and convenient.
- for those households that were using the curbside recycling service, 45% felt that they would prefer a simpler curbside recycling system using a cart, and 34% felt they would prefer to continue using the three-bin system. Slightly more people in rural areas (48%) felt they would prefer the cart than those in the UGA (42%).
- only 18% overall of the survey respondents stated they would be willing to pay up to \$2.00 more each month for a new system of curbside recycling, 73% said no to this idea and 10% were unsure. The number of people willing to pay more was lower in the UGA (10%) than in the rural area (25% and 23% for those with recycling and without recycling, respectively).
- 93% felt that their household had been provided with adequate information about how to prepare recyclables for curbside collection (responses were similar for all three areas).
- 37% of the survey respondents stated that they self-haul recyclables to a transfer station or recycling center. The response to this question was lowest in the UGA (20%), followed by the rural residents with recycling services (34%), and highest for those households in rural areas that did not subscribe to curbside recycling services (57%). Altogether, 62% of all households self-haul one or more materials (garbage, recyclables, yard debris or hazardous wastes), and these households made an average of 4.2 trips per year to a disposal facility or recycling center.

- 37% wished to recycle one or more additional items, including styrofoam (11%), plastic tubs (10%), all plastic containers in general (9%), and a variety of other materials.
- 71% of the survey respondents stated that they were recycling as much as they can. The response to this question was highest in the UGA (83%), followed by the rural residents with recycling services (78%), and lowest for those households in rural areas that did not subscribe to curbside recycling services (52%).

SECTION SIX

IMPACTS OF POTENTIAL PROGRAM DESIGN CHANGES

INTRODUCTION

This section discusses various aspects of program design, for both the existing program and potential new approaches. Because this study examines potential changes to the recycling program, a brief review of these issues and alternatives is provided here.

THE VALUE OF RECYCLING GLASS

One of the larger questions currently faced by local recycling programs is what, if anything, should be done about glass. Glass has proven itself to be a problem in almost every type of recycling system:

- the three-bin approach used in Clark County currently results in large piles of mixed-color broken glass that is suitable only for low-value applications. This glass could be sorted mechanically, but even the cleanest color-sorted glass has only a small market value that would not pay for the additional processing expense.
- the single-stream approach also creates a stream of mixed-color broken glass, and the broken glass contaminates other materials. Glass contamination in paper is especially a problem for the mills processing single-stream material, but plastics processors are also having problems with glass. In fairness, it should be noted that other materials (such as plastic bottles and metal cans) also show up in the paper sent out from single-stream facilities. These can be screened out at the paper mills more easily, but still represent a loss of recyclables.
- dual-stream systems require a separate container to collect the glass curbside, and then either a separate truck or a truck with two or more compartments to collect it. Participants either need to keep the colors separate (as is done in Eugene), which reduces the convenience factor, or if all colors are placed in one bin (as in Tacoma), then this approach again results in a mixture of colors with a low market value.

There is no easy answer to the problems associated with glass, and in response some communities have simply ceased collecting it. This creates other problems, such as customer dissatisfaction and difficulties in achieving recycling goals (glass bottles make up 12.3% of the tonnage in Clark County's curbside recycling programs).

Ironically, all of these problems are created by a material that has the lowest value when recycled. Market value for color-sorted glass is typically low, and even clear glass brings in less than \$30 per ton. Recyclers have to pay to get rid of mixed color broken glass. Yet there are other benefits to recycling glass, besides just its value on recycling markets.

An analysis of the environmental benefits of using recycled glass to manufacture new containers compared with using the recycled glass as a construction aggregate estimates that the former has environmental benefits worth about \$285 per ton for recycled glass used in producing new glass containers versus \$22 of environmental benefit for recycled glass used as a construction aggregate. This is because substituting recycled glass for the virgin raw materials used to make glass containers – primarily sand, calcium carbonate and sodium carbonate – eliminates the energy usage and pollution emissions created when those virgin materials are mined and processed to produce new glass containers. For example, melting recycled glass to make new glass containers uses 35% less energy and produces 48% less greenhouse gases. By contrast, using recycled glass as a construction aggregate only offsets the energy required to operate a gravel pit and transport the crushed rocks and gravel to the construction site.

Processors of single-stream recyclables are much less successful at being able to clean and color-sort glass so that it can be used in manufacturing new glass containers. Processors for dual-stream and three-bin recycling systems also produce some mixed color broken glass that can only be used in low economic and environmental value applications such as construction aggregate. But dual-stream and three-bin programs typically are able to send 50% or more of the collected glass to manufacturers of new glass containers, whereas single-stream processors often make no attempt to recover any of the recycled glass for shipment to glass container manufacturers.

Thus, the decision as to whether to collect glass, and if so, whether in a separate stream or combined with other materials, needs to take into account the high environmental value for using recycled glass to produce new glass containers. This environmental value is substantially greater than the relatively low market value for recycled glass, and suggests that traditional closed-loop glass recycling is a much more valuable endeavor than the market prices for color-sorted glass might indicate. These factors mean that one should not be too quick to throw glass out of the curbside recycling collection system altogether. Nor should one too readily decide to throw it in with other materials that will prevent the separation of the collected glass into the three colors that can be marketed to glass container manufacturers.

ALTERNATIVE APPROACHES

In addition to the alternatives examined in this study (three-bin, single-stream and dual-stream), there are other alternatives for curbside recycling or for recycling glass. It is worthwhile to note these options if only in passing, because changing conditions in the future (such as increasing energy costs or fuel shortages) may make some of these options more feasible.

Co-Collection using Separate Compartments on the Collection Truck

One variation of co-collection is to use a truck with separate compartments on it to collect garbage in one section and recyclables in another. This approach saves somewhat on collection costs by avoiding the need for a separate truck for the curbside recycling service, but also poses problems with proper sizing of the compartments and other issues. Interestingly, a key factor in the success of this approach is to have a recycling facility located close to or at the same property

as the transfer facility for garbage, which of course Clark County already has in the West Van Materials Recovery Center. This approach, however, generally works best in rural areas, where driving distances between customers are large and hence the savings in transportation costs help offset the inefficiencies caused by trying to collect two different materials on the same truck.

Alternating Weeks for Garbage and Recycling Service

Clark County currently has weekly recycling collections in the urban areas, and so it would seem that reducing the collection service to every-other-week would be a step in the wrong direction for recycling tonnages. In the case of alternating weeks for garbage and recycling services, however, some communities have found this to be a good method for maintaining recycling levels while also reducing costs. The theory behind this approach is that households still recycle at high levels, even though the collection frequency is every-other-week, because recycling is the only option for that week. The City of Olympia uses this approach, for instance, and their recycling performance compares favorably to other areas. Other, smaller cities (such as Port Townsend) also use this approach. Recently one hauler (Waste Management) has promoted this approach as a method of reducing truck traffic (thus reducing vehicle emissions and collection costs) and boosting waste diversion rates in the Puget Sound region.

Container Deposits

Container deposits may appear to be an ideal solution to the problems associated with glass collections, by creating a separate collection system where people have a financial incentive to participate. This approach would also remove the burden of dealing with this material from the public sector and put it back on the private companies that are making and selling products in glass packaging. A deposit system, however, whether just for glass or beverage containers in general, does not present a quick solution nor is it likely to be politically feasible.

Container deposit systems are generally conducted through statewide programs, but with Clark County's position across the river from Oregon, it may be feasible for the county to adopt the same or a similar approach, essentially hooking onto Oregon's program. Since Oregon's deposit program does not require a transfer of funds between the state and private companies such as bottlers or retailers (as is done in some states), it could be relatively simple to adopt the same approach in Clark County.

Product Stewardship

Nationally and regionally, there is increasing interest in using product stewardship approaches to address waste disposal problems. For instance, Washington State recently adopted a new law requiring manufacturers to take back some types of electronics. In the case of glass containers, product stewardship could take the form of:

- private companies taking over the glass collection by offering money for glass bottles;

- the glass industry paying for new equipment or improvements at MRFs to allow more glass to be recovered; and/or
- the glass industry paying for new equipment or improvements at local glass plants to allow more glass (or mixed glass) to be accepted.

Unfortunately, the glass industry has been largely absent from discussions about curbside collection problems, and expecting this industry to undertake additional efforts voluntarily is probably unrealistic. Mandatory programs would probably be necessary, and again this is an approach that would be handled better on the state level.

SECTION SEVEN

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Conclusions from the Benchmarked Areas and Case Studies

The primary conclusions of the research and analysis done for the benchmarked areas and case studies are:

- Both dual-stream and single-stream programs perform better than three-bin programs in terms of total volumes collected. Increased contamination can be a problem, however, especially in automated systems where the driver no longer sees the recyclables being collected.
- All other factors being equal (demographics, collection frequency, materials collected, container size, etc.), dual-stream and single-stream programs perform about equally.
- Existing programs, especially mature programs such as Clark County's, can benefit from program changes for no other reason than the program is new and more public education is conducted.
- There is a trend for programs with larger containers to collect more material, but this idea must also be balanced against having containers that are too large and unwieldy. A variety of container sizes should be offered to allow people to choose the size that works best for them.
- All of the jurisdictions that collect commingled materials deliver those goods to a highly automated material recovery facility. Savings achieved by automating the collection system may be negated by the cost of these separation facilities.
- Processing facilities for dual-stream and single-stream programs require a higher level of sophistication and greater investments in equipment than three-bin systems, and so typically require larger flows of materials to be operated in a cost-effective manner.
- Market prices are typically lower for single-stream materials, and specific markets may even reject the materials.

The motivation for single-stream or other commingled collections has come from the haulers in all of the studied cases. Efficiency of collection is the dominant driver for these decisions. It should be noted that the programs that collect three-bin recyclables do so manually. Programs that switch to single-stream or some level of commingling usually also switch to a cart system. Carts can be collected by either semi-automated or automated collection, or a combination of both depending on route conditions. This change results in decreased staffing requirements by the hauler and less time on the road, which often offsets the capital expense of new trucks and hauler-provided carts.

Providing a large cart for collection of recyclable materials offers some advantages, both real and perceived. Covering the materials keeps them drier, making them easier to separate via mechanical processes. The cover also minimizes litter problems caused by open containers set out curbside. Providing a large container for recyclables provides a visual statement that the program's desire is to maximize recycling, while also making easier to recycle materials such as cardboard. Finally, it is hoped that a cart containing mixed recyclables will discourage scavenging. There is a significant amount of anecdotal evidence that Clark County is losing part of the aluminum cans set out for recycling to scavengers who are taking this material across the river into Portland for the deposit value.

Automated collections provides additional significant benefits to the collection company, in terms of reducing worker injuries, allowing larger payloads in the collection trucks, and making it possible to collect from many more households each day with a single driver and truck. The efficiency of fully automated systems may, however, suffer in neighborhoods that have alleys, cul-de-sacs, flag lots, on-street parking, or other access issues that slow trucks down. Some companies use a small truck to service accounts that are difficult to reach with the regular collection truck.

Using a cart with a lid and automated collection does not allow any feedback to the generator if there are improper setouts. Additional public education should be conducted to help counter the lack of oversight in these cases.

Some programs are still using a semi-automated approach, where the driver needs to leave the truck to push the cart onto a device that empties it into the truck. The semi-automated approach does not allow as many households to be served with a driver and truck in a day (thus increasing collection costs), but it does allow for scrutiny of the cart's contents (thus reducing processing costs). Examination of the cart's contents allows for better quality control of the collected materials, and also allows feedback to the participants. Without feedback, there is the potential for contamination to spiral out of control as more and more people come to think that it is okay to recycle unacceptable materials simply because those materials are taken away without objection.

Conclusions from the Focus Groups and Phone Surveys

Participants in the focus groups and phone surveys generally liked the idea of using a large cart for recycling, although not at the expense of being able to recycle glass curbside. Not all respondents were in favor of switching to carts and a pilot program would allow for a practical assessment of whether they could be "won over."

Summary of Findings

Table 36 summarizes the findings from the research and public input conducted for this project.

Table 36: Summary of Findings

	Program Performance				Public Input		Overall Rating
	Tonnages Collected	Collection Costs	Processing Costs	Market Value	Focus Groups	Phone Surveys	
Ideal System	High	Low	Low	High	High	High	High
Three-Bin Program	Low	High	Low	High	Low	Medium	Low
Single-Stream, with Glass	High	Low	High	Low	High	High	Medium
Single-Stream, without Glass	Low	Low	High	Low	Low	Low	Low
Dual-Stream	High	Medium	Medium	Medium	Medium	High	Medium

Note: The “ideal system” is shown simply to indicate whether a high or low rating is preferable for each factor.

RECOMMENDATIONS

Based on the findings of this research, the dual-stream approach appears to offer the best combination of convenience to the participants, collection and processing costs, tonnages collected, and market value for the collected materials. The container used for the commingled materials in this approach should be primarily a 96-gallon cart with wheels and a lid, but 64-gallon and smaller containers should also be available on request. The bin for the glass should be a 14-gallon or 18-gallon bin, or possibly the bins used currently for the recycling program.

Should the county and cities choose to go with a dual-stream program, there are still several aspects to consider:

- **Glass separation by color:** Although requesting participants to place all glass bottles in the same container, without separation by color, provides more convenience, this approach also yields a mixture that cannot easily be recycled back to bottles but instead is best suited for low-value applications. Requiring participants to keep glass sorted by color (as is done in Eugene) may cause a reduction in the amount of glass collected but the glass can then be used for a higher value application. The additional market value for color-sorted glass may partially offset the increased collection cost for this approach. The current recycling bins could be used for collecting the glass separately by color.
- **Other materials to be collected:** A broad range of materials should be recycled. The more materials that can be recycled, the more people appear to recycle for all materials. The desire to recycle the broadest range of materials possible should, however, be weighed against the idea that once a material is added to the recycling program, it is essentially impossible to remove it. A related concern is that people will try to recycle similar materials, or what they perceive to be similar. If they are told that it is acceptable to recycle plastic tubs of one type, for instance, some of the participants will set out plastic tubs of all types.
- **Collection frequency, weekly versus every-other-week:** Weekly programs collect more materials, but every-other-week collections reduce fuel consumption.⁴ The alternating week schedule (alternating weekly collections of garbage and recyclables) may help offset the reduced results from every-other-week collections, but the evidence of this is partly anecdotal. Part of the reduction in tonnages from using every-other-week collections can be offset by providing a larger cart.

These and other factors could be tested in pilot projects to determine which approach would be the most acceptable to Clark County residents.

⁴ The balance between greenhouse gas generation for recycling versus fuel consumption weighs heavily in favor of more recycling being better. Recycling has substantial greenhouse gas (GHG) benefits because products manufactured using recycled materials require less energy and raw materials than products manufactured without recycled content. The average ton of curbside recyclables yields about 2.5 tons of GHG reductions when those materials are used to make recycled-content products that replace virgin-content products. Yet, additional GHG generation from collection trucks, processing facilities, and shipping is typically less than 0.25 ton of GHG per ton of curbside collected materials. This does not take into consideration the reductions in GHG generation at the disposal sites and from garbage collection trucks.

PRELIMINARY COST ANALYSIS

Comparison of Costs for all Four Approaches

An important question for any changes to a recycling program is how those changes will affect the cost. Clearly, any changes in collection methods will require significant expenditures for new collection and processing equipment. These expenditures may be at least partly offset by increased collection efficiencies (lower operating costs) and increased market revenues (from increased tonnages).

The conclusions shown in Table 36 provide general information about the relative costs and results of the various approaches. Table 37 takes the cost analysis a step farther by providing cost data for specific items. The data shown in Table 37 includes:

- the cost of collection vehicles is based on the cost for trucks recently purchased by the City of Tacoma. Tacoma purchased two trucks with stand-up drive on the right-hand side (which allows the driver to easily leave the vehicle to empty the glass bin) and an arm that can be used in either fully-automated or semi-automated mode for the commingled toter. The trucks have Labrie bodies on a Crane Carrier chassis (which is expensive but durable). The trucks have a “bubble” door in back, which adds about two cubic yards of capacity to the commingled compartment.

The truck cost shown for the dual-stream approach assumes that a two-compartment truck would be used to service the routes, but another possibility is to use two trucks; one for the commingled materials and a second for the glass. The second truck could also pick up waste oil and possibly other materials that could be added to the program (such as electronics and textiles). It might be possible to modify the existing trucks used by Waste Connections to serve as one or the other collection trucks for a dual-stream program, or to serve as the collection vehicle in a single-stream program.

- cost of collection containers are based on recent purchases by other cities for amounts similar to what will be needed in Clark County. Distribution costs for the containers may add an additional \$2 to \$3 per container.
- for collection costs, the statement that single-stream without glass leads to a collection cost that is \$1 to \$3 lower per household than single-stream with glass is based on information filed with the Washington Utilities and Transportation Commission (UTC) for the Pierce County program.
- processing costs are based on existing contracts for various communities in the Pacific Northwest.
- market revenues for other materials for the existing program in Clark County are from the first quarter of 2006 and include glass sales. For Tacoma, market revenues for other materials are for 2005 and exclude glass.
- net recycling costs for other areas is based on information from the UTC (see Table 26), primarily for unincorporated (franchise) areas.

Table 37: Cost Comparison

Cost Factor	Type of Program			Comments	
	Three-Bin Method (existing program)	Single-Stream, with Glass	Single-Stream, without Glass		Dual-Stream
Collection Vehicles	\$170,000	Collection truck costs about \$200,000 each		2-compartment truck = \$240,000	Costs based on recent purchases by Tacoma.
Collection Containers	\$8 per bin, or \$24 for a set of 3 bins	\$30 to \$60 per roll cart	\$30 to \$60 per roll cart	\$30 to \$60 per roll cart	Actual price will depend on size, use of imprinted information, and other factors.
Collection Costs	Highest collection cost	Lowest collection cost	\$1 to \$3 per household less than s-s w/glass	\$3/HH/mo (estimated) #	Single-stream without glass is \$1 to \$3 less than single-stream with glass.
Processing Costs	\$30 per ton *	\$20 to \$40 per ton	\$20 to \$30 per ton	\$20 to \$30 per ton #	Tacoma's costs = \$20.50 per ton for the commingled materials and \$22.50 for glass in 2006.
Market Revenues, Glass	-\$10 to \$15/ton *	-\$10 to 0/ton	NA	-\$10 to \$15 per ton #	Does not include processing costs.
Market Revenues, Other Materials	\$43.16 per ton * all materials, inc. glass)	Lower	\$60.30 per ton	\$60.30 per ton # (exc. glass)	Actual market revenues vary by material and grade.
Public Education		Additional public education will be needed for the first year or two for any new program.			Also need more public education for fully-automated collections and for systems that use drop-off sites.
Other Administration			Higher		Higher cost of single-stream without glass is to maintain drop-off sites.
Net Recycling Cost for Other Areas (per household per month)	Average of Everett, Kitsap County and Whatcom County = \$3.18	Average of four areas = \$4.92	Pierce County, average of two haulers = \$2.68	Tacoma = \$3.70 (estimated)	See Table 26. Note Clark County's costs = \$2.59 to \$3.07 (depending on area).

Notes: Data is shown where available. In all cases, actual costs for new programs will depend on many factors.

* Clark County's costs. # Tacoma's costs.

Projected Collection Costs for Top Two Program Options

Table 38 provides a detailed cost estimate for the two most likely program choices: dual stream collection and a new three-bin program. The decision as to which of these options (or other options) to choose for the future program in Clark County will not be made until after pilot programs are conducted in the summer of 2007, and a bidding process is conducted shortly after that.

The following table includes estimates that are based on a large number of assumptions and conditions. A few of the more important points to bear in mind while reviewing this information are:

- the two programs modeled in the table are being provided as examples only, and there are many details that will affect the cost that cannot be determined until responses are received to the County's bidding process.
- this type of cost estimation cannot take the place of a bidding process for other reasons as well. Bids submitted to Clark County will need to include the contractors' best guesses about future costs for fuel, labor and other important factors.

The following cost analysis begins with assumptions about whether new trucks and containers would be needed to service the program. In this case, all new trucks and containers are assumed to be necessary, in part due to the assumed term of the contract (a term of five to ten years means that even if new trucks or containers aren't needed immediately, they will be needed at some point during the life of the contract). The assumption of all new trucks and containers also allows for the possibility of a change in contractors for the new program. The existing bins could be used for the glass in the dual-stream program, but over the term of this analysis (eight years), those bins will need to be replaced (in addition to the new customers needing bins, etc.).

For operating expenses, a few of the figures shown for the new three-bin program are based on current expenses. For the dual-stream program, expenses are either prorated based on existing program expenses and the relative number of trucks and drivers, or are based on specific calculations as explained in the footnotes to the table.

Other assumptions are shown in the table and in the footnotes.

NEXT STEPS

The next step in this project will be to conduct pilot programs on Clark County in the summer of 2007. The pilot programs will be used to test several variations of the dual stream approach.

Table 38: Projected Expense for Two Types of Recycling Programs

Parameter	Dual-Stream Approach	New Three-Bin Program	Comments
Program Description	Assumes the use of a two-compartment truck for automated collection of commingled materials in a new toter and manual collection of glass.	Assumes the use of a single truck to manually collect three bins of materials (same as the existing program).	
Program Basic:			
Total SF Households in County UGA (1)	48,530 HH	48,530 HH	The estimated number of single-family households in the Urban Growth Area of the county (plus Battle Ground) was provided by the county planning department.
Garbage Subscription Rate (2)	90%	88%	
Recycling Sign-Up Rate (3)	98%	94%	
Total Sign-Ups	42,800	40,144	
Setout Rate (3)	75%	78%	
Setouts per Week (4)	32,130	31,310	
Stops per Truck per Day (5)	700	550	
Number of Trucks and Drivers Needed (6)	9.2	11.4	
Pounds per Setout (7)	25	19	
Tons per Year (8)	20,880	15,470	
Capital Costs:			
Trucks;			Number of trucks needed is based on the calculations shown in the above section, plus a back-up truck. Trucks and other equipment are amortized for an 8-year period and financed at 7.5%.
Number of Collection Trucks Needed (9)	10	12	
Purchase Price, per collection truck (10)	\$240,000	\$170,000	
Delivery Truck (11)	1	1	
Purchase Price, per delivery truck (10)	\$50,000	\$50,000	
Purchase Price, all trucks (12)	\$2.45 million	\$2.09 million	
Annual Cost (12)	\$389,100	\$331,900	
Carts/Containers;			Carts and bins are amortized for an 8-year period and financed at 7.5%.
Roll carts (13)	\$56/HH	NA	
Bins (14)	\$8/HH	\$24/HH	
Total Cost (15)	\$3.01 million	\$1.06 million	
Annual Cost (15)	\$478,600	\$168,300	
Total Annual Capital Costs (16)	\$867,700	\$500,200	Includes depreciation and interest.

Table 38: Projected Expense for Two Types of Recycling Programs, continued

Parameter	Dual-Stream Approach	New Three-Bin Program	Comments
Operating Costs:			Based on current, typical rates for these types of employees in the Clark County area. Supervisory and overhead is based on current (2006) costs for the existing program.
Labor;			
Labor, Collection (17)	\$504,000	\$616,000	
Labor, Delivery (17)	\$56,000	\$56,000	
Labor, Public Education (18)	\$16,000	\$16,000	
Labor, Supervisory and Overhead (19)	\$109,100	\$130,300	
Fuel, Supplies, Maintenance (20)	\$366,000	\$439,200	Based on \$36,600 per truck.
Promotional Materials (21)	\$15,000	\$10,000	
Insurance (22)	\$13,000	\$15,000	
Taxes and Fees (23)	\$195,000	\$195,000	
Total Annual Operating Costs (24)	\$1,274,100	\$1,477,500	
Subtotal, Annual Capital and Operating Costs	\$2,141,800	\$1,977,700	
Profit (10%)	\$214,200	\$197,800	
Total Annual Cost	\$2,356,000	\$2,175,500	
Revenue from Materials Collected (25)	\$683,200 to \$845,200	\$506,200 to \$626,200	Based on current rate of \$32.72 to \$40.48 per ton.
Net Annual Cost	\$1,510,800 to \$1,672,800	\$1,549,300 to \$1,669,300	Total annual cost minus market revenues
Cost per Ton Collected (26)	\$72.36 to \$80.11	\$100.15 to \$107.91	Based on projected tons per year.
Monthly Cost per Household (27)	\$2.94 to \$3.26	\$3.22 to \$3.47	Current cost per HH is \$3.14 per month.

Notes:

1. The number of single-family (SF) households in the service area is a projected 2006 figure for the UGA and the City of Battle Ground, and does not include households in rural areas of the county or in Vancouver, Camas, or Washougal.
2. Garbage subscription rates are based on the current rate for the three-bin program and a slight increase (2%) for the dual stream program (based on Bellevue's experience with switching to single-stream).
3. The estimated sign-up and setout rates for the new three-bin program are based on current program performance. Recycling sign-up is actually mandatory in this area of the county for all but the monthly garbage service level (but garbage service itself is optional), but the sign-up rates shown in the table account for a small percentage that still refuse to participate. The sign-up rate for the dual-stream program is based on Eugene's program. The setout rate for the dual-stream program assumes fewer setouts due to the larger container.
4. The figure for setouts per week is calculated based on the following formula: [total households with garbage service] x [recycling sign-up rate] x [setout rate] = [setouts per week].
5. The estimated number of stops per truck per day are industry standard figures and have been verified based on current programs in Clark County and elsewhere.

Table 38: Projected Expense for Two Types of Recycling Programs, continued

6. The figure for the number of trucks and drivers is calculated based on the following formula: [total setouts per week] / [stops per truck per day] / [5 days per week] = [number of trucks and drivers].
7. The figure for pounds per setout for the new three-bin program is based on current program performance for Clark County in 2005 (which was an average of 19.02 pounds per setout). For the dual stream program, the pounds per setout figure is based on Eugene's program performance (961 pounds/HH/yr, as adjusted for weekly collections) compared to Clark County's existing performance (716 pounds/HH/yr).
8. The figure for tons per year is calculated based on the following formula: [total setouts per week] x [pounds per setout] x [52 weeks per year] / [2,000 pounds per ton] = [tons per year].
9. The number of collection trucks needed includes one backup truck for every 12 collection trucks (industry standard, the extra truck fills in for regular trucks during maintenance and repairs).
10. The purchase price for trucks is based on the recent cost to Tacoma for dual-stream trucks and quoted prices for other trucks.
11. One cart (or bin) delivery truck is needed, plus one full-time driver (1.0 FTE) for that truck.
12. The total purchase price is simply the cost per truck times the number of trucks, and this figure is converted to an annual cost assuming the trucks have an eight-year useful life and are purchased using a loan with a 7.5% interest rate. The figure of 7.5% interest was provided by an industry source. No credit is provided for any salvage value at the end of the eight years, although the trucks will have a small amount of residual value.
13. The cost per cart is based on the current cost for a mix of 64 and 96-gallon carts with imprinted instructions.
14. The cost for bins assumes one bin will be needed for the dual stream program and a new set of three bins will be needed for the three-bin program, at a cost of \$8.00 per bin.
15. The total cost for the carts and bins is based on the cost per household (\$64 for the dual-stream program and \$24 for the three-bin program), times the number of households signed up, plus 10% extras for replacements and new customers.
16. The total annual capital costs are simply the sum of the annual costs for the trucks and for the containers. Here the figure is combined, but in other financial breakdowns these amounts may be divided into separate figures for interest and depreciation.
17. The cost for drivers for the collection and delivery trucks is based on \$40,000 per year plus 40% for benefits and other overhead expenses, multiplied by the actual number of trucks in use (i.e., not including the backup truck).
18. The labor for public education assumes 0.5 FTE as the portion that applies only to the county urban area, at a total salary of \$24,000 per year plus 33% benefits and other overhead.
19. Supervisory and overhead labor costs for the new three-bin program is based on current (2006) costs for the existing program, prorated for urban versus rural areas (90% of the 2006 total is shown). These costs are prorated for the dual-stream program based on other labor costs being lower (84%) than the three-bin program.
20. The figure for fuel, supplies and maintenance is calculated based on \$36,600 per truck per year (from a confidential industry source), and the actual number of trucks in use (i.e., not including the backup truck).
21. Promotional costs shown here are for direct expenses such as flyers and brochures (i.e., does not include public education labor costs). Promotional costs will be higher initially for a different program (such as a new dual-stream program). For a new three-bin program, public education costs are assumed to be the same as in the current program.
22. For the new three-bin program, insurance costs are assumed to remain the same as for the existing program. Insurance costs are prorated based on the number of trucks for the dual stream program.
23. Taxes and fees are assumed to remain the same as the existing program for the new three-bin program, but prorated for the urban portion (90%) of the county service area.
24. The total annual operating costs are simply the sum of the costs shown in the rows above it, for labor and other operating expenses.
25. Revenues from tonnages collected are based on the current payments to the collector of \$32.72 to \$40.48 per ton (revenues are shared between the collector, processor and municipalities), although this rate could change in a future contract or could change based on the mix of recyclables collected.
26. The cost per ton collected is based on the projected number of tons collected each year and the net annual costs.
27. The monthly cost per household is based on the number of households signed up for recycling and the net annual costs (divided by 12 to provide a monthly figure). Note that the current cost for the recycling program in Clark County is \$3.14 per household per month.