

Assessment of Markets for King County Recyclable Materials



KING COUNTY

Prepared for the

*King County Commission for
Marketing Recyclable Materials*

Cascadia Consulting Group
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Executive Summary

Purpose

This report presents key findings and recommendations from a three-month study of markets for recyclable commodities collected through residential, commercial and self haul recycling in King County. From July through September 1998, a consultant team led by Cascadia Consulting Group collected a range of data on supply and demand conditions for eight primary recyclable materials that together comprise a majority of total waste generation in the County. In addition, focus groups and interviews were conducted with industry experts to obtain the best possible insights into market trends, needs and opportunities for these materials.

The goal of this research was to provide the King County Commission for Marketing Recyclable Materials (Marketing Commission) with answers to three central questions:

What are the market conditions and dynamics for each targeted material?

What is or will be the likely impact of these markets on local recycling programs?

What can or should King County or the public sector in Puget Sound do to further develop these markets?¹

Findings and recommendations from this study are intended to be used by the Marketing Commission to establish its priorities, strategies and work plan and to provide the King County Solid Waste Division with the information and direction needed to update the Comprehensive Solid Waste Management Plan.

This study has focused on markets for materials used as feedstocks for manufacturing, and has placed less emphasis on markets for finished products.

Definitions

The following terms are used throughout this report:

- *end user* – in this context, a manufacturer that buys feedstock with at least some recycled content
- *end market* – market in which products with recycled content are sold from end users to public, private or individual buyers

¹ Data cited in this report on tons recycled or disposed in King County include residential, commercial, self-haul and construction, demolition and landclearing waste streams in unincorporated jurisdictions, suburban cities and Seattle.

- *market development* – actions that maintain or enhance the transaction of recyclable materials at any stage in the recycling loop, e.g., ensuring that adequate supply is collected, promoting demand for manufacturing feedstock with recycled content, and facilitating creation or maintenance of critical processing capacity
- *public sector* – county or municipal governments in Puget Sound with whom King County could act jointly or whom King County could encourage to take market development action

The commodities examined in this study are listed in the table below. Definitions of each material are provided in each chapter.

general category	targeted material
glass	mixed glass sorted glass
gypsum	gypsum wallboard
metals	aluminum cans aluminum scrap white goods steel food cans other ferrous metals
organics	food waste yard waste animal waste
paper	newspaper cardboard & kraft (old corrugated cardboard – OCC) high grade paper mixed waste paper
plastic	#1 PET bottles #2 HDPE bottles other rigid containers (#3-#7) film
textiles	used clothing
wood	urban wood green wood

Outline

This executive summary, addresses the following issues:

- *structure* – how the report is structured and why
- *overview of disposal & recycling data* – what these data suggest about the relative magnitude of each targeted commodity
- *rankings* – how each targeted material is ranked relative to the others in terms of the need and opportunities for market development and the ability of the public sector to influence markets
- *key findings and recommendations* – central conclusions are presented for each targeted material

- **overall findings** – what the research suggests about markets for targeted materials in general
- **overall recommendations** – the main actions proposed for consideration

How the report is structured

- **Executive summary is the central focus.** We include three main parts in this report: executive summary, chapters and appendices. The executive summary serves as the primary focus for readers. Chapters meet a secondary purpose, as explained below.
- **Chapters intended to be used “at a glance.”** In support of the executive summary, the chapters have been written to provide background information and analysis, rather than recapitulate conclusions and recommendations in detail. Chapter formatting includes many bullets and headers in order to highlight key information.
- **Appendices offer further details.** The appendices offer additional information for readers who would like to examine the baseline data, assumptions and methodology in closer detail.

Overview of disposal and recycling data

Data indicate relative tonnages

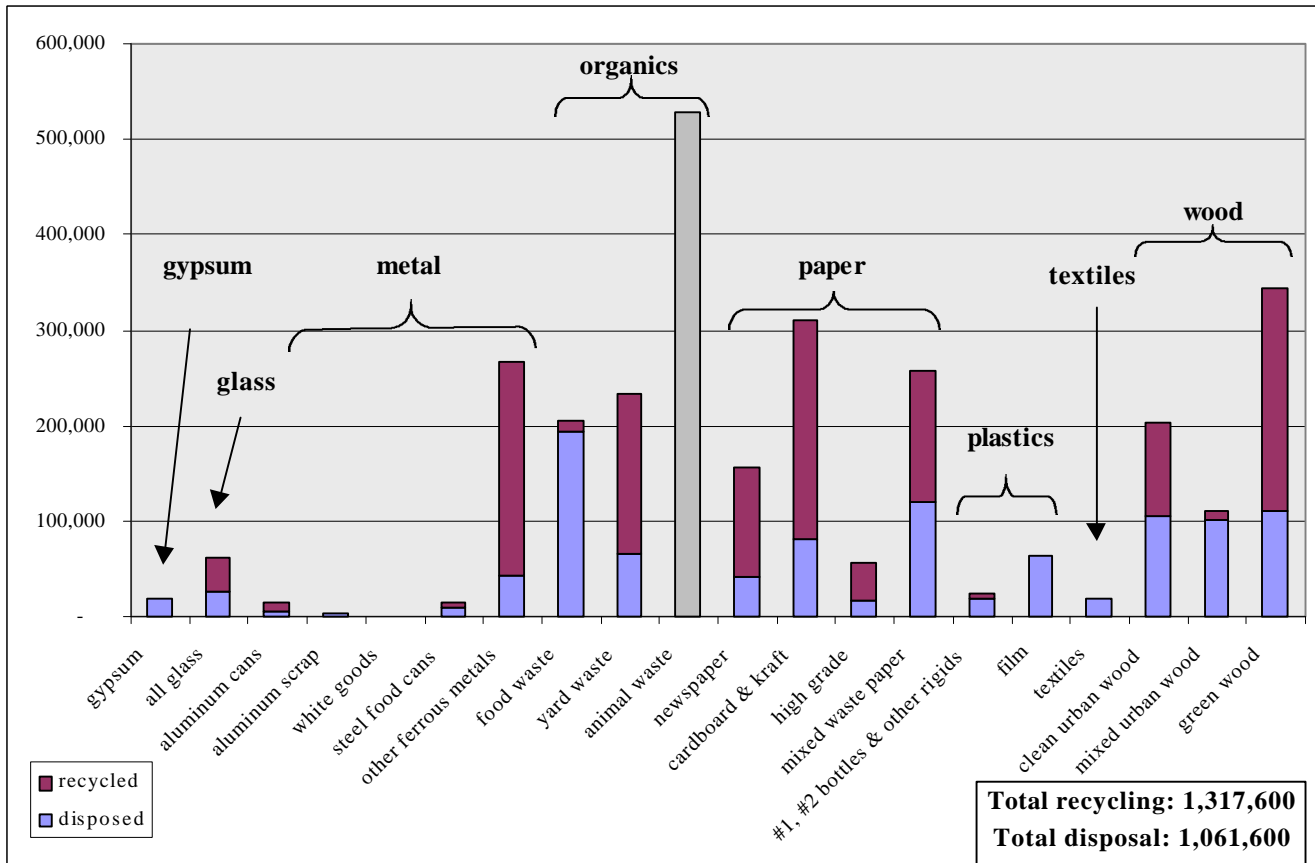
The data obtained for this study from King County and the City of Seattle provide the estimated tons of targeted materials in both the disposed and recycling streams.² Tons per year offer one measure of significance, though not the only measure. The analysis also takes into consideration factors such as landfill volume (space) and environmental implications.

Figure E-1 below illustrates tons disposed of and recycled for each commodity in 1996. Figure E-2 provides detail on the relative percent and quantity of material recycled from King County. These data yield important insights into the markets for recycled materials in the county:

- **Paper fiber and wood comprise the largest segment of both the recycled and disposed waste streams.** “Paper fiber” and “wood” combine to account for well over 50 percent of total generation of targeted materials. These materials account for 577,400 tons disposed of and 861,900 tons recycled – these tonnages represent 54 percent of total disposal and 65 percent of total recycling.
- **Organics is the second largest component of the waste stream with much yard waste and little food waste currently being recycled (composted).** The market for compost from yard waste is well developed with about 72 percent of this material recovered from the waste stream. In contrast, very little food waste is being composted and marketed in the region.

² In Appendices A through H, we include these reported estimates.

Figure E-1: Estimated recycling and disposal of targeted commodities (1996 tons)³

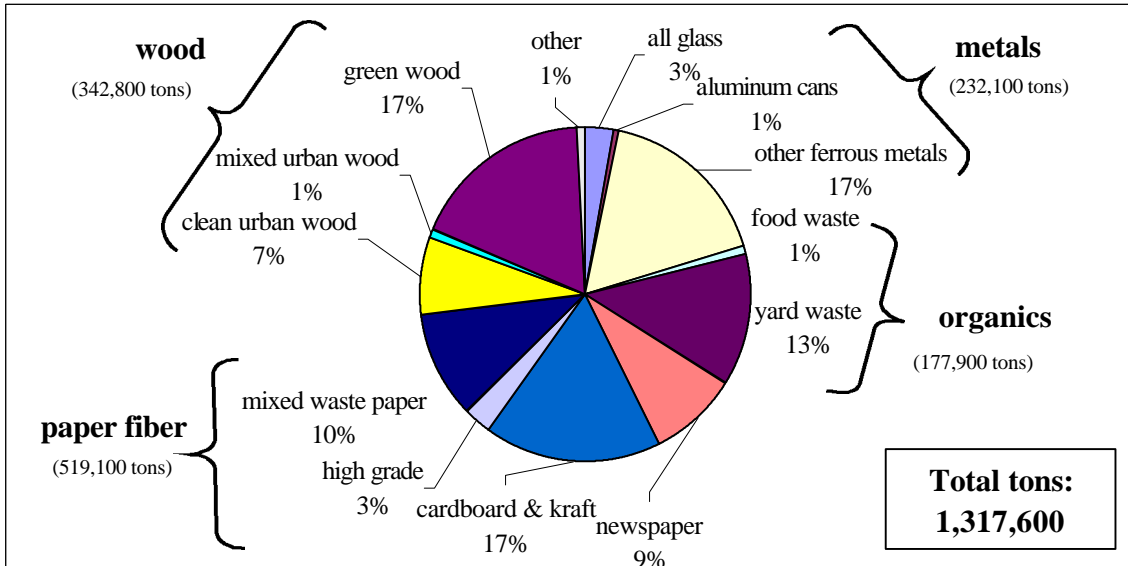


- Animal waste prominent yet different.** Animal waste represents the single largest type of material generated, dwarfing all other categories. It is shown in Figure E-1 with its own unique shading (not as “recycled” or “disposed”) because it does not enter the municipal solid waste stream. Instead, it is typically land applied for growing crops on farms.⁴

³ Only disposal data are available for gypsum, film and textiles. Textiles recycling is believed to be substantial. Only limited recycling data are available for white goods, reported at 100 tons. Green wood recycling and disposal amounts shown are estimated, not officially reported.

⁴ Animal waste is also not included in Figures E-3 and E-5 because it is not disposed as municipal solid waste from either residential or commercial generators.

Figure E-2: Estimated recycling of targeted commodities (1996 tons)⁵



- **Most metals are currently being recovered from the waste stream.** The overall recycling rate for metals is 79 percent. Regional, national, and international markets currently absorb about 62 percent of King County’s total metal generation, according to reported data.
- **All other materials – glass, plastics, gypsum, and textiles – comprise only eight percent of total generation and three percent of the total recycling stream.** While these materials are only a small part of the recycling and disposal stream, they can have a significant impact on the economics of both recycling and disposal systems. For example, glass which is only three percent of total recycling, is (as shown in Figure E-4) nine percent of the residential recycling program. Thus, difficulty with markets for glass could have a significant impact on the viability of King County’s curbside recycling programs.

⁵ Textiles data not available. Also, “other” includes: gypsum, aluminum scrap, white goods, steel food cans, animal waste and all plastics. These qualifications also apply to Figures E-4 and E-6.

Residential sector recycling & disposal

Figures E-3 and E-4 provide detail on tonnages disposed of and recycled from the residential sector only. These data include recycling by residents using curbside, drop-off and self-haul services. These data show that organics and paper fiber account for most of the disposed of and recycled tonnages.

Figure E-3: Estimated RESIDENTIAL SECTOR recycling and disposal of targeted commodities (1996 tons)

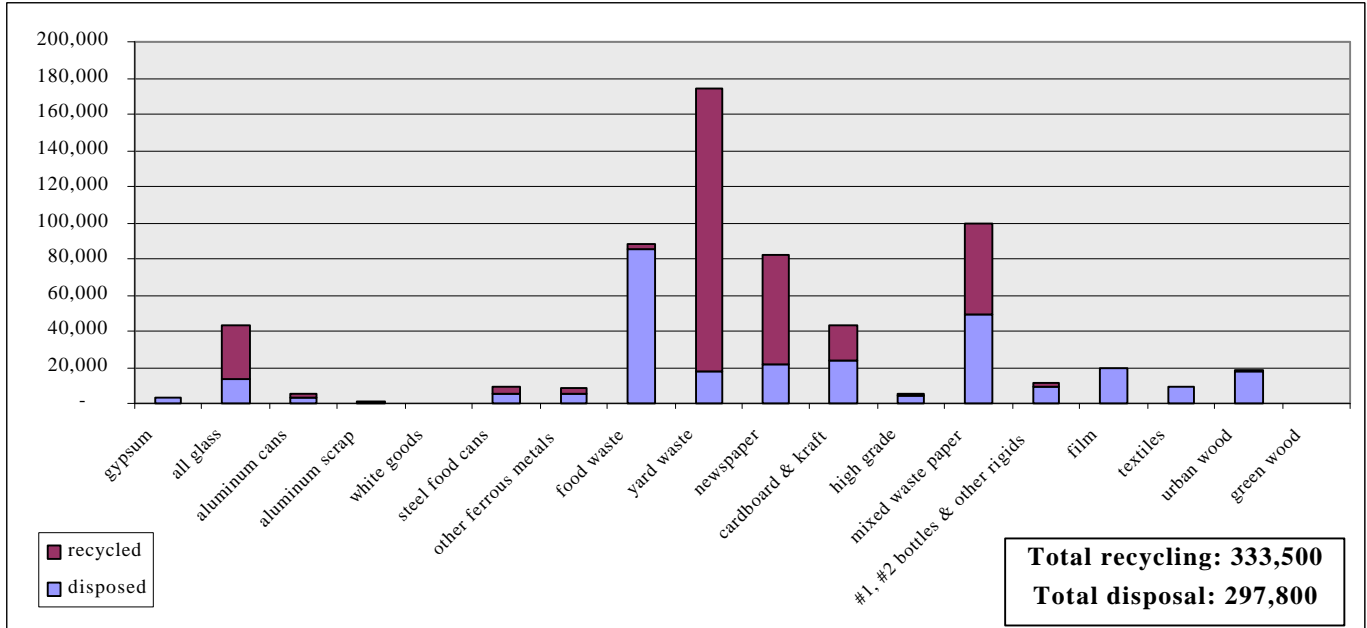
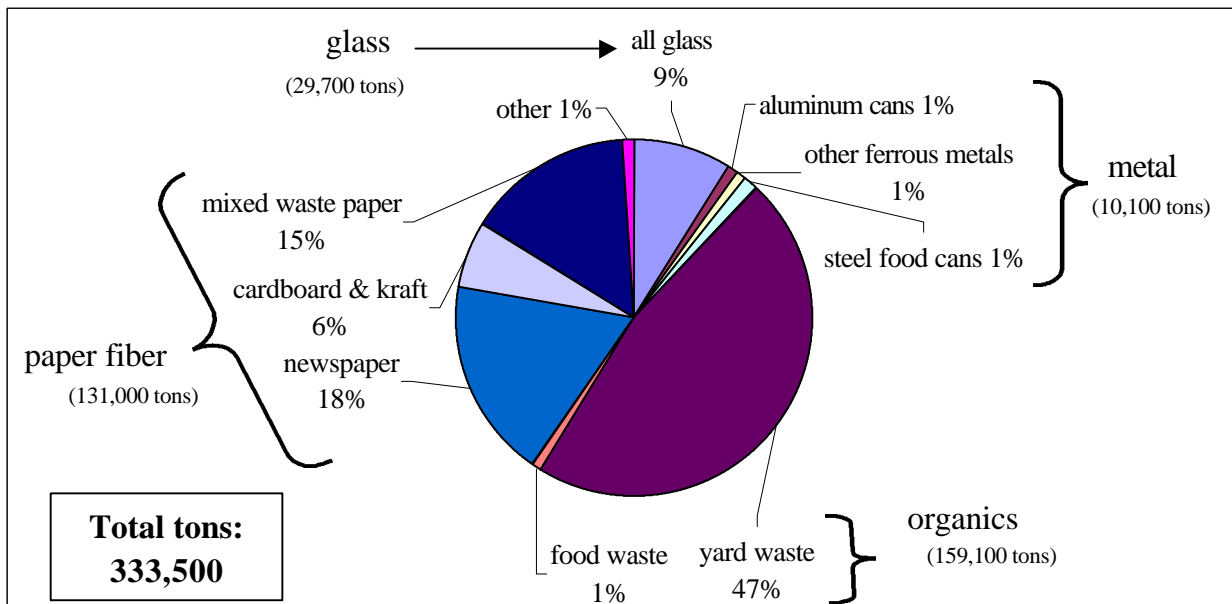


Figure E-4: Estimated RESIDENTIAL SECTOR recycling of targeted commodities (1996 tons)



Commercial sector recycling & disposal

Figures E-5 and E-6 provide similar detail on quantities of the targeted materials recycled and disposed of by the commercial sector. As can be seen, metals, cardboard and wood comprise a significant percentage of the recycling stream with glass and yard waste relatively less important compared to the residential sector.

Figure E-5: Estimated COMMERCIAL SECTOR recycling and disposal of targeted commodities (1996 tons)

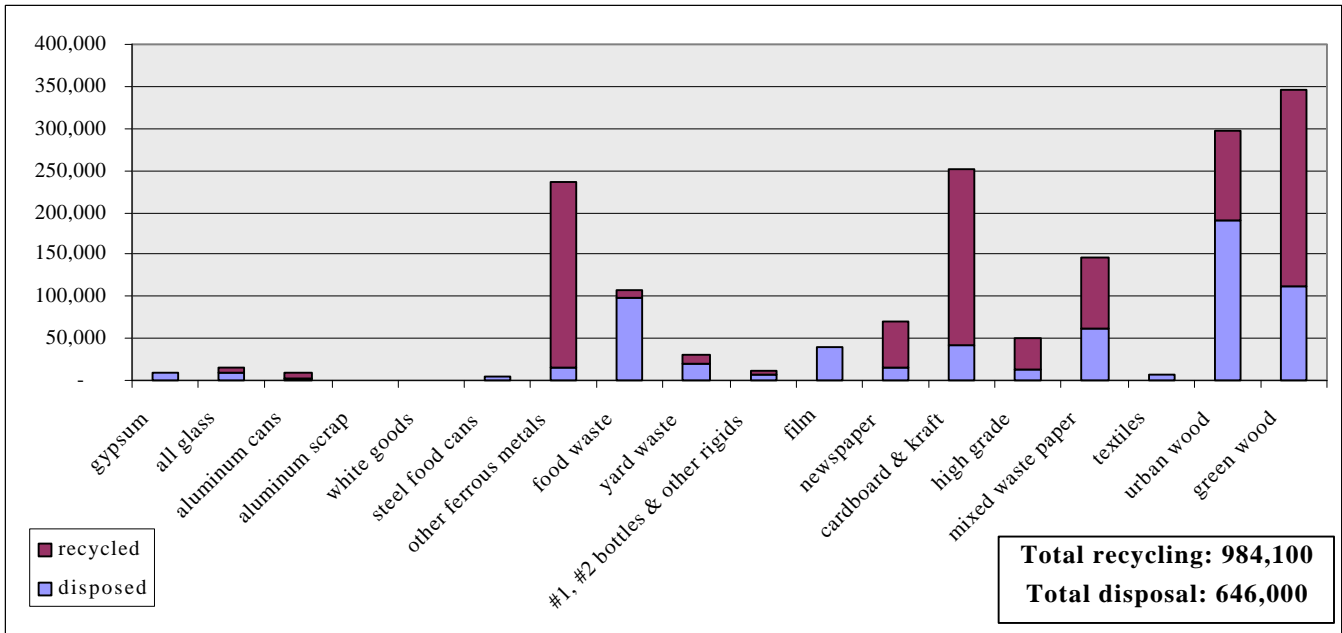
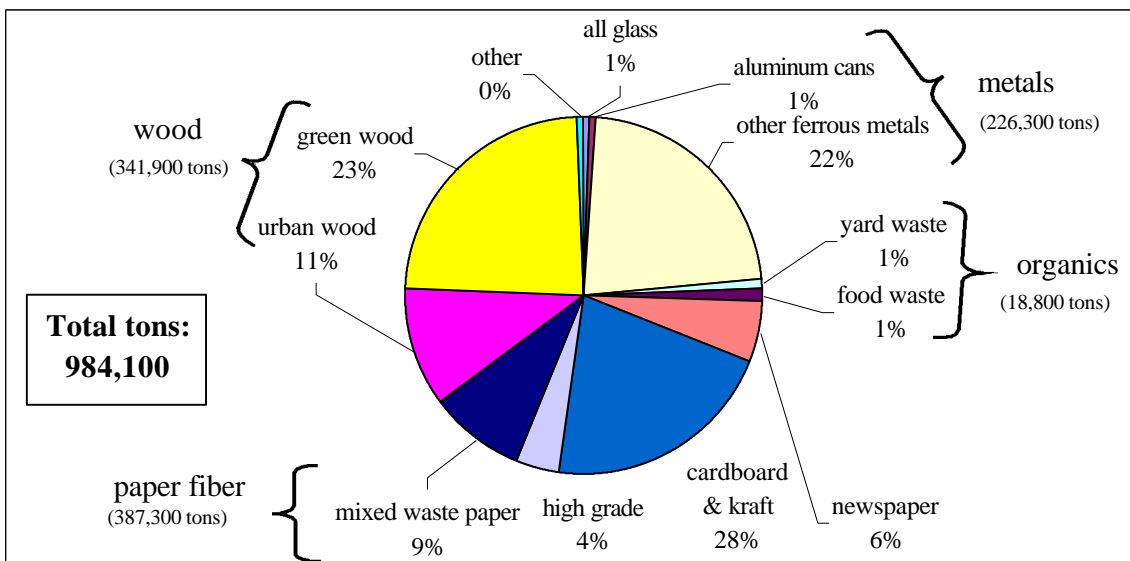


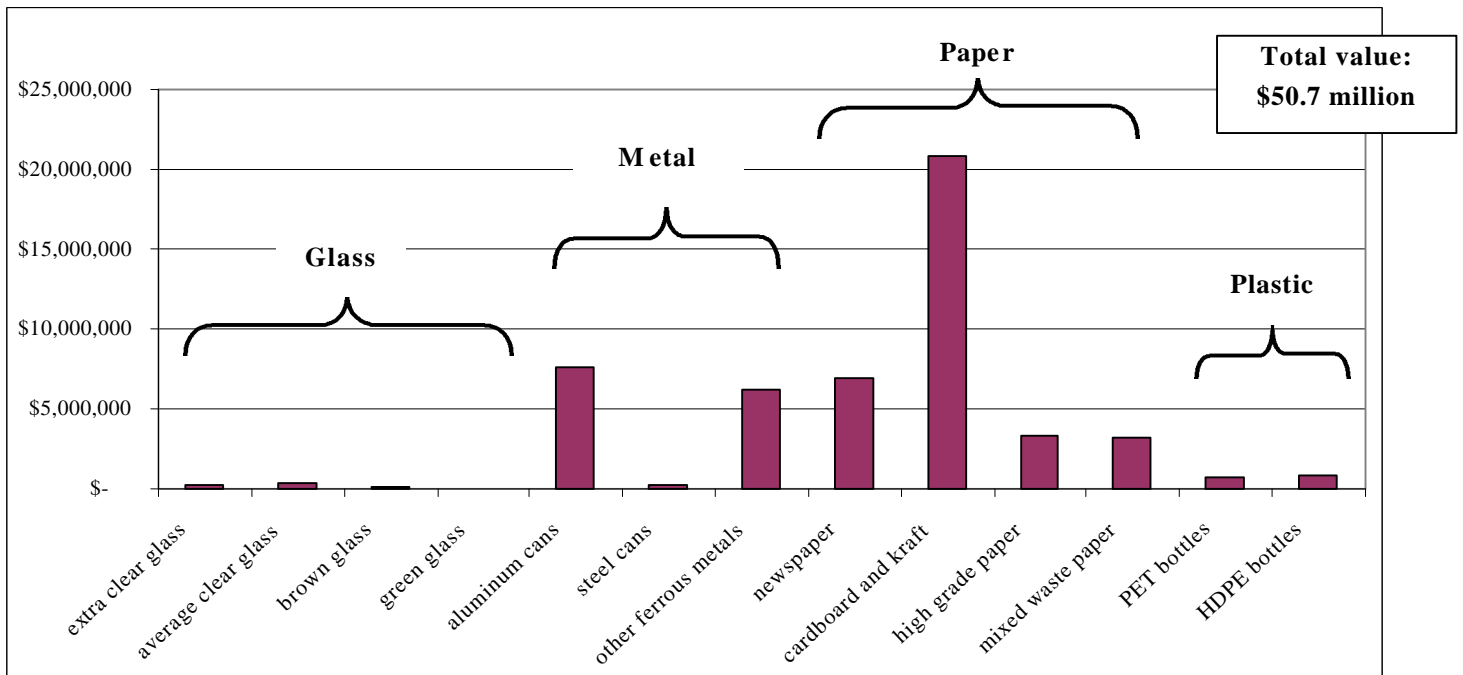
Figure E-6: Estimated COMMERCIAL SECTOR recycling of targeted commodities (1996 tons)



Value of material recycled

Multiplying the tons recycled of selected targeted materials by market prices offers a look at the estimated revenue generated by these materials.⁶ Figure E-7 illustrates the value of each material in the overall recycling stream. Figure E-8 juxtaposes the residential share of these values with the values of commercially recycled materials.

Figure E-7: Market value of targeted recycled materials (price x tons recycled)⁷



Market values – key findings

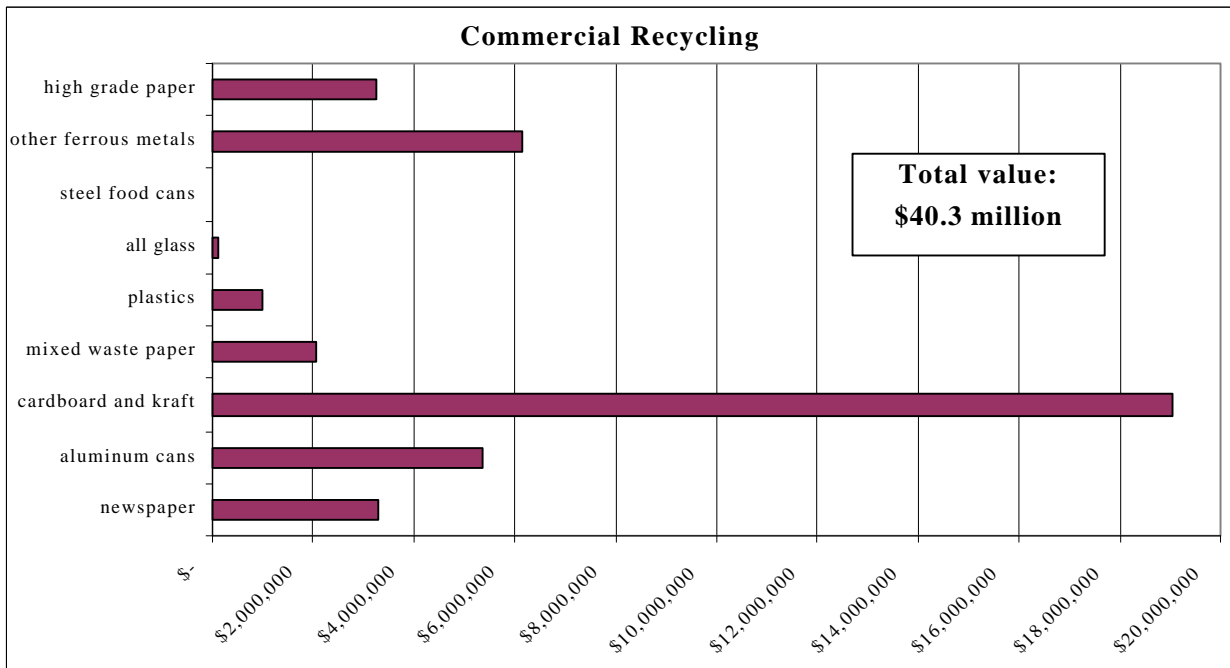
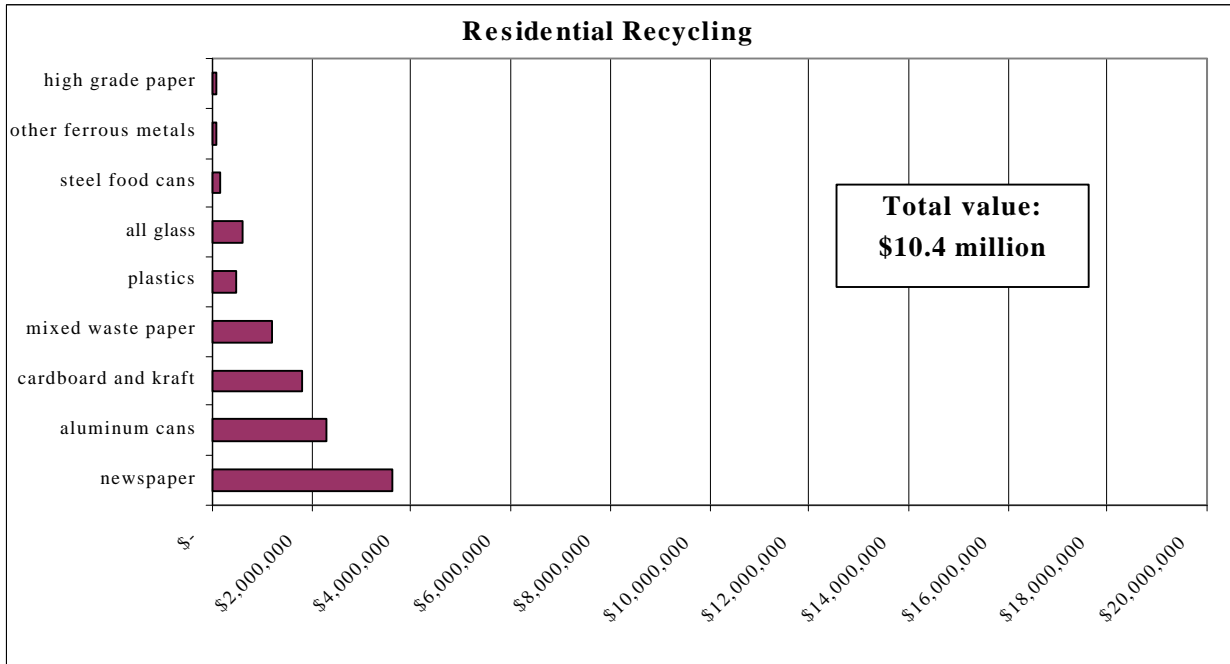
The market values of recycled materials reflected in Figures E-7 and E-8 suggest several key points:

- **Overall value substantial.** The estimated revenues from recycling these selected materials is considerable – more than \$50 million. Residential programs account for about \$10.4 million, while commercial recycling represents \$40.3 million. Cardboard has by far the greatest value, at more than \$20 million – perhaps not surprising, given its high number of tons (229,400) and relatively high price per ton (\$91). Cardboard is also easy to obtain, lightweight and enjoys strong demand from local mills. Aluminum cans and other metals rank second in value, as a group (\$13.5 million), followed by newspaper (\$7 million).
- **Commercial recycling driven by cardboard.** Cardboard and kraft clearly represent the highest revenue source for recycling from commercial generators, at about \$19 million. Other ferrous metals (more than \$6 million) have greater total tons than cardboard (220,000 vs. 209,000) but receive a lower price per ton (\$28 vs. \$91).

⁶ These values represent approximate revenue to collectors for each target material.

⁷ Tons are base year 1996. Prices are averages from the first six months of 1998.

Figure E-8: Market value of residential versus commercial recycled materials (price x tons recycled)



- **Newspaper value highest in residential recycling.** Recycled newspaper represents the highest revenue generator among materials in curbside collection programs, at just under \$4 million. Aluminum cans have the second greatest value, at just over \$2 million.
- **Historically, prices have fluctuated but tons have stayed flat.** Over the past decade, prices for each of the targeted commodities have varied – considerably in some cases (see each chapter for details on actual and projected prices). Tons recycled, however, have remained largely steady.

Rankings

Purpose

As part of the assessment of market conditions, each targeted material was evaluated and ranked to determine relative market development needs and opportunities as well as the ability of the public sector in King County to influence those markets.⁸ The goals of this evaluation process were to:

- **Recommend where to focus public sector action.** We sought to identify those commodities for which the public sector could most effectively develop or maintain markets.
- **Propose where the public sector should be less involved.** We also aimed to determine on which commodity markets the public sector should not focus, due to low need, opportunity or ability to influence market development.

Approach

Our approach consisted of three main steps:

1. **Establish ranking criteria.** The potential for successful public sector market development actions hinges primarily upon three criteria:
 - *The need for market development* – what problems if any exist with the supply, demand or infrastructure?
 - *The opportunity for market development* – what potential exists to either expand demand or increase supply to existing or anticipated end markets?
 - *The public sector’s ability to influence markets* – can King County on its own or in partnership with other local governments affect the supply, demand, or infrastructure for each targeted material?

⁸ Ability to influence was defined generally as options available to the public sector for enhancing the development of markets for recyclables, e.g., restrictions or bans on landfill disposal of recyclable materials, public financing of recycling infrastructure (i.e., processing capacity) and legislation requiring recycled content in finished products.

The consultant team discussed each of these factors in detail, defining questions and key issues associated with each. These are described further in the Criteria section below.

2. **Rank materials.** Each commodity was then qualitatively ranked against the criteria using a scale of 1 to 5, with 5 equaling the highest possible rating. In other words, the higher the number the greater the need, opportunity and/or ability to influence the market. All team members contributed to this evaluation and ranking process to ensure that the results reflected the collective judgment and expertise of the entire team.
3. **Establish priorities.** Finally, the separately ranked materials were organized into three levels of priority for market development action: high, medium and low.

Criteria

The questions and issues associated with each of the three criteria are as follows:

- **Market Development Need**
 - *Sustainability:* How stable and diverse are markets for this commodity?
 - *Volatility:* Are prices, supply, and/or demand volatile or unpredictable?
 - *Magnitude:* How many tons are disposed? How many tons recycled? Do these tons represent significant shares of King County disposal or recycling streams?
 - *Environment:* To what degree would increased recycling offer environmental benefits?
- **Market Development Opportunity**
 - *Demand potential:* Can markets absorb more material? Is there unmet or latent demand in intermediate or end markets?
 - *Supply potential:* How much recyclable material is being disposed? Does excess supply exist in Puget Sound or the greater Northwest?
 - *Technology potential:* Are new technologies available that would spur market development?
- **Ability to Influence**
 - *Local markets:* To what extent are demand and prices determined by local factors versus tied to global markets?
 - *Regulatory factors:* What regulatory or other power does King County have to affect markets?⁹

⁹ Recent attempts to pass “bottle bills” in Washington state have appeared not to draw sufficient support, whereas local measures (e.g., landfill bans) have had influence (e.g., wood and gypsum). “Bottle bill” laws in California seem to drive markets for mixed glass from King County.

- *Market share*: What share of supply and demand, at each stage of the recycling loop, is in King County?
- *Maturity*: To what degree are markets at each stage of the recycling loop already fully developed or mature? For example, does there appear to be sufficient supply and demand at each stage, such that a significant share of generated material is recycled?

Results of ranking process

Table E-1 lists the results of the ranking process on a scale of one (lowest) to five (highest). Figure E-9 also illustrates these results in a grid that plots both the *Ability to Influence* criteria on the Y axis and *Need/Opportunity* on the X axis.

In reviewing these results it is important to understand that **rankings are relative, not absolute**. Each targeted material has been ranked relative to the others in order to provide the Marketing Commission and other public sector entities with an understanding of priorities and where market development action could make a difference. Also, in Figure E-9, the rating for the separate criteria of need and opportunity have been averaged together, again to more clearly demonstrate relative priorities for public sector action.

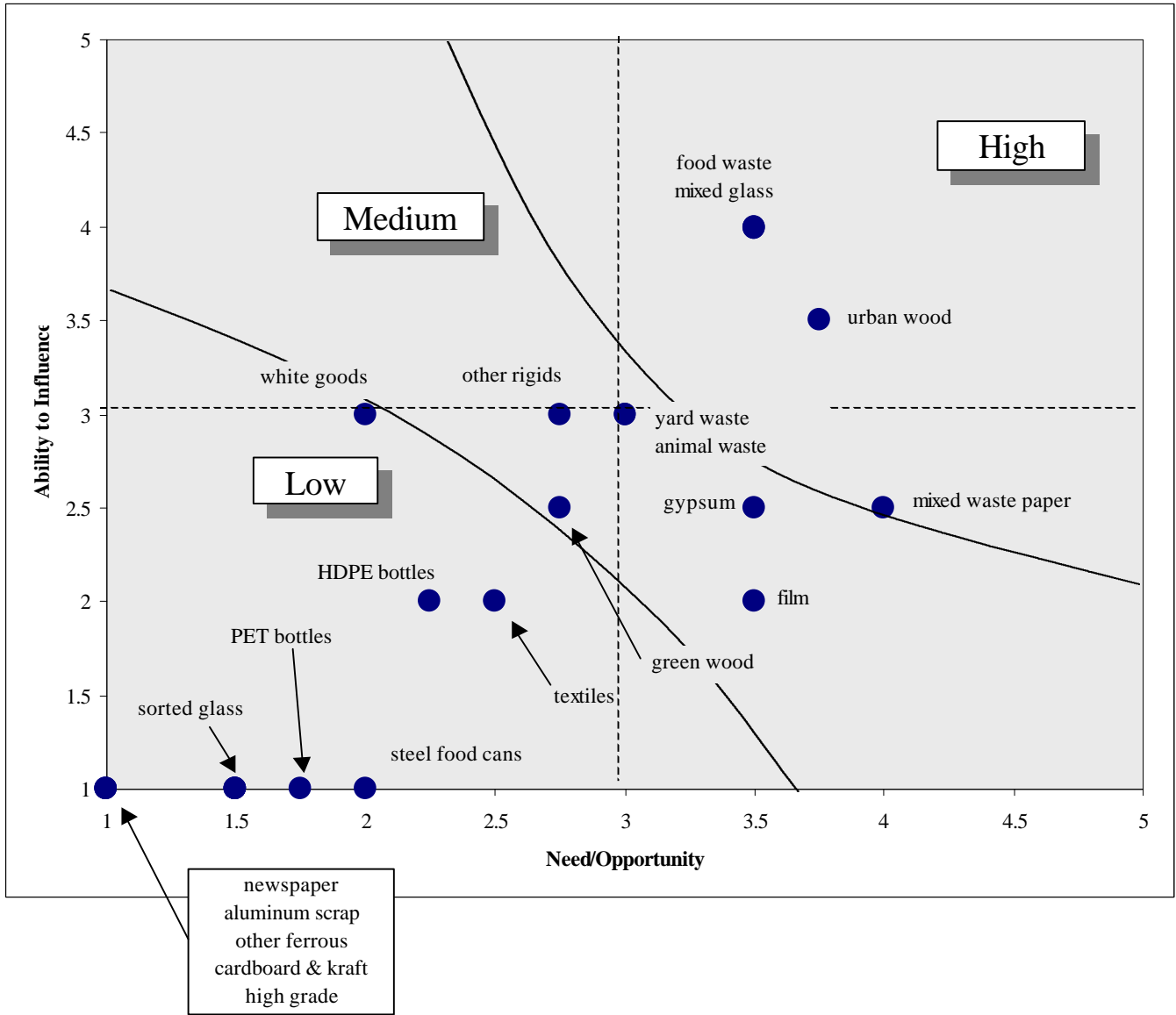
The ranking process can be used to provide guidance for future market development initiatives:

- **Four materials are included in the *high-priority* category: food waste, mixed glass, urban wood, and mixed waste paper.** The market situation for each of these materials differs as discussed in more detail later in this Executive Summary and in subsequent chapters. These are all materials where the need and/or opportunity is high. For food waste, mixed glass, and urban wood, the ability to influence markets is also considered high, primarily because markets for those materials are primarily regional in scope. For food waste, the opportunity is high given the quantity of material in the waste stream and the potential size of the regional organics market. With Seattle considering adding food waste to curbside collection, the potential need for market development activities is also high. For mixed waste paper, the need is relatively high, while the public sector’s ability to influence that market is considered to be somewhat less.
- **Six materials are grouped in the *medium-priority* category: yard waste, animal waste, other rigid plastics, plastic film, gypsum, and green wood.** The needs and opportunities associated with these materials vary as does the ability of the public sector to influence market conditions.
- **The remaining 11 materials are grouped in the *low-priority* category.** The conclusion of the team is that the markets for these materials are *relatively* stable, developed and healthy and that the public sector’s ability to materially affect supply and demand conditions is limited.

Table E-1: Results of commodity ranking process

	<u>commodity</u>	<u>need</u>	<u>opportunity</u>	<u>avg. of need & opportunity</u>	<u>ability to influence</u>
glass	mixed glass	3.5	3.5	3.5	4
	sorted glass	2	1	1.5	1
gypsum	gypsum	4	3	3.5	2.5
metals	aluminum cans	1	1	1	1
	aluminum scrap	1	1	1	1
	white goods	2	2	2	3
	steel food cans	3	1	2	1
	other ferrous metals	1	1	1	1
organics	food waste	4	3	3.5	4
	yard waste	3	3	3	3
	animal waste	3	3	3	3
paper	newspaper	1	2	1.5	1
	cardboard & kraft	1	2	1.5	1
	high grade	1	2	1.5	1
	mixed waste	4	4	4	2.5
plastic	#1 PET bottles	2.5	1	1.75	1
	#2 HDPE bottles	2	2.5	2.25	2
	other rigids (#3-#7)	3	2.5	2.75	3
	film	3.5	3.5	3.5	2
textiles	textiles	2	3	2.5	2
wood	urban	3.5	4	3.75	3.5
	green	2.5	3	2.75	2.5

Figure E-9: PRIORITY MATRIX – Results of commodity rankings, according to need/opportunity versus ability to influence



Recommended priorities

The ranking process leads to a set of recommended priorities for action by type of material:

- 1. Focus on commodities with high need, opportunity and ability to influence.** The public sector should actively work to address market needs and opportunities for glass, wood, and mixed paper. In addition, if curbside or other programs to collect food waste are implemented, efforts will be required to address processing and end markets for organics.
- 2. Consider possible action on commodities with mid-level rankings.** The Marketing Commission and other public entities should carefully consider the market needs and opportunities of these materials on a case-by-case basis. Some new initiatives may be warranted for these materials, e.g., encouraging manufacturers to use recycled feedstocks. In addition, ongoing programs to expand supply (e.g., through education and incentives to expand collection) and activities to stimulate end use demand (e.g., “Get in the Loop”) should include these commodities.
- 3. Monitor situation for commodities with lowest rankings.** The Marketing Commission and other solid waste agencies should follow supply and demand trends for these lowest ranked materials and ensure that the collection, processing, and re-manufacturing infrastructure remain strong. New initiatives are probably not advisable for these materials. However, as with the medium-priority commodities, efforts to encourage residents and businesses to both recycle these materials and buy recycled content products are likely to contribute to the long-term viability of King County’s recycling system.

Key findings and recommendations for top-ranked materials

In this section, we outline our main findings and recommendations about each of the top-ranked commodities. For each material, we include a diagram of the recycling loop. On each diagram, arrows indicate at which points of the loop we recommend public sector action.

Food Waste

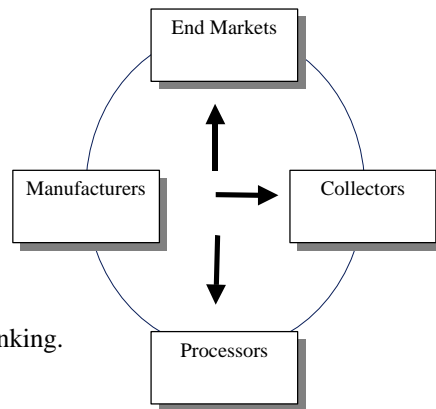
- **Situation:** Neither the City of Seattle, suburban cities nor King County presently collect food waste as part of their residential recycling programs. Most food waste is disposed of in landfills. Some food waste also flows into sewage treatment facilities via residential disposal units or commercial food grinders. Nevertheless, many residents in both Seattle and the County have successfully adopted backyard composting practices. Also, some pre-consumer food waste is gathered in Seattle for recycling by collectors that haul it to the Cedar Grove compost facility.

Seattle is considering adding food waste to its curbside program in an effort to divert this material from the disposal stream. It is unclear what impact this action would have on the area’s organics processing capabilities or on markets for products made from recycled organics, such as topsoil and compost. Joint collection of food waste with yard waste may increase the supply of organics considerably and increase processing costs. Growth in supply or changes in feedstock may require expanded processing capacity and/or type of capacity.

- **Recommendation:** King County should consider the following actions:
 - Study the possible effects that the addition of food waste to curbside recycling would have on the County’s compost processing infrastructure.¹⁰
 - Identify feasible steps by which the County could expand the area’s organics collection, processing capacity and/or demand. Publicly procured compost could be used, for example, as road fill or to mitigate soil erosion.
 - Continue to promote backyard composting.
 - Promote markets for food waste in the context of public sector action for all organics feedstocks – yard waste, animal waste and food waste. Markets for products made from each of these materials are tightly interrelated. Changes in supply for any one of them may have direct implications for organics markets as a whole.

need/opportunity = medium
ability to influence = high

See Chapter Four for further discussion of the interconnected nature of organics markets



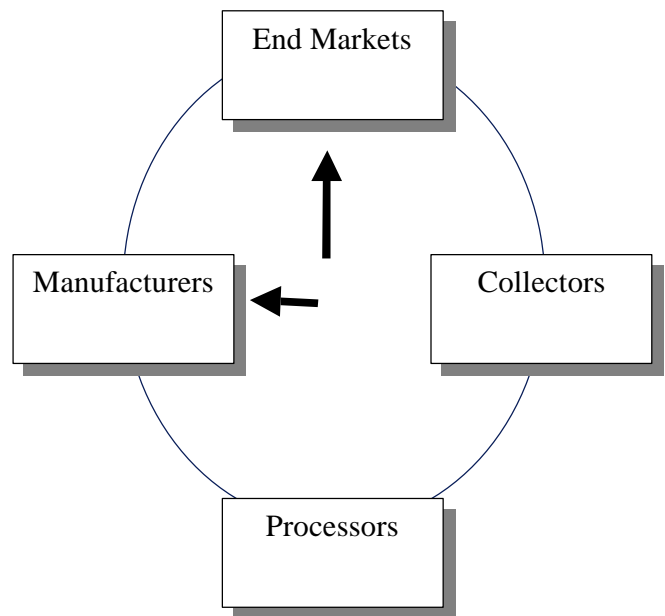
¹⁰ The public sector’s ability to decide whether to collect food waste for recycling and whether to increase processing capacity are large reasons for this commodity’s high “ability to influence” ranking.

Mixed Glass

- **Situation:** While overall glass supply continues to decrease over time, the supply of mixed glass is increasing as collectors and materials recovery facility (MRF) operators move away from sorting glass. Meanwhile, markets for mixed glass are limited, with most of the County's glass going to one end user (Gallo in California). The mixed glass market in California is driven by state minimum content requirements. If these requirements are reduced (a legislative initiative in California is underway to make this change), the current market for glass from King County could be eliminated overnight.
- **Recommendation:** The public sector should work to expand end uses, create market options and promote recycled content. Recommended actions include:
 - Strengthen the market for glass as an abrasive by working with local processors to develop a viable use for the spent abrasives. Currently no such use exists, limiting the potential for glass to be used in this application.
 - Ensure adequate infrastructure for processing of mixed glass. Identify ways in which local processors may need assistance, such as siting or permitting of facilities.
 - Maintain an option for use of glass as a construction aggregate.
 - Investigate and encourage the use of mixed glass as a septic filtration medium in King County.
 - Encourage the wine industry to use more recycled glass in wine bottles.

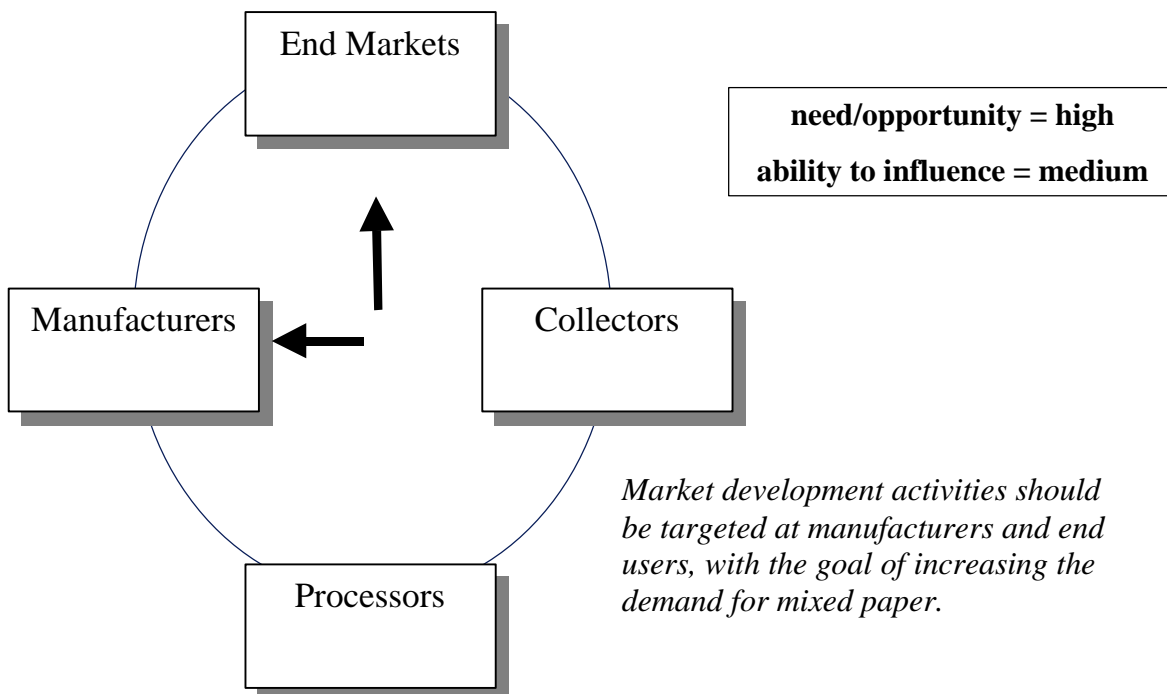
See Chapter One for a more detailed description of the situation in mixed glass markets and of each of these recommended actions.

need/opportunity = medium
ability to influence = high



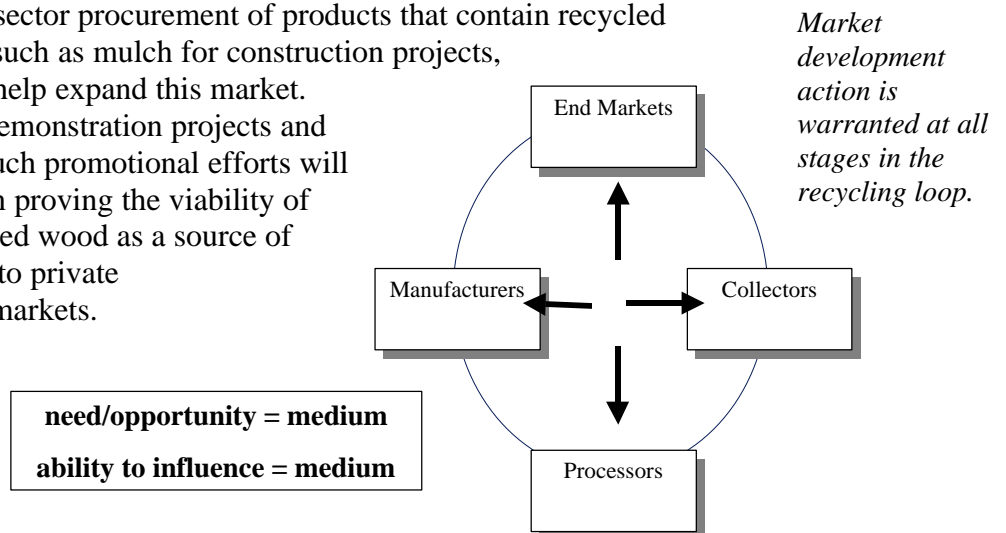
Mixed Waste Paper

- **Situation:** Mixed waste paper is recycled and disposed of in substantial quantities and takes up considerable space in landfills. Only one local end user exists in the region (Abitibi in Steilacoom, south of Tacoma), making this market vulnerable. Potential exists for growth in regional supply, both from increased frequency of collection in Seattle and possible new collection in Portland, Oregon. Rising supply could depress local prices and have a negative effect on recycling programs. In order for other mills to use mixed waste paper as a feedstock, they must first invest in equipment that requires substantial capital investment.
- **Recommendation:** The public sector – whether King County acting alone or in conjunction with county and municipal governments or state agencies – should encourage area mills other than the one in Steilacoom to consider using mixed waste paper as a feedstock. It should also promote development of secondary products made from mixed waste paper, such as molded pulp, landscaping and construction products.



Urban Wood

- Situation:** A considerable amount of the supply of urban wood is disposed. While the general infrastructure for collecting and processing urban wood is well developed, significant barriers adversely affect diversion and penetration of markets for use of urban wood as a feedstock. Many generators continue to have limited access to recycling, and manufacturers have a limited understanding of recycled wood as a raw material alternative.
- Recommendations:** The public sector should act to bolster diversion opportunities and expand demand by manufacturers. These actions will lead to more wood recycling and greater stability in the industry. Increased receiving capacity is needed to facilitate diversion. Leadership is needed to improve access to individual markets for regional wood processors. The following three initiatives are recommended:
 - Site more integrated receiving facilities.** “One-stop shop” receiving facilities that are able to accept two or three grades of recovered urban wood waste will greatly improve the feasibility of recycling for generators and improve diversion potential. King County should site such facilities itself or provide incentives and support for the private sector to do so.
 - Expand feedstock markets by promoting industry standards and organizing coalitions.** The wood recycling industry today has improved technical processing abilities, but there is a lack of understanding among large fiber users of the potential associated with recovered wood. There is an opportunity for a collaborative effort with industry to educate mainstream fiber users, using standardized terms and grade descriptions. Such an effort could convey information about how recycled wood can be processed to control quality and geometry, and greatly improve value-added market potential.
 - Procure recycled wood products; promote mid-value uses.** Public sector procurement of products that contain recycled wood, such as mulch for construction projects, would help expand this market. Also, demonstration projects and other such promotional efforts will assist in proving the viability of recovered wood as a source of supply to private sector markets.



Key findings and recommendations for medium priority materials

Animal waste

- *Situation:* Agricultural animal wastes – primarily horse and cow manure – are generated in the rural areas of King County in substantial quantities. Historically, these materials have been managed at the source (e.g., on the farm). However, new regulations related to water quality may require that these wastes be managed differently. Consequently, opportunities exist by which farms could more effectively handle these materials, including producing valuable compost for the regional organics market.
- *Recommendations:* Determine the scope of the market need/potential for animal waste through additional research and analysis. Identify processing and end market opportunities for animal manure. Develop markets for animal waste in the context of public sector action for all organics feedstocks – yard waste, animal waste and food waste.

Plastic film

- *Situation:* Plastic film makes up a significant portion of the commercial waste stream, with more than 38,000 tons disposed of in 1996. This quantity appears to be increasing over time as more and more packaging of shipping containers is in plastic. On the demand side, mixed plastic film is now being collected under a pilot program for a composite building application. If this product, which is still in the research and testing phase, proves successful, demand for plastic film generated in the region will soar. Other markets for film exist both domestically and internationally, but these other markets have tighter specifications and are more distant. Consequently, the economics are less favorable.
- *Recommendation:* Monitor changes in supply and developments with the pilot program. Provide education to commercial generators on how to recycle film. Assist in building a finished product supply network, if necessary, through demonstration projects and other technical assistance and promotional activities.

Green wood¹¹

- *Situation:* Green wood accounts for a sizable share of total tons disposed of and recycled. End market demand potentially may grow significantly over time.
- *Recommendation:* Facilitate collection and processing; and support and stimulate efforts to expand end markets.

¹¹ Green wood is unmilled wood of any species. See Chapter Eight for a more detailed definition.

Gypsum

- *Situation:* The ability to recycle gypsum is considered important to the success of construction and demolition recycling efforts. Gypsum comprises a significant portion of the construction and demolition stream, and its disposal is restricted to certain landfills. However, while much of the wallboard manufactured has some recycled content, technical factors limit the percentage of recycled content that can be used in new wallboard. Also, many market barriers exist to recycling gypsum, including the high cost of transportation relative to the market value of the material and the limited number of facilities where gypsum can be taken for recycling. These factors constrain the viability of and supply to processing facilities.
- *Recommendation:* Explore steps that can be taken locally to reduce the cost of recycling, such as locating drop boxes on construction sites and encouraging the local siting of a processing facility. Also, increase end-use demand for recycled gypsum by specifying recycled content as part of public sector procurement and promoting such use by the private sector.

Other rigid plastic containers

- *Situation:* Substantial public interest appears to exist to recycle all plastic containers, not just #1 (PET) and #2 (HDPE) bottles. Many residents are vocal about their desire to have all plastics added to the curbside collection program. In response to this sentiment, the City of Seattle is currently planning to add all plastic containers to curbside programs in its new collection contract, which begins in the year 2000.

However, the processing infrastructure and end markets for rigid containers are not well developed either regionally or nationally. For example, only one processor in the region is currently accepting and sorting mixed containers (Garten Services) and, in most cases, they charge a fee to accept this material. Also, the capabilities to reclaim (clean and repelletize) #3-#7 plastics are very limited and the price paid for them is low relative to cost. If Seattle does indeed begin to collect these containers at the curb, some effort will likely be needed to expand processing and demand by manufacturers.

- *Recommendations:* Monitor developments associated with Seattle's plan to collect these plastics at the curb. Consider taking action now to identify the lowest-cost, most efficient means of handling and marketing these materials. Specifically, work with haulers, recyclers, and plastic processors and reclaimers to determine where the Marketing Commission or other solid waste entities could become involved. If Seattle adds these items to its collection program, study markets and changes in tons disposed of before adding to County collection programs.

Yard waste

- *Situation:* Market conditions for yard wastes have fluctuated in recent years, primarily as a function of changes in supply and problems with regional processing facilities. In 1997, for example, a surge in supply caused by the warm wet spring overloaded processing capabilities and threatened to shut down the entire yard waste collection system.

The situation has improved since 1997 with less supply generated and the emergence of new processing options. In addition, end markets for compost appear to be expanding steadily, though at a rate which is not certain. Consequently, the situation appears to be in balance for now. However, significant changes in the regional supply of organics or the regional processing infrastructure could potentially spark a new crisis for this market.

- *Recommendation:* Continue efforts to reduce the amount of yard waste that enters the municipal composting system. Educational and promotional efforts to increase backyard composting and grasscycling serve to expand the effective processing capacity of this system. More broadly, consider all organics as interrelated. Develop diverse processing options and markets accordingly.

Overall findings

The assessment of needs and opportunities for each of the materials targeted in this study lead to several overall findings about recycling markets affecting King County.

1. Puget Sound benefits from favorable markets for many high-volume recyclables.

While significant market development needs exist in the region, the favorable market conditions that King County recyclers enjoy must be recognized and understood.

First, the county benefits from a vast regional market for fiber, which comprises the majority of the recycling stream by weight. Unlike recycling programs in most other parts of the nation, King County can rely on nearby mills and processing facilities to absorb virtually all of its cardboard, mixed paper and high grade paper, with minimal transportation costs incurred to reach those markets. The location of these markets is a fundamental underpinning to the successful recycling programs that the region enjoys.

Second, King County benefits from its proximity to export markets. Our Pacific Rim location and nearby port facilities make King County a low-cost supplier of metals, plastics and fiber to overseas processors. The situation offers King County relatively strong markets and low transportation costs compared to other municipal recycling programs throughout the country.

2. While markets for these recovered materials are extensive, demand for finished products with recycled content is less well understood.

This study focuses on examining the markets for selected commodities collected from King County as feedstock for manufacturing. The research did not explore the demand for finished products with recycled content. Accordingly, market development needs for these materials have not been investigated. Some limited discussion of end markets is included in chapters on wood (e.g., mulch), organics and paper (e.g., mixed waste paper).

3. The public sector has significant influence over organics markets, but many issues remain to be resolved.

Markets for King County's organics are regional in scope. The County has the ability to affect supply and demand, as well as the processing infrastructure for organic materials. Over the last ten years, these organics markets have seen tremendous growth, particularly for yard waste derived compost. However, important concerns remain to be addressed, including odor issues associated with processing, the availability of adequate processing capacity, costs associated with collecting and transporting organic materials, and the extent of regional end market demand. While organics markets may be in balance and functioning well today, they are vulnerable to change, especially if new materials such as food waste enter the organics stream.

4. Glass, mixed paper, & gypsum pose challenges. Wood, plastic film & other rigid plastic containers offer particular opportunities.

This study has identified existing or potential problems with the markets for glass, mixed paper and gypsum that warrant public sector action. In addition, opportunities to expand markets and so increase recycling levels may exist for clean wood and plastic film. Finally, intermediate and end markets will need to be developed for #3-#7 plastic containers, if the decision is made to add these to the collection program.

Key Challenges

The public sector in Puget Sound faces a range of important challenges related to developing recycling markets in the months and years ahead:

- **Addressing the impact of expanded collection of food waste and plastics on processing systems and markets.** If food waste and other rigid plastic containers are added to curbside collection, processing infrastructure and viable markets will need to be developed.
- **Enduring the consequences of a sustained downturn in global commodity markets.** Investments in recycling and the development of a recycling infrastructure have occurred primarily over the last ten years, when the economy has been robust and growing. The positive economics of recycling are due in large part to the prices paid for these recycled commodities in the marketplace. The potential exists, however, for a sustained downturn in these global commodity markets – putting prices for all recyclables at historic lows for a considerable period of time. Solid waste authorities in the region should be aware of this scenario and may need to develop new strategies to ensure the economic viability of curbside recycling.
- **Maintaining market diversity in the context of mergers among collectors and processors.** The recent consolidation in the solid waste and recycling industry may put additional pressure on recycling programs if competition for collection services decreases and prices charged for disposal (landfill tipping fees) also fall.
- **Maintaining the viability of fragile markets for mixed waste paper and glass.** As discussed elsewhere in this Executive Summary and in the main report, markets for glass and mixed paper, which make up a very high percentage of the curbside mix by weight, are vulnerable due to limited end markets. Market development efforts are needed to ensure that diverse stable markets continue to exist for these materials.
- **Managing food, yard and animal wastes in the context of a complex, highly interrelated market for organics.** Collection and composting of food and animal wastes offer the potential to significantly increase the recycling rate and improve water quality in King County. However, any increase in supply must be matched by a corresponding increase in processing capacity and demand for organics. Again, market development action will be needed here, if collection programs expand to cover these materials.

- **Influencing markets without using new regulations or laws.** The public sector’s ability to influence market development for recyclables has often been perceived as a set of regulatory tools, such as minimum content legislation, landfill bans, bottle bills, tip fee structure adjustments or tax incentives. Yet, such measures can have negative effects and be seen as heavy-handed. The public sector should continue to explore other ways of affecting market development, such as promoting to manufacturers the benefits of using recycled feedstocks or encouraging consumers to buy products with recycled content.
- **Avoid being reactive, be more proactive.** The public sector faces important opportunities for proactively developing markets, especially those for materials such as plastics and engineered/composite wood products. The public sector can take strategic, forward-looking action to ensure that markets are maintained or enhanced. Promoting product stewardship by manufacturers represents a key example of a proactive public sector opportunity.

Overall recommendations

These findings lead to several overarching recommendations:

Focus public sector resources on high-priority materials.

Priority should be placed on urban wood, food waste, mixed glass and mixed waste paper. The public sector should also consider taking action to strengthen and diversify markets for plastic film, gypsum, yard waste, green wood and other rigid plastic containers.

Consider market implications of expanding supply of food waste & plastics; address processing and end markets as needed.

Decisions to add these materials to the collection program should be coordinated with market development efforts to ensure adequate processing and end-use demand.

Coordinate regional public sector action on markets.

The research for this study has shown clearly that markets for recycled materials are integrated and that many are regional in scope. Decisions about changes in what materials are collected and efforts to develop end markets for King County materials all have implications beyond the County. It makes sense for public sector policies and investment decisions to be coordinated as much as possible. The burden of market development led by the public sector should also be shared as the benefits in most cases accrue regionally rather than locally.

Establish the public sector capacity to monitor markets on an ongoing basis, forecast market trends and respond accordingly.

Future market development needs may be difficult to anticipate, but ongoing efforts to monitor supply, demand, prices and market dynamics for key recyclable materials will enable the County to respond most effectively. This role can likely be handled by existing Marketing Commission staff and would fit with the Commission’s mission.

Minimize barriers to private investment in processing capacity for recycled materials and consider public investment in special, high-need cases.

Public sector actions that increase the supply of materials into the recycling stream should be accompanied by appropriate steps to ensure that adequate handling and processing capabilities exist. As a first priority, the public sector should create an environment in which barriers to private investment in such capacity are minimized appropriately. In some cases, lack of information or perceived market risks may compel private investors to shy away from critical capacity-building projects. In such instances, public investment – e.g., purchasing and leasing land for siting a processing facility – should be considered as a possible catalyst for these projects.

Continue efforts to expand demand for finished products made with recycled content.

Ultimately, the health of the region’s recycling system depends on stable long-term demand for recycled content products. This demand is a function of price and the perceived value (in terms of sales or environmental benefits) of the recycled content. Public sector actions in the region to strengthen demand for recycled products have proven successful in the past and are appropriate to continue. Examples of these actions include procurement specifications, standards and policies, demonstration projects that illustrate the viability of products, and marketing and recognition programs. Vibrant and sustainable market demand plays a critical role in maintaining the viability of recycling systems.

Expand convenient collection opportunities for recyclable materials.

For example, increased collection opportunities, ranging from drop sites, public or privately-owned transfer stations, on-site collection for construction waste, or special collection events would greatly increase the supply and reduce the cost of selected materials. This increased collection would help in developing the markets for clean wood and gypsum.

Chapter One: Glass

Definition

Focus on container glass. For this report, glass recycling means container glass recovered from residential or commercial collection recycling programs in King County and Seattle. Container glass comes primarily in three colors: clear, amber and green. We use several terms in this chapter that describe container glass at particular stages of recycling:

- *mixed glass* – container glass collected without separation by color
- *break glass* – a recycling industry term that refers to bottle glass broken specifically during collection and/or processing
- *cullet* – crushed glass processed to specific size for use as feedstock; an alteration of the word “collet,” meaning the neck of the glass left on the blowing iron

Plate glass also important, but outside focus. Aside from container glass, window and door manufacturers within 50 miles of Seattle generate approximately 10,000 tons per year of post-industrial plate glass waste. These generators currently subsidize shipment of that waste to one of two recyclers: either Potters Industries in Canby, Oregon, for use in manufacturing glass beads, or to Vitreous Environmental Corporation near Calgary, Alberta in Canada, for manufacture into fiberglass insulation. Those generators have always been, and probably will continue to be, responsible for their own waste. That glass is pertinent to this study only as it potentially influences any of the markets or end-uses discussed here.

Methodology

During July and August 1998, we collected information on glass markets and opportunities through three main tasks. First, using 1996 as a base year, we acquired reported estimates from King County and the City of Seattle on tons disposed of and recycled. (In Appendices A through H, we include these reported estimates.) Second, we held a focus group on July 28, 1998, with representatives of leading King County recycling collection firms and industry experts.¹ Third, we reviewed major industry publications, consulted with a recycling economist, and performed telephone and in-person interviews with processors to address issues that had arisen in the focus group and to gather additional information.

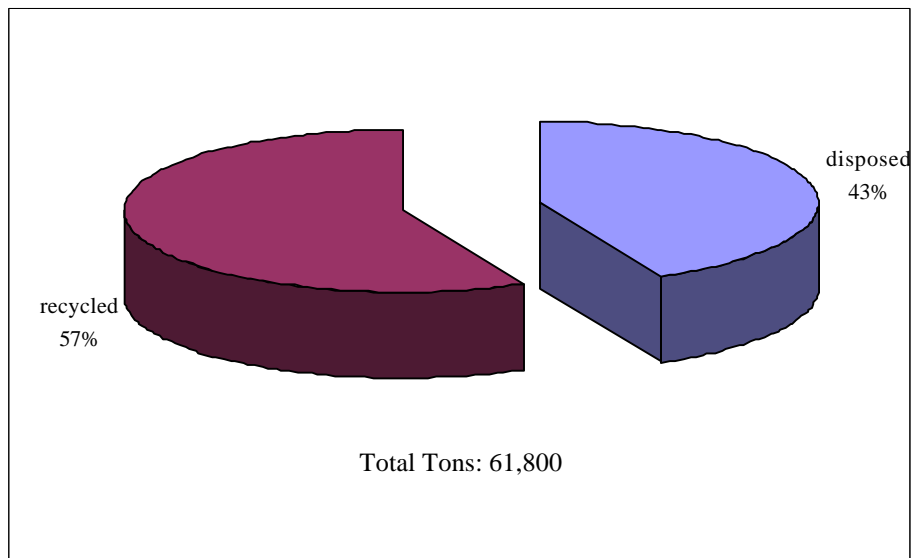
¹ Participants included Don Davidson (Rabanco Recycling), Don Freas (TriVidro Corporation), William A. “Nick” Harbert (Waste Management) and Bob Kirby (consultant).

Market conditions

Supply

- **High recycling rate.** According to data assembled for this study, approximately 61,800 tons of container glass were generated in King County in 1996. Assuming a population base of 1.75 million, that tonnage translates to 70 pounds per resident. The U.S. Environmental Protection Agency (EPA) reports that the average American used 83 pounds of container glass in 1997.² The closeness of these two averages suggests that the data collected for this study are valid. These data indicate that the recycling rate for container glass in King County reached 57 percent in 1996. Figure 1-1 below illustrates the breakdown of glass disposed of and recycled in King County in 1996.

Figure 1-1: Estimated quantities of recyclable glass disposed of and recycled in King County and Seattle (1996 tons)



- **Estimated composition by color.** Approximately 34,800 tons were collected for recycling. No reliable data exist for the breakdown by color, but the EPA study cited above estimates 57 percent clear, 25 percent amber and 18 percent green. This mix varies significantly by both location and season.

² *Characterization of Municipal Solid Waste in the United States: 1997 Update*, prepared for the U.S. Environmental Protection Agency, Municipal and Industrial Solid Waste Division, Office of Solid Waste, Report No. EPA530-R-98-007, 1998.

Collectors

This section and the next provide an overview of major industry players that handle glass recycled from King County. The major collectors in the County include the following four firms:

- Rabanco (Allied Waste)
- Recycle America (Waste Management)
- RST/Nick Raffo Disposal
- Waste Connections

Rabanco & Recycle America

- **Two collectors haul the largest share of the County's recycled glass.** Rabanco, a division of Allied Waste, and Recycle America, a division of Waste Management Corporation, collect and handle the vast majority of King County's glass, either through their own collection programs or through sub-contractors. Recycle America and Rabanco each collect roughly 50 percent of Seattle's 14,500 tons of recycled glass.
- **Each collector separates glass differently.** In residential collection, Rabanco separates glass into the three colors at the curb. For this reason, Rabanco generates very little mixed (or co-mingled) glass in its program, though it has begun a pilot project in which it collects mixed glass. Recycle America collects glass through a co-mingled collection program, then sorts colors at its materials recovery facility (MRF). The co-mingled collection results in breakage of up to half of the collected glass. Each firm has reached its own decision about the value of source-separating glass. While Rabanco has decided that curbside sorting maximizes the value of its collected glass, Recycle America believes that, for now, its MRF separates glass most cost-effectively.

Other collectors

- **Two other large collectors active in County.** Waste Connections and RST/Nick Raffo Disposal are two other large franchise/contract haulers in King County. As the population increases in their service areas, the volume of glass they collect can also be expected to grow.³
- **Smaller collectors also play a role.** Several smaller recycling companies collect glass from multifamily complexes and commercial businesses in Seattle and King County. Nuts n Bolts Recycling accounts for the largest share collected in this category.

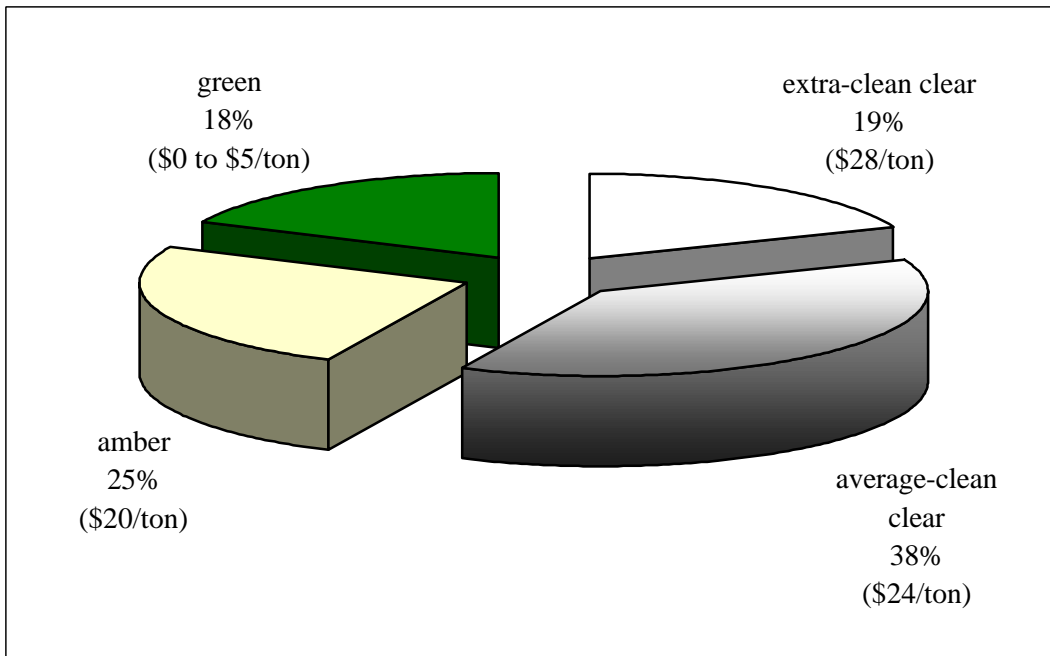
³ In addition, American Disposal collects from commercial generators on Vashon Island. Although the tons it collects are small, American Disposal collects large amounts of glass from Pierce County.

Processors

The two main processors in King County are Fibres International and TriVitro. There also exist several smaller processors that, together with the two processors above, handle glass for one glass container manufacturing plant in Seattle – Ball Glass – and a multitude of other local end users.

- **Prices for glass vary by color.** The prices reflected in Figure 1-2 below are based on reports from one major processor in the area.⁴ The weighted average price for color-sorted glass is \$20.50 per ton.⁵ This price assumes that the color composition of color-sorted glass sales is the same as the composition of glass collected. It also assumes that 33 percent of clear glass is extra-clean and 33 percent of green glass is bought at \$5 per ton.

Figure 1-2: Estimated composition and prices of color-sorted glass sold to processors in King County (1998)



⁴ These rates apply to full container trucks – handling charges apply to smaller volumes.

⁵ Price is for transactions between collectors and processors, and does not include shipping and handling.

Fibres International

- **Fibres International is the primary processor.** The largest processor in King County, and the only large glass processor in the state, is the Bellevue-based Fibres International. Fibres processes or “beneficiates” glass for the sole glass container manufacturing plant in Seattle, Ball Glass.
- **Most supply is from King County.** Fibres International processes 40,000 to 45,000 tons per year at its sole processing facility in the South Park neighborhood of Seattle. Of that volume, about two-thirds or 28,000 tons originates from King County. The balance comes from recycling programs outside of King County but within Washington. Fibres then crushes the color-sorted glass, removes as much ferrous and non-ferrous metal contaminants and ceramics as possible, and ships most of the glass to a local manufacturer, Ball Glass.
- **Trade “deficit” for green glass.** Historically, green glass and mixed color break glass have proved problematic for both collectors and processors. In the United States, green containers comprise about 18 percent of U.S. container glass sales. However, only 12 percent is manufactured domestically. The remaining six percent enters the country in the form of bottles containing imported beer and wine. In many instances, the local supply of green glass cullet has exceeded local demand, resulting in excess inventories and low market value.
- **Fibres accepts all clean color-sorted glass.** Fibres has made a business decision to purchase all clean color-sorted glass delivered by collectors in King County. One result of this policy is that Fibres occasionally needs to liquidate excess inventories of particular colors. It does so by shipping to glass plants in other states, sometimes at lower than market rates when freight is included. Major destinations include markets in California and Colorado. Fibres has also supplied excess glass for construction projects in King County, also at lower than market rates.

TriVetro

- **TriVetro a medium-sized processor.** The Seattle-based TriVetro Corporation is one of only three glass processing facilities in the United States that does not process glass primarily for container or fiberglass manufacturing plants. TriVetro's largest market for processed glass is as a blasting abrasive. The company also supplies glass to a number of niche markets, including:
 - textured wall coatings
 - recirculating pool filtration
 - concrete paving stones
 - aquarium gravel
 - terrazzo floor installations
 - cement block filler
 - abrasive wheel manufacturing
 - tile manufacturing
 - pre-assembled crafts kits, shipped throughout the U.S.
- **Planned relocation to larger site.** Local authorities recently condemned TriVetro's current building and slated it for demolition in early 1999. TriVetro's management hopes to find a new site for processing, one that has increased capacity. In 1998, TriVetro will process between 5,000 and 10,000 tons of glass. In its new facility, slated to be located in Kent, TriVetro plans on increasing capacity to 30,000 tons per year. However, whether it will be able to move to this facility as hoped remains unclear.
- **TriVetro has multiple suppliers.** TriVetro receives glass from a number of sources, including collectors inside and outside of King County, Fibres, and Ball Glass at various times. It has also received post-industrial plate glass from window and door manufacturers.
- **Recycling spent abrasives difficult.** Identifying potential low-cost recycling options for spent abrasive blasting grit with glass content marks one of the largest barriers that TriVetro faces in improving its market for blasting abrasive. Asphalt manufacturers have expressed interest in mixing non-hazardous spent grit into asphalt mixes. However, TriVetro reports that permitting problems and solid waste definitions have made it difficult to recycle spent abrasives in this way. Spent abrasives with glass content currently must be disposed of as solid waste.

End Markets

More than half of all glass recycled from King County remains in Washington. Significant tonnages also flow out of state to California, Colorado and elsewhere in the Northwest. Table 1-1 below outlines these flows of recycled glass.

Table 1-1: Estimated share of all recycled glass that is purchased by buyers, according to location (1998)

End-User	% of Total	King County	Puget Sound	WA	NW	Other N. America	Overseas
Local Bottle Industry	50-60%			√			
Out of State Bottle Industry	20-25%					√	
Abrasives	10-15%				√		
Construction	5-10%	√					
Specialty / Misc.	<1%	√					
Fiberglass	0%					√	
Landfill	0%	√					

Ball Glass

Ball Glass is a wholly-owned subsidiary of the French glass manufacturing conglomerate St. Gobain. Our research has suggested several key findings with respect to Ball Glass' operations and the market conditions it faces:

- **Supply of virgin materials affordable, stable.** Virgin materials cost about \$50 to \$60 per ton. All of the materials needed as ingredients for container glass are readily available from domestic sources at stable prices, with mining capacities sufficient to last several centuries at current consumption rates.
- **Recycled glass poses advantages & disadvantages.** Using recycled glass offers several advantages to Ball Glass over using only virgin glass:
 - lower emissions
 - lower furnace temperatures
 - an approximate 10 percent energy savings per ton during manufacturing

Disadvantages of using recycled glass include materials handling costs, systems maintenance and increased risk of product failure due to ceramic contamination.

- **Recycled glass as valuable as virgin, but costs to process.** On balance, the value of recycled glass is equal to the batch value of virgin material at about \$50 per ton. The cost to process glass into furnace-ready pieces is about \$15 per ton.

- **Location helps and hinders Ball Glass' competitiveness.** Ball Glass' location represents both a blessing and a curse. Ball occupies the best position to serve the wine and food industries in Washington, but it is not as competitive in the huge California markets. The nearest competitor to Ball Glass is the Owens Brockway plant in Portland. The second nearest is in San Leandro, California. As may be expected, the Washington wine industry comprises the largest segment of Ball's business.
- **Ball Glass' recycled content is relatively low.** Ball Glass blends beneficiated glass with raw virgin materials to make new containers. Ball manufactures glass on the scale of 200,000 tons per year, with its new containers having an average of 15 to 20 percent post-consumer recycled glass. Other glass plants around the country have considerably higher averages. However, Ball specializes in relatively short production runs and has relatively small furnaces – both of these factors weigh against using much larger percentages of recycled glass.
- **Ball Glass produces mostly green glass containers, amber manufactured infrequently.** Ball Glass produces mostly green glass, which comes in three shades: deadleaf, antique and champagne. Ball Glass can use recycled glass only for making champagne-shaded green bottles, since deadleaf and antique shades are too sensitive to contamination.

As of September 1, Ball had not produced any amber bottles during 1998. In order to meet its Northwest customer demands, Ball only needs to manufacture amber bottles for a few months out of the year. These bottles typically are kept in inventory until needed. As with green glass, the local supply of amber glass cullet exceeds local demand. This has put additional pressure on Fibres to maintain its flow of amber recycled glass out of the state.

- **Nearest competitor obtains supply elsewhere.** As noted above, the closest competitor to Ball Glass is Owens Brockway. Owens uses approximately 10,000 tons per year of recycled container glass from Washington, or roughly one-third of what Ball Glass uses. This glass all seems to come from recycling programs in the southern and eastern part of the state, except under certain circumstances whereby Fibres or suppliers in other areas sell excess inventories to Owens Brockway. In addition, Owens uses about 30,000 tons collected in Oregon.

Gallo

Gallo Corporation owns the largest glass container manufacturing plant on the West Coast, dedicated to making glass containers for its own products. Gallo also has pioneered two areas of glass technology in the United States.

- **Gallo the first major plant to use “fine grind” recycled glass.** In this process, Gallo grinds glass down to the gradation of coarse sand, less than one-sixteenth of an inch, before using it in their furnaces. By contrast, Fibres crushes glass to five-eighths of an inch pieces for Ball Glass’s furnaces. Fine grind offers the advantage that most ceramic contaminants will melt in a glass furnace if enough surface area is exposed. Disadvantages of fine grind include the cost of additional equipment and a more difficult “fining” process required to eliminate air bubbles introduced with the finely ground glass.⁶
- **Gallo the only major plant to use “curbside mix.”** Gallo utilizes all three colors, in approximately their percentages as collected, to make containers. The resulting color, known as Gallo Green, differs somewhat from other wine bottle colors, and varies somewhat by season. However, Gallo has concluded that savings from fine grinding and using the curbside mix outweigh any resulting loss in sales from the inability to create bottles with a uniform color year-round.
- **California recycling laws affect Gallo’s recycled content.** California’s state recycled content requirements have a notable impact on Gallo’s use of recycled glass. During 1998, every glass container manufacturer in California must have a minimum average of 35 percent post-consumer recycled glass in its product mix. The law had originally included a scheduled increase to 65 percent in the future but this percentage has now been frozen at 35 percent. Gallo’s plant makes over 400,000 tons of containers per year, so it needs more than 140,000 tons of recycled glass. Because of its ability to fine grind and to use the curbside mix, Gallo can purchase mixed glass from recyclers who have few or no other markets.
- **Local collector ships most of its mixed break glass to Gallo.** Gallo’s price to suppliers for curbside mix almost offsets the costs of shipping the glass by rail to Gallo in Modesto, California. Therefore, for the past two years one local collector has shipped most of its mixed break glass to Gallo. However, the California legislature is currently debating a bill that would reduce the percentage requirement to 25 percent if the container producer uses mixed glass, as Gallo does. This potential reduction by 40,000 tons or more in Gallo’s mandated need raises the possibility that Seattle’s break glass will no longer find a home in California.

⁶ It is unclear whether “fine grind” is technically feasible in King County, due to high moisture levels in collected bottles as a result of the area’s wet climate.

Construction aggregate

- **Construction aggregate use has decreased.** Since 1993, both Recycle America and Fibres have processed glass for construction projects. Recycle America, in particular, used construction as the outlet for all of its break glass from 1994 to 1997. However, in 1997, coinciding with the adoption of minimum content laws in California, market demand for mixed glass in California increased and left little for use by the local construction industry. While Fibres has continued to be open to supplying glass for projects upon request, depending on the availability of appropriately sized recycled glass, Recycle America has moved little, if any, glass into the construction industry. If market demand for mixed glass in California drops, collectors may once again face excess supply of mixed glass and may need to develop local construction aggregate markets.
- **Stoneway also a buyer of glass for fill material.** In addition to the larger recyclers processing glass for construction projects, Stoneway Rock & Recycling, a concrete recycling business in Renton, accepts glass and mixes it with demolition concrete for processing into aggregate for general fill. Stoneway creates aggregate with nearly 10 percent recycled glass content.
- **Stoneway accepts lowest value glass for a fee.** Stoneway charges a tip fee, reportedly \$25 per ton. With this large of a tip fee, Stoneway receives the lowest value, most contaminated glass from unattended drop box programs. It tends to process more plate glass than container glass. Stoneway's annual volume of container glass is an estimated 2,000 tons, though it has capacity to take an estimated additional 43,000 tons. Stoneway essentially establishes the lowest cost option available for recycled mixed glass.

Trends

- **Industry mergers may affect recycling costs.** Both of the County's largest haulers have undergone mergers in the past year. The impact that this consolidation will have on the costs of recycling programs in King County remains to be seen.
- **Stable supply expected to last.** Industry experts anticipate that the volume of recovered glass will remain fairly flat into the foreseeable future. The recycling rate of 57 percent from residential collection seems remarkable, given that Washington does not have a bottle deposit law. Increased collection volumes could be obtained through commercial collections. However, due to the relatively low value of glass compared to the cost of collection, volume increases likely would be marginal at best.

- **National trend for gradual growth.** The United States glass industry projects a 1.5 percent growth rate in glass container sales through 2002, despite decreasing consumption per person and some erosion of market share to plastic containers.⁷ Two main factors influence this projection:
 - increasing population
 - increasing manufacturing of thinner walled containers, thus using less material per container
- **Local supply expected to support local recycling infrastructure.** The projected increase in the quantity of glass collected in King County is expected to match population growth at most. There appears to exist sufficient supply in Washington glass recycling markets to fully meet current local demand at present prices.

Opportunities for public sector action

1. Promote diversity in end uses for mixed glass

Situation. With markets for mixed glass declining, collectors have begun experimenting with reducing color sorting during collection and processing. Although sorted glass commands higher market prices, collectors maintain that the savings from not sorting tends to outweigh the added value of sorted glass. One collector is piloting several collection routes through which it sells mixed glass directly to TriVitro. Another has lowered the level of sorting at its processing facility, creating larger volumes of mixed glass for sale to end users.

Opportunity. King County could enhance the diversity of end markets for mixed glass by encouraging the further development of mixed glass end uses, such as abrasives, construction aggregate, floor tile, floors and counters, reflective paint, frictionators (strips on matchboxes for striking matches) and pipe bedding.

2. Facilitate use of spent abrasives

Situation. One application for recycled mixed glass is as an abrasive, such as sandblasting material. Once used, non-hazardous “spent” abrasives can be further recycled as an ingredient in applications such as asphalt. However, producers contend that state, County and other local regulations limit their ability to find locations for the recycling spent abrasives.

Opportunity. The County could work with interested suppliers of non-hazardous spent abrasives to identify institutional and economic barriers to recycling this material. The County could also coordinate inter-agency activities needed to implement options that are developed.

⁷ *Ceramic Industry*, August 1998.

3. Maintain option for construction aggregate

Situation. In the past, break glass has been used locally in construction aggregate – a low-value use but still an option short of disposal. The County should help ensure that it remains an option. One danger is that construction contractors may lose interest in using break glass, the longer they do not receive a supply of it.

Opportunity. The County should work with Fibres and Recycle America to ensure that some supply continues to flow each year into construction aggregate applications.

4. Evaluate septic filtration option

Situation. San Juan County sends all glass collected for recycling to a county-owned facility which processes this material into a septic filtration medium. While sewer systems continue to replace septic systems inside urban growth boundaries in King County, septic systems are expected to remain important in more rural locations for the foreseeable future.

Opportunity. King County could assess the feasibility of processing break glass to be used as a septic filtration medium in King County. The study's purpose would be to help major local generators of waste glass to decide whether to establish such a processing facility in the private sector.

5. Help TriVidro with permitting and siting of new facility

Situation. TriVidro represents an important part of King County's processing infrastructure for recycled glass. It currently needs to move from its present location to a new one but has encountered difficulty doing so. If it is unable to find a new location quickly, it may incur substantial financial losses and possibly could go out of business.

Opportunity. Local, County and state economic development, solid waste or recycling organizations may be able to help TriVidro in siting and permitting new processing facility.⁸

⁸ At the time this study goes to print, reports have surfaced that TriVidro may have secured a new site in Kent.

6. Encourage wine industry to use recycled glass

Situation. Over the years, marketers in the wine industry have regarded the wine bottle as an integral part of their product – a “package” that can be targeted toward consumer preferences and used to enhance brand image. They require particular bottle colors and shades. This sensitivity has limited the amount of recycled glass used in wine bottle manufacturing. Ball Glass of Seattle, the state’s only bottle maker and whose largest market segment is Washington wineries, has been unable to use any recycled glass in two of the four main wine bottle colors it produces. Two of these colors, deadleaf green and antique green, have high sensitivity to color contamination that can result from using recycled glass.

Opportunity. King County and wine growing counties could investigate the potential for convincing the wine industry to boost recycled content in their bottles by undertaking a study of:

- potential benefits of using mixed glass in wine bottle production
- expected effects on consumer purchasing and brand image
- other wineries’ willingness to use bottles containing recycled glass

Chapter Two: Gypsum

Definition

The State of Washington’s Department of Ecology defines gypsum as follows:

“Gypsum wallboard consists primarily of gypsum rock (hydrated calcium sulfate) formed into sheets which are covered with paper and starch to become wallboard. New wallboard also contains small amounts of foaming agents, dispersing agents, and other additives to improve its manufacturing properties.”¹

Methodology

From July to August 1998, we collected information on gypsum markets and opportunities through two main tasks. First, using 1996 as a base year, we acquired reported estimates from King County and the City of Seattle on tons disposed of and recycled. (In Appendices A through H, we include these reported estimates.) Second, we reviewed major industry publications, consulted with industry experts and performed telephone and in-person interviews with processors to gather additional information.

Market conditions

Supply

Information from the Department of Ecology and results of our industry research point to the following findings on the disposal and recycling of gypsum:²

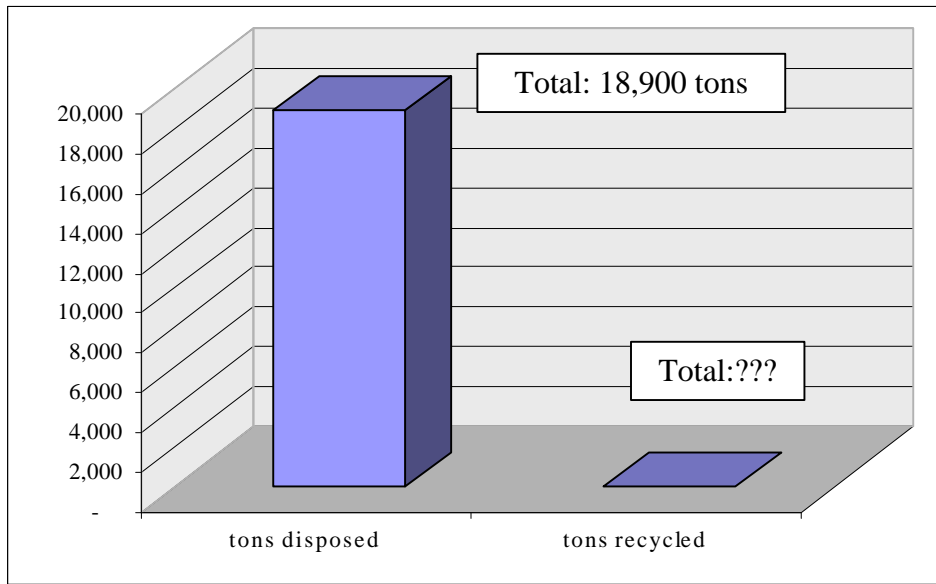
- **Construction generates substantial gypsum waste.** Construction of a new house can generate up to a ton of gypsum wallboard waste. This accounts for approximately six to ten percent of all wallboard used in new construction annually.
- **Gypsum from construction very recyclable.** Gypsum waste from construction typically has little paint, asbestos or other contaminants that tend to affect wallboard over the life of a building.
- **Gypsum from demolition more likely contaminated.** Substances that were used in building older structures – such as asbestos, paint and wallpaper – often contaminate gypsum waste from demolition of those structures. Nevertheless, one processor, New West Gypsum, does accept contaminated wallboard. New West processes the wallboard, removes the contaminants and blends it as feedstock for making new wallboard. It is unclear to what extent removing contaminants adds to the cost of processing.

¹ “Focus on Gypsum Wallboard Waste,” publication 96-1556-SWFS, Washington State Department of Ecology, 1996, p.1.

² “Focus,” p.1.

- Disposal restricted, due to health risks.** In the presence of organic material and in moist conditions without oxygen, the sulfate components of gypsum break down into sulfide ions, forming hydrogen sulfide gas and acidic leachate. Hydrogen sulfide gas produces an offensive odor even in small amounts. This gas poses a serious health hazard and can be fatal in concentrations above 300 parts per million. For this reason, gypsum is *not* defined as a demolition or inert waste,³ which limits where wallboard waste can be disposed. Figure 2-1 illustrates the amount of gypsum waste from King County and Seattle disposed of in 1996.

Figure 2-1: Estimated quantities of gypsum disposed of in King County and Seattle (1996 tons)



- Incineration emits harmful gases.** Incineration of wallboard tends to create high emissions of hydrogen chloride and other acid gases. Most gypsum, therefore, is disposed of in landfills.⁴ No incineration of waste gypsum occurs in King County.
- Greater collection occurs elsewhere in Northwest.** One processor with facilities throughout the Northwest processes a total quantity of gypsum twice as large as what it receives from King County collectors. Some attribute those higher collections, at least partly, to bans on landfill disposal of gypsum wallboard in those other areas.

³ As defined in the Minimum Functional Standards for Waste Handling (ch. 173-304 WAC).

⁴ In British Columbia, landfill disposal of gypsum wallboard waste has been banned.

Collectors & Processors

- **Market incentive to recycle depends on scale.** Smaller collectors – or private contractors or individuals – must either pay a \$75 per ton tipping fee to dispose of gypsum at a transfer station or a \$65 per ton tipping fee to recycle at a gypsum processing facility.⁵ The \$10 savings of recycling often fails to offset transportation costs. For large haulers or collectors, recycling gypsum wallboard waste can still be cost effective. One major construction company that handles its own waste reports that its costs, including shipping, handling, all applicable taxes, and the tipping fee are \$88 per ton to recycle and \$140 per ton to dispose.
- **Lack of processors.** No processors currently accept waste gypsum wallboard for recycling in King County. Table 2-1 lists the four processors located in or near King County.

Table 2-1: Processors located in or near King County

processor	city	county
James Hardie ⁶	Seattle	King
New West Gypsum	Marysville	Snohomish
New West Gypsum	Fife	Pierce
Resource Recovery	north of Woodinville ⁷	Snohomish

- **Distance and travel time make transportation costly.** The geographic distance between the three processors and construction sites in King County creates high transportation costs for collectors. One collector notes that, as a general rule, the distance from job site to processing facility must be less than 20 miles in order for recycling to be economically viable. When these distances exceed 20 miles, recycling gypsum costs about twice as much as disposal. It is unclear what the travel time threshold would be for cost-effective shipping.
- **Demolition wallboard not allowed.** Not all processing facilities accept demolition wallboard, due to its higher risk of being contaminated.

⁵ These costs do not include shipping and handling, which tend to make total recycling and disposal costs for smaller collectors higher than those for larger collectors.

⁶ This manufacturer in South Seattle accepted waste gypsum wallboard from collectors/haulers in the past for processing but currently does not. It currently accepts only ground wallboard from one nearby processor and some scrap from its distributors. While there is some indication that this manufacturer plans to accept gypsum from collectors again in the future, it has not yet begun to do so.

⁷ This facility lies about four miles north of the King-Snohomish county line in Snohomish County.

End Uses

- **Several recycling options exist.** Alternatives to disposing of uncontaminated gypsum waste include the following:
 - *land application* – this option can improve soil porosity and, in appropriate levels, provide essential plant nutrients⁸
 - *bedding* – ground-up gypsum waste can be used as bedding for poultry and dairy cows, and reportedly reduces the incidence of bovine foot and udder problems
 - *new wallboard with recycled content* – the state’s Department of Ecology strongly encourages this high-value end-use option, by which it reports that up to 95 percent of waste gypsum can be recovered⁹
- **Little land application apparent.** Land application of gypsum requires minimal processing since there is no need to remove the wallboard paper. Users must first obtain a permit from the Health Department and County records indicate that none have been issued. It would appear that land application occurs infrequently, if at all, in King County. However, it is unclear if any illegal land application takes place or how much waste gypsum from King County is land applied beyond County borders.
- **Only one known user of gypsum for bedding.** The only known user of gypsum for cattle bedding in the greater King County area is Thomas Farms in Snohomish County. It has used about 100 to 200 tons of new construction drywall per month for approximately five years. Thomas Farms blends one part drywall with two parts sawdust, and ultimately land applies the manure/bedding mixture. Snohomish County reports that the use of gypsum bedding appears to have reduced the incidence of bovine infections.
- **Two nearby wallboard manufacturers.** Two manufacturers are located in or near King County, as Table 2-2 shows:

Table 2-2: Manufacturers located in or near King County

processor	city	county
Georgia Pacific	Fife	Pierce
James Hardie	Seattle	King

⁸ The paper from wallboard need not be removed. It biodegrades in the soil.

⁹ While the above options allow 100 percent of waste gypsum to be used, this alternative provides higher value recycling.

- **Recycled gypsum costs less.** Manufacturers pay a reported \$2 per ton for recycled and processed gypsum, compared to \$26 a ton for virgin material.
- **Maximum recycled content 15 to 20 percent.** One manufacturer indicates that it may eventually use up to 20 percent recycled content for producing new wallboard without any loss in product quality. Another manufacturer claims the maximum lies closer to 15 percent.

Trends

- **Demand expected to rise.** One nearby large manufacturer plans to double the amount of recycled gypsum used in its production of new wallboard. It is unclear to what extent this will have an impact on local demand. Factors such as the company's share of local demand, or whether the increased quantity of recycled gypsum will come from the existing recycling stream or new collection sources are uncertain.
- **On-site collection increasingly common.** One hauler reports that collecting wallboard directly at construction sites has become a more common practice and might eventually emerge as a construction industry standard. Industry experts note that several large contractors have responded to customer recycling preferences and have begun to emphasize recycling for marketing reasons. This has created pressure for other contractors to follow suit in order to stay competitive.

New Developments

- **Synthetic gypsum under exploration.** Some manufacturers elsewhere in the country have begun making synthetic gypsum, though it has not gained widespread acceptance. It is unclear why this new material has not become more widely used. Industry experts expect that, for the foreseeable future, synthetic gypsum will have little or no impact on the gypsum market in King County.
- **Possible use in cement and other products.** At least one local cement maker has begun considering the possibility of incorporating recycled gypsum into cement mixes. Two cement producers are located in the greater King County area. Other products in which recycled gypsum has potential for use include kitty litter and oil absorbents.

Barriers & Opportunities

- **Distance to facilities.** Small collectors argue that a greater number of facilities – processing sites or simply drop boxes at transfer stations – conveniently located throughout King County would help to reduce the barrier to recycling that distance poses for smaller collectors and haulers.
- **High fixed costs and regulatory compliance standards.** Processors maintain that the capital intensity of gypsum processing or manufacturing facilities necessitates long-term contracts between parties and effective cooperation with county health, environmental, and solid waste departments.

Opportunities for public sector action

1. Need for increased convenient collection opportunities.

Situation. Currently, collectors have a very limited number of sites to take wallboard waste for recycling. Except for large construction jobs, shipping gypsum to processors in Snohomish and Pierce counties often costs more than disposal. According to some industry players, an effective means to recycle construction waste would involve locating drop boxes for all recyclable construction materials at one site. This would help to divert wallboard and other construction wastes from landfills.

Opportunity. For example, King County could improve the recycling of gypsum wallboard by facilitating the location of collection sites or drop boxes.

2. Encourage contractors to separate construction waste on-site.

Situation. Separating wastes into different bins on-site improves the efficiency of collection and thus the recycling of construction waste. For smaller construction sites, this situation is not particularly feasible, due to limited amounts of space as well as the increased expense of having multiple containers. However, some collectors have increased collection of clean gypsum wallboard debris by providing separate on-site containers.

Opportunity. King County could improve collection of gypsum, as well as other recyclable construction wastes, by encouraging on-site waste separation. The extent to which this action will enhance gypsum recycling, though, depends at least partly on whether collectors and contractors can cost-effectively deliver the material to processors.

3. Study whether to encourage siting of processor in King County

Situation. There may be a need for gypsum processing in King County.¹⁰ As noted above, substantial tons of recoverable gypsum wallboard now end up in landfills apparently because disposal options tend to be closer, and therefore cheaper, for generators and smaller collectors. It is unclear, though, whether a *new* processing facility is needed. The South Seattle gypsum manufacturer mentioned above currently has tentative plans to resume accepting gypsum for processing in the future.

Opportunity for action. The County should investigate the likelihood that the South Seattle gypsum manufacturer will accept gypsum from collectors for processing. If that probability is low, the County should examine whether and, if so, how it might help encourage the siting of a new processing facility. One key question is whether the potential supply of gypsum waste would be sufficient to make a new facility viable.

¹⁰Until recently, New West Gypsum operated a facility near Bellevue. However, it closed down, reportedly unable to attract adequate volumes of gypsum waste to be economically viable. Industry observers differ as to why New West encountered this problem. Despite the closure of New West's operation, sufficient quantities of gypsum waste may be available to make a processing facility feasible in King County.

Chapter Three: Metals

Definition

We define the four metal types targeted in this study as follows:

- *aluminum cans* – beverage cans composed of aluminum only
- *aluminum scrap* – other types of aluminum containers such as pans and trays; includes foil and foil products or packages, and all other aluminum materials including furniture, house siding, cookware and scrap
- *steel food cans*– tin-plated steel cans used as food containers; does not include other bi-metals, paint cans or other types of steel cans
- *other ferrous metals* – ferrous and alloyed ferrous scrap materials derived from iron, including household, industrial and commercial products such as other cans and containers; this category includes scrap iron and steel to which a magnet adheres

Methodology

From July to August 1998, we collected information on metals markets and opportunities through two main tasks. First, using 1996 as a base year, we acquired reported estimates from King County and the City of Seattle on tons disposed of and recycled. (In Appendices A through H, we include these reported estimates.) Second, we reviewed major industry publications, contacted the Institute of Scrap Recycling Industries (ISRI) for national information, performed telephone and in-person interviews with processors, and consulted with a recycling economist to gather additional information.

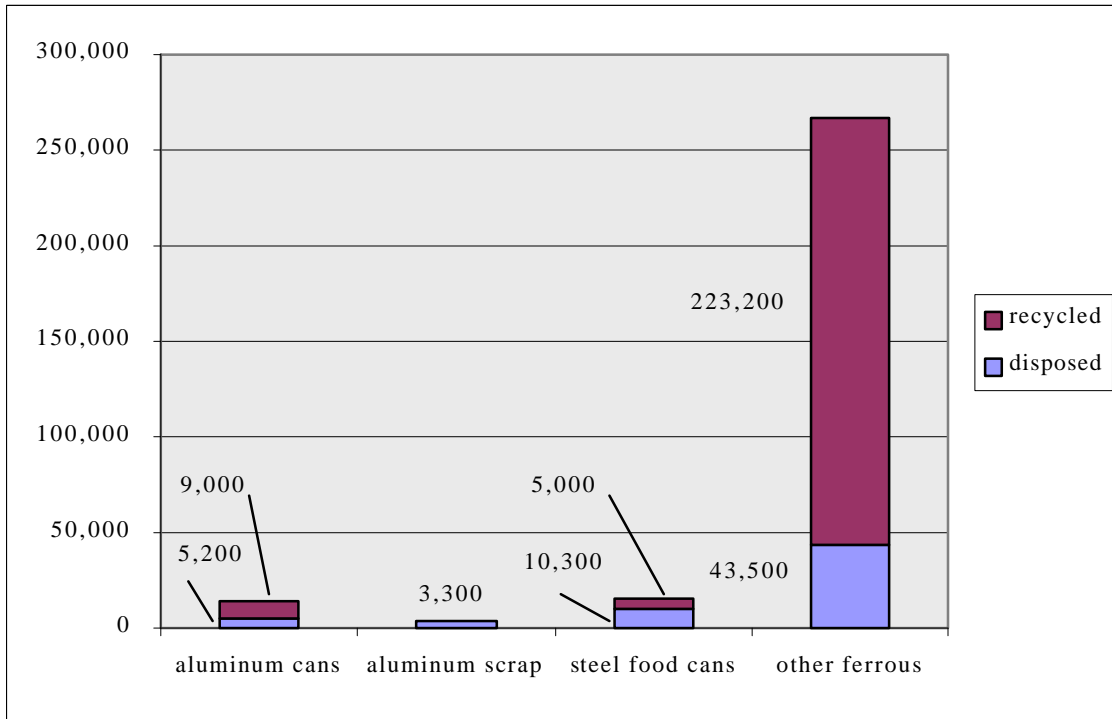
Market conditions

Supply

Figure 3-1 below illustrates the supply of each targeted metals category that is disposed of and recycled. These data suggest three important points:

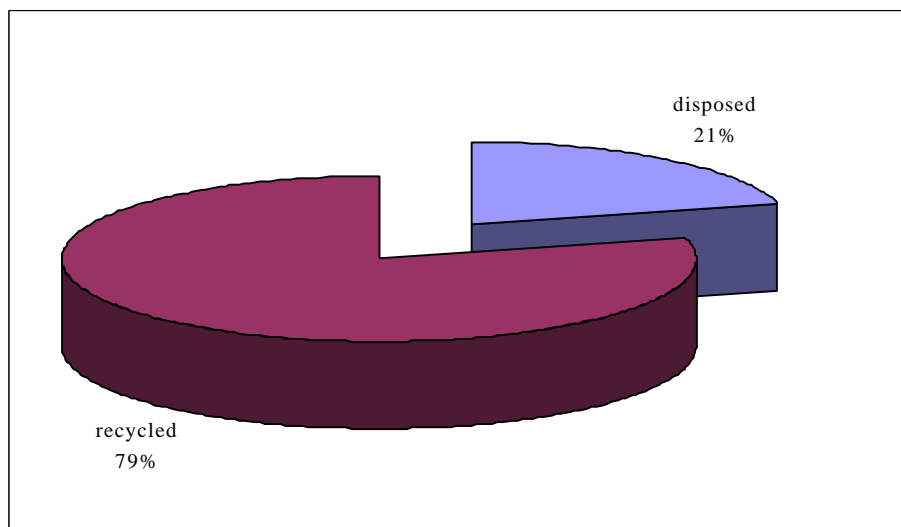
- **Other ferrous metals outweigh the rest.** Items in the “other ferrous metals” category are recycled in vastly greater amounts than any other category. It is important to note that other ferrous includes white goods and car hulks.
- **Three parts to scrap industry.** Scrap traded in the metals recycling industry, which falls mainly into the above category of other ferrous metals, consists primarily of the following:
 - 1) household scrap, such as white goods and car hulks
 - 2) industrial scrap, such as by-products from manufacturing
 - 3) demolition scrap

Figure 3-1: Estimated quantities of target metals disposed of and recycled in King County and Seattle (1996 tons)



- High recycling rate.** Metals as a whole enjoy one of the highest recycling rates of all recycled commodities in King County. Figure 3-2 below shows the overall breakdown of recycled versus disposed of metals, for those categories targeted in this study. Industry officials estimate that an even larger share of these metals actually get recycled than are reported.

Figure 3-2: Estimated overall share of metals disposed of versus recycled in King County and Seattle (1996 tons)



Infrastructure

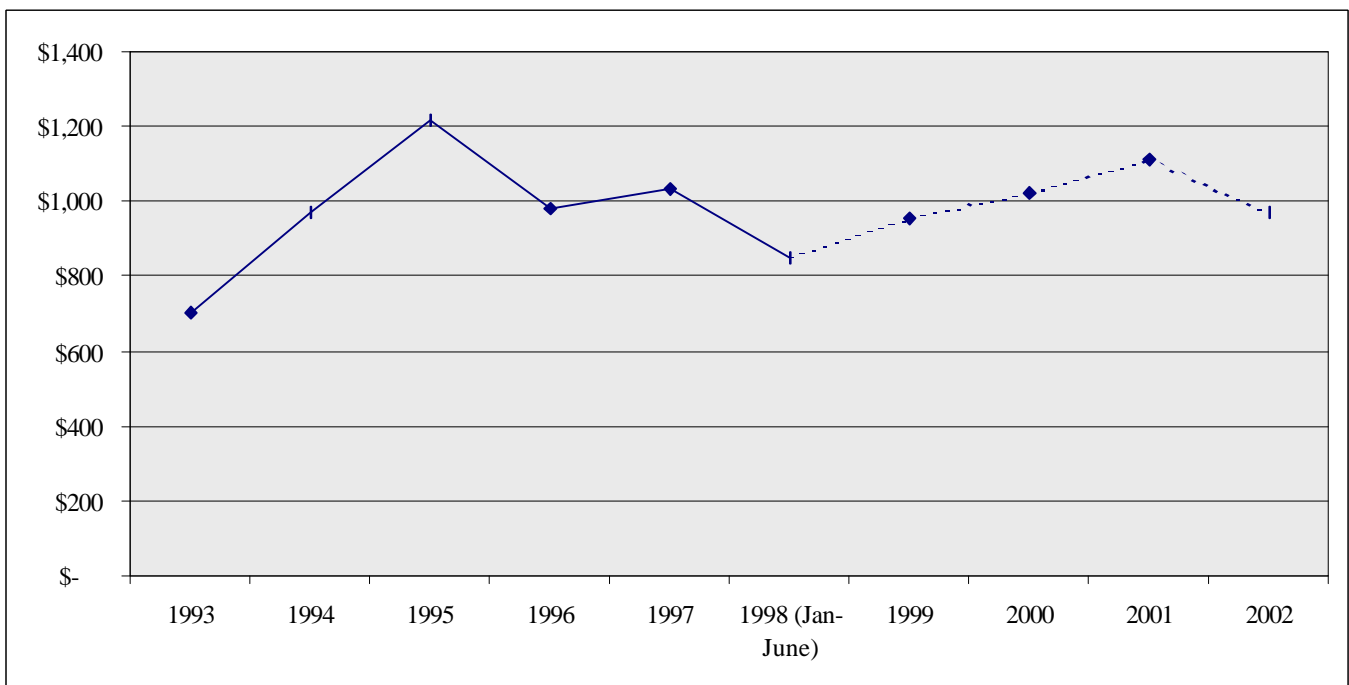
Collectors & Processors

- **A well-developed, mature market.** The scrap metal business has been around for more than 100 years. Scrap dealers understand the market fluctuations and cycles, and are able to plan for them. Scrap yards abound throughout the region and feed both domestic and overseas mills.
- **Collection from various sources.** Collection of metals for recycling occurs in several ways:
 - curbside recycling programs
 - buy-back and drop-off programs (steel food cans and aluminum)
 - recycling events, transfer stations and special pick-ups (white goods)
 - delivery to scrap yards (cars and all other metals)
 - commercial collection (industrial and demolition scrap)
- **Collectors perform some processing.** Collectors bale or flatten aluminum cans, and bale steel food cans for delivery to mills.
- **Scrap yards also process.** Scrap yards serve as the middle person or “processor” for many types of steel. They receive white goods, car bodies, industrial and demolition scrap for baling or shredding, and sell these items to mills.
- **Several area scrap yards exist.** King County has several large scrap yards and numerous small scrap yards. Schnitzer’s facility in Tacoma is the largest scrap yard in the Northwest, supplying domestic mills and exporting to Asia depending on price.
- **Steel food cans sent out of state.** Until recently, a Seattle facility provided local de-tinning of steel food cans. Since this facility has closed, all steel food cans now travel by rail to Gary, Indiana, for detinning, with the metal then flowing into the Midwest scrap market. Markets for steel food cans also exist in St. Paul, Minnesota, and in Utah – however, most of King County’s steel food cans go to Indiana because these closer facilities have reached capacity through other sources of supply.

Prices

- **Prices falling generally but long-term optimism.** Scrap dealers have begun lowering prices but they insist that a market for metal diverted from landfills will always exist. For example, Alaskan dealers pay for scrap recycling – this option remains cheaper than disposal.
- **Prices for local aluminum driven by global price.** Although no aluminum exports to Asia occur currently, the local price of UBC's (used beverage containers) is affected by the world market price for aluminum. Foreign supply would substitute for domestic supply, if world prices¹ fell below domestic prices. Figure 3-3 illustrates the price of aluminum in recent years and projected through 2002.
- **Japan starts exporting aluminum.** Aluminum prices have fallen with the Japanese yen, as Japanese suppliers have begun exporting aluminum for the first time. This increase in supply on the world market has contributed to depressed prices in the U.S.

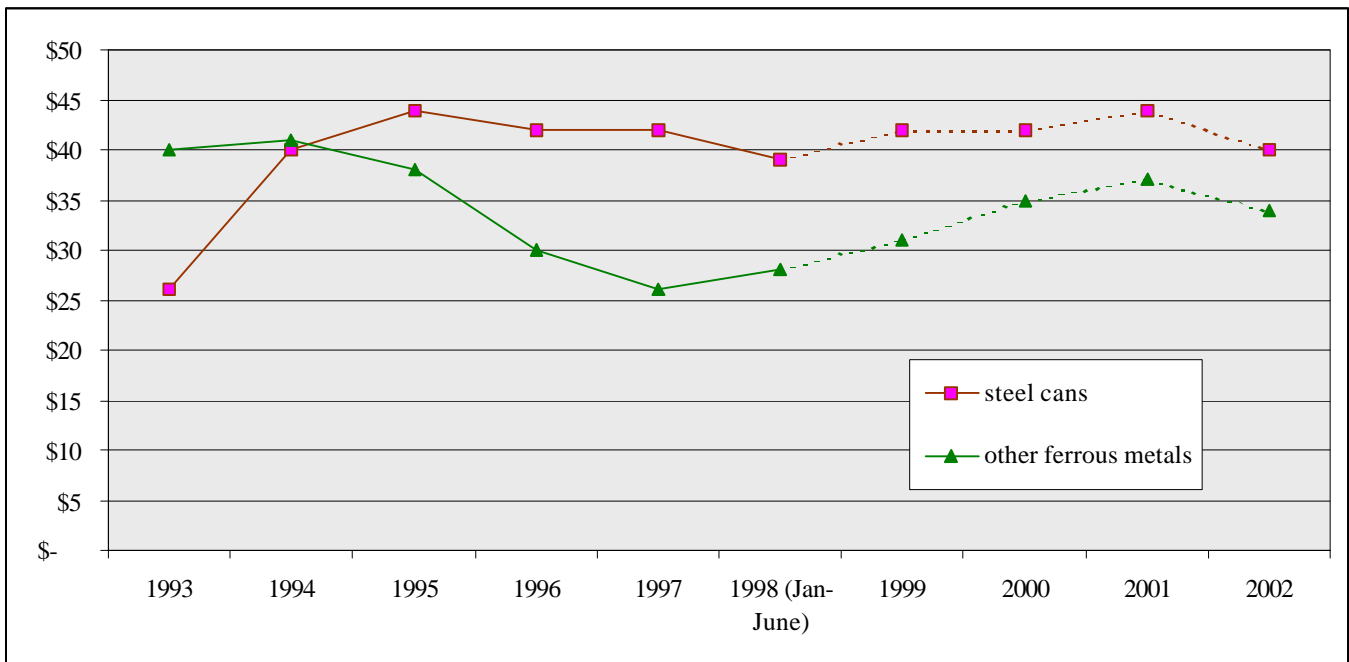
Figure 3-3: Actual and projected prices for aluminum from King County and Seattle (1993 to 2002)



¹ Including applicable shipping, handling, taxes and other costs.

- **Russia to add to world aluminum supply.** Russia built modern aluminum smelters in the early 1990s. Industry observers expect it to add considerable quantities of aluminum on the world market in the near future to generate cash revenues, thus driving the price of aluminum down below its already low price.
- **Korean steel exports competing with U.S.** For the first time, Korea has begun exporting finished steel goods, which compete with U.S. manufactured steel goods in U.S. markets. This continues to drive the price for steel, and scrap, down. The U.S. does not export finished products – only scrap. Figure 3-4 shows prices for steel food cans and other ferrous metals since 1993 and projected through 2002.

Figure 3-4: Actual and projected prices for steel food cans and other ferrous metals from King County and Seattle (1993 to 2002)



End Markets

- **Most recycled metal stays either in King County or North America.** While about half of King County’s scrap ferrous metals flow to one end user in King County, Birmingham Steel, all aluminum goes to end users in Eastern Washington, Colorado and the Southern U.S. Exports overseas represent a significant share of all recycled metals. Table 3-1 outlines flows of two kinds of recycled metals to end users, by location.

Table 3-1: Flows to end users of metals recycled from King County, by location

Metal category	King County	Other N. America	Overseas	TOTAL
Scrap Ferrous	50%	20%	30%	100%
Aluminum		100%		100%

- **Markets are global in nature.** Metals markets are world markets, influenced by market dynamics around the globe. We include in Appendix I a letter from Arrow Metals Corporation to its customers that explains the nature of metals markets and why current prices have fallen considerably.
- **Korean markets influence West Coast markets.** Korean metals markets dramatically affect West Coast scrap markets, as South Korea represents the largest importer of U.S. scrap metal. A dramatic reduction has occurred in the number of tons exported to Korea in the past year. This directly impacts the price of scrap metal on the West Coast.
- **Entering low market cycle for metals.** Metal markets historically have 10-year cycles. Dealers expect that we are entering a two-year low.
- **Low market means higher supply locally.** In down markets, scrap does not travel far, which results in greater supply to the one steel mill in Seattle.
- **One steel mill in Washington.** Only one steel mill exists in Washington State – Birmingham Steel in Seattle. Two of Oregon’s three mills and Utah’s one mill also buy scrap metal from Washington. No steel mills exist in Idaho.
- **One aluminum smelter in state also.** There is one aluminum smelter in Spokane, which recycles approximately 30 percent of King County’s aluminum. Smelters in Colorado, Tennessee and Alabama purchase the rest.

Consumer Demand

- **Less metal per product, but generation has not decreased.** Manufacturers today make more and more products with plastic. Often they make products with thinner metal that can still meet product specifications. However, a reduction has not occurred in the overall amount of scrap metal generated.

Barriers & Opportunities

Barrier

- **Local market for steel food cans gone.** The shipment of steel food cans to the Midwest for recycling has left Northwest steel food can markets vulnerable since local markets no longer exist. As markets for all metals continue to fall, recycled steel food cans will see a further drop in price.

Opportunity

- **Possible new steel mill may stabilize Northwest market.** Reports have surfaced of a new steel mill planned for construction in Clark County, Washington. Land has been purchased, but construction of the mill has not yet occurred. The existence of this new mill will help keep more recycled metal in North America and help to stabilize Northwest market prices.

Trend

- **Low markets forecast.** Industry experts anticipate that metals markets will continue to be depressed for the next two years. This low cycle will force recyclers to accept lower prices for recycled metals and thereby increase the cost of municipal and county recycling programs.

Opportunities for public sector action

Metals markets taking care of themselves – wait and watch

Situation. Markets for metals have been around for a long time and have reached a level of notable maturity. Scrap dealers understand these markets and plan for fluctuations in price and demand. There are few, if any, gaps in the collection, processing and manufacturing infrastructure. Little visible need for public sector action exists.

Opportunity. We nevertheless suggest that the County consider taking the following possible action, which could help the local scrap industry in both the short and long term:

- ***Streamline and simplify government rules.*** Cross-referencing governmental policy and regulations would reduce the cost to the metal industry of doing business. Industry officials contend that redundant or inconsistent policies and regulations from jurisdiction to jurisdiction mean more work for metals recyclers.

Chapter Four: Organics

Definition

Under the broad category of organics, we have targeted four specific areas:

1. *food waste* – leftovers and wastes from food preparation; this also includes food that remains in its original or another container when the container weighs less than 10 percent of the total weight
2. *yard waste* – leaves, grass clippings, garden wastes, and brush and branches of up to four inches in diameter
3. *animal waste* – livestock manure
4. *biosolids* – "a subset of what is commonly known as sewage sludge... [but also] a more precise term properly used only to describe that portion of the wastewater solids stream which meets federal and state regulations for beneficial use by land application or other methods."¹

In this chapter, we also refer to the following materials that may be unfamiliar to some readers:

- *topsoil* – the nutrient rich top layer of soil (when sold by landscapers, topsoil is composed roughly of 20 percent compost, 10 percent sand and 70 percent sorted soil)
- *compost* – decomposed organic material
- *land application* – the application of organic material to crops

Methodology

In July and August 1998, we collected information on organics markets and opportunities through three main tasks. First, using 1996 as a base year, we acquired reported estimates from King County and the City of Seattle on tons disposed and recycled. (In Appendices A through H, we include these reported estimates.) Second, we held a focus group on August 6, 1998, with representatives of leading King County compost facilities and industry experts.² Third, we reviewed major industry publications and local studies on organics. We also performed telephone and in-person interviews with additional organics industry experts to address issues that arose in the focus group and to gather further information.

¹ <http://www.wef.org/docs/biofact/explanation.html>, Water Environment Federation, 1997. See also the note on biosolids at the end of this chapter.

² Participants included Gary Ewing (Northwest Waste Industries), John Sinclair (Soos Creek Farms), Jim Lindsay (Pacific Topsoil) and Jan Allen (CH2MHill).

Market conditions

Overview

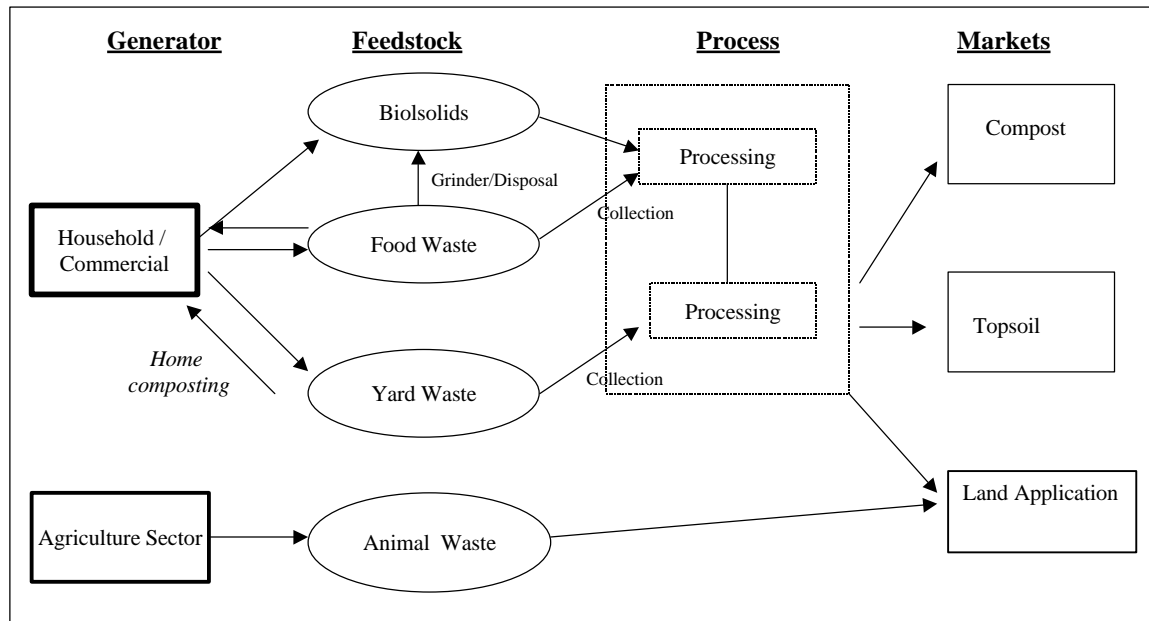
Markets for organics recycled from King County are complex and interconnected. Three main sources of generation exist: household, commercial and agricultural.

- **Household.** The vast majority of yard waste currently collected comes from single family households in Seattle and King County. The only residential food waste collected in King County occurred during two pilot programs run in the mid-1990s by Seattle and King County, respectively. Most residential food waste is disposed in landfills, though some also goes into the sewage system through garbage disposal units. Some waste from household pets is also disposed.
- **Commercial.** A variety of commercial operations generate food and yard waste in King County.
 - *Food waste.* Pre- and post-consumer food waste is either picked up by collectors as part of municipal solid waste collection or is run through a grinder and disposed of into the sewage system, where it becomes part of the County’s biosolids product. About 8,000 tons of pre-consumer food waste is gathered in Seattle for recycling by collectors who haul it to Cedar Grove for composting – this recycling represents only a small amount of total food waste generated. A very small amount of pre-consumer food waste is also recycled in King County outside of Seattle.
 - *Yard waste.* Collectors haul most yard waste from commercial sources to transfer stations. In King County, yard waste is collected at the Cedar Falls drop box and the Enumclaw and Factoria transfer stations. It is then sent to local composting facilities. In Seattle yard waste is transferred to Cedar Grove for composting. A few private landscapers also deliver some large quantities directly to compost facilities.
- **Agricultural.** Agricultural waste is generally managed on site or, in some cases, blended with other organic waste by compost facilities as a feedstock for compost.³ The County is currently considering an ordinance that would require a solid waste permit for handling animal waste.

³ Agricultural waste often includes animal waste with bedding and by-products. It is unclear how much of these materials combined with animal waste are generated. “Management” of animal waste on site does not always mean “use,” since in some cases animal waste piles up for years and may leach into bodies of water.

Figure 4-1 below illustrates the overall flows of organics materials generated in King County along each recycling stage.

Figure 4-1: Current recycling flows of organics generated from King County



Supply & Processing Infrastructure

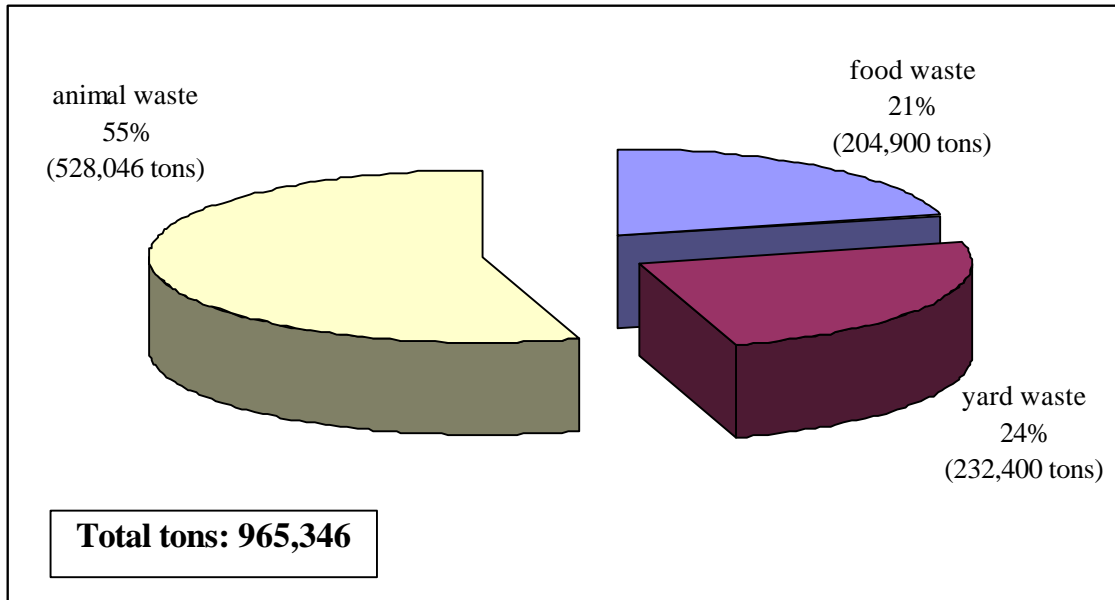
Our research into organics markets suggests the following findings:

- Supply fluctuates and is interlinked.** Supply varies by annual growing conditions. Local supply would change with the addition of food waste collection programs, a change in biosolids handling practices, or a change in regulations that affect animal manure. As Figure 4-1 above shows, each of these feedstocks supplies similar end-use demand. An increase in supply of any feedstock increases the overall supply of organics.
- Massive quantities of animal waste generated.** King County’s Department of Natural Resources (DNR) recently completed a cross-team analysis of animal waste volumes and handling options in the County. This study conservatively estimates that 528,046 tons of animal waste are generated in the County each year.⁴ That amount represents more than all other food and yard waste generated in the County, estimated at 437,300 tons.⁵ Figure 4-2 below illustrates the generation of all three of these types of organic waste.

⁴ “Agricultural Waste Issue Paper,” King County Department of Natural Resources Organics Cross Team, October 1998. The team includes staff from the Marketing Commission, and DNR’s Solid Waste Division, Wastewater Treatment Division, Water and Land Resources Division and the Director’s Office. It also invites participation from Seattle Public Utilities, Snohomish County Solid Waste and the Seattle-King County Health Department. The team seeks to enhance integration of planning and implementation of programs that affect the following organics: wood, yard waste, food waste, animal waste and biosolids.

⁵ See Appendix E for details.

Figure 4-2: Estimated total generation of animal, food and yard waste in King County and Seattle (1996)



- **Processing varies according to type of organics.** Different organics require varying amounts of processing. Land application requires minimal handling or processing while compost requires much more.
- **Changes in supply would affect processing.** Substantial changes in flows of any of these materials may have dramatic consequences on the current organics processing infrastructure. Supply currently meets existing demand, and processing capacity is sufficient to handle this material. A considerable change in supply without a concurrent increase in processing capacity and/or a change in the type of capacity may create an imbalance in the system.
- **Increased regulation of animal waste would pose serious problems.** Should regulation of animal waste force some or all of this material to be handled off the site from which it is generated, several compost-related problems would arise. The problems include, among others:
 - *Insufficient composting and processing capacity.* The only King County compost facility permitted to accept animal waste is Soos Creek Organics. While this facility is expected to grow, its existing permitted capacity is relatively small.
 - *Demand unknown.* Market demand for compost products that include animal waste is unknown.
- **Potential Seattle food waste collection would impact processors.** Seattle is considering a comprehensive residential food waste collection program through which an estimated 10,000 to 15,000 tons of food waste would be collected. This would add to the existing 35,000 tons of yard waste collected in the City.

- **Co-mingled yard and food waste collection would require additional changes in processing.** If Seattle collected yard and food waste mixed together, the co-mingling of these feedstocks would increase the level of capital investment needed for the low-technology processing operations that formerly only dealt with yard debris. There are additional costs associated with processing material containing food waste since steps must be taken to minimize odor. While co-mingled collection offer economies of scale for collection, overall processing costs would increase.
- **Changes in finished product ingredients might impact sales.** Altering the composition of compost ingredients, for example, could pose implications for buyers and affect sales. Consumer preferences for compost that includes animal waste may vary – some consumers may have concerns about odors or health risks that they associate with manure.
- **Food waste collection and handling of manures and biosolids require enclosed tipping area.** Cedar Grove and Land Recovery, Inc. are the only existing compost facilities that may be able to handle food waste in large volumes. Cedar Grove is enclosing its tipping and conveyor areas to more effectively address odor issues.
- **Yard waste collection well-developed, but participation varies..** Curbside collection programs for yard waste are well developed, especially in urban locations. Rural areas tend to have lower participation because the cost of service is higher and there is more room for residents to handle materials on site. All suburban cities in King County have yard waste collection programs.
- **Yard waste drop-off available at Seattle transfer stations.** Seattle provides transfer station collection options for self-haul yard waste and for residential collection firms. The yard waste is transferred at Seattle’s North and South Transfer Stations and delivered via transfer trailer to the Cedar Grove Compost Facility in King County.
- **Yard waste drop-off not available at all County transfer stations.** The lack of convenient drop-off/transfer facilities for yard waste in King County possibly marks the biggest gap in the local collection infrastructure. There is an 81 percent recovery rate for yard waste in Seattle versus a 65 percent recovery rate in King County. Due to space constraints, King County does not provide collection areas for source-separated waste at several of its facilities.⁶ Previously planned transfer station upgrades, which would have added yard waste at most of these facilities, have been postponed pending the results of stakeholder discussions about the County’s future role in providing solid waste services. Yard waste collection is currently provided only at the Cedar Falls Drop Box, Enumclaw Transfer Station, and Factoria Transfer Station (only in the evening).

⁶ Algona, Bow Lake, First Northeast, Renton and Houghton transfer stations; Vashon landfill, and the Skykomish drop box.

End Markets

- **Compost markets stable, low need for development.** Industry and public sector representatives indicate that demand for compost and compost products is adequate, given that there are permitted facilities in Snohomish, Skagit and Thurston Counties taking the overflow from Cedar Grove. No need exists for the development of additional end markets, given current market conditions. Demand for compost may not be adequate, however, to absorb a substantial increase in supply.⁷
- **Processing capacity currently sufficient.** Processing capacity is adequate, assuming no major changes occur in the handling or supply of animal manure, biosolids or food waste. For example, if Seattle begins curbside food waste collection, processing capacity may prove insufficient to handle the resulting surge in feedstock. Or, if King County’s Livestock Management Ordinance⁸ is enforced such that manure must be added to compost, then the County’s total permitted compost processing capacity will be insufficient.
- **Increased land application of yard waste occurring.** Experiments are being conducted in which yard waste is directly applied to crop lands in King County. Remlinger Farms land-applied yard waste from several different compost facilities in 1998 and plans to monitor the results. Land application for crops has become a major end use for yard waste in California, suggesting that it could become more widely adopted in Washington. Bailey Farms in Snohomish County, for example, uses compost from yard waste collection programs on its farm.
- **Land application less costly, requires little processing.** Land application represents an inexpensive way to handle large quantities of yard waste. It requires minimal processing, considerably less than compost.

⁷ On the other hand, a recent U.S. Environmental Protection Agency report speculates that demand at the national level is potentially very high: “[the] potential market for finished compost is much larger than the potential supply...If all applicable materials addressed in this report were captured for composting, approximately 33 million tons of finished compost would be created each year. End users for compost in agriculture, silviculture, residential retail, nursery sod production and landscaping might have a market potential for more than 1.27 billion tons of finish compost.” “Organic Materials Management Strategies,” EPA, May 1998, p.4.

⁸ Manure management requirements go into effect in January 1999.

Consumer Demand

- **Topsoil in high demand, less costly than compost.** Demand for topsoil made from organics outweighs current supply. Topsoil costs less than compost and is used in many landscaping applications. Population growth and new construction in King County create an ongoing demand for both topsoil and compost. Also, many Northwest residents are avid gardeners who purchase compost products on a regular basis.
- **Mixing feedstocks with compost will require outreach.** Consumers are most familiar with using compost derived from yard waste. They may need substantial consumer education in order to accept compost products that include food waste, animal waste or biosolids.

Barriers & Opportunities

Barriers

- **Efficient, sizable processing capacity needed to handle food waste.** Economical and large-scale, in-vessel food waste processing capabilities may be necessary for the next step in diverting food waste from the waste stream. Enclosed composting requires special containers for processing food waste. This method tends to be more expensive than open air composting, but minimizes odors and offers greater control over the composting process. Odor reduction may be key to securing local siting approval for new or expanded composting facilities.
- **Industry questions food waste recycling potential.** Industry representatives are skeptical of the future for food waste composting. They cite several barriers:
 1. Substantial regulations exist regarding odor and contamination from food waste processing.
 2. Costs of collecting source-separated food waste for recycling exceed costs of collecting food waste as municipal solid waste. Existing commercial food waste programs in King County have attempted to achieve collection efficiencies by collecting food waste mixed with yard waste.
- **Wood waste could displace other organic feedstock in low markets.** Wood waste normally used as hog fuel for mills is used to produce mulch when demand for hog fuel drops.⁹ This substitution of wood waste as a compost ingredient could potentially displace tons of other organics used to manufacture compost when prices for recycled wood fiber are low.

⁹ Hog fuel, also commonly referred to as *biomass*, is green or urban wood burned to generate steam, heat and/or electricity.

Opportunities

- **New technologies: in-vessel composting.** Economical in-vessel composting technologies may open the door to increased food waste composting.
- **Co-mingled collection of food and yard waste.** Joint curbside collection of food waste and yard debris could change the markets for organics by substantially increasing supply. They could also add considerably to overall processing costs.
- **Yard waste use on farms could expand demand.** Facilitating use of residential yard waste on farms would create a “win-win” situation. For example, a dairy farm can get two uses from yard waste: 1) it can mix yard waste with sawdust to use as bedding and 2) it can then use soiled bedding on-site as a soil amendment product. The County could facilitate yard waste use by simplifying the process for obtaining a permit. Current regulations classify yard waste as “solid waste” and require a solid waste handling permit for moving it to and using on a farm. Obtaining this permit reportedly can prove onerous and deters potential interest.
- **Cedar Grove is upgrading its organics facility.** Cedar Grove is creating a shelter over its organics tipping and conveying area, so it may be in a position to handle increased quantities of food waste.

Recommendations

We recommend that the County consider the following actions:

1. Implement recommendations of 1998 study

A January 1998 report prepared by solid waste staff from King County, the City of Seattle and Snohomish County identified a range of specific recommendations for public sector action.¹⁰ The County should give consideration to the following specific actions suggested in that report:

- ***Promote land application uses.*** This may become an important way of handling yard waste if animal waste handling regulations are implemented. As part of this effort, the County could support a reduction in permitting impediments to landspreading green mulch.
- ***Investigate options for use of yard debris in site reclamation.*** Coordinate with biosolids and agricultural waste management agencies to examine alternatives for this purpose – both in and out of the region. It will be important to continue the team approach illustrated by the organics cross-team noted above to dealing with these materials.

¹⁰ “The Yard Waste Processing Group – Work Group Report,” Snohomish County Waste Division, King County Solid Waste Division and Seattle Public Utilities, January 27, 1998.

- ***Increase capacity via expanded or new facilities.*** It is important that the private sector be successful in siting and operating diverse facilities and, thereby, expanding and providing resilience to the organics processing infrastructure. This may be important for the handling of yard debris, food waste, landclearing debris and animal waste.
- ***Promote small-scale on-farm composting.*** Farmers currently are able to pursue on-farm composting of organics only with material generated on site – for materials brought in from off-site, a solid waste handling permit is required. Benefits to on-farm processing include increased stability through diversity of the infrastructure, and the ability to compost agricultural wastes and other compostables in combination with yard waste. The public sector could explore ways of possibly simplifying the permitting process based, for example, on scale of operation.

2. Increase yard waste collection opportunities.

- **Increase collection points for yard waste and combine with resale points.** The County should work with industry and permitting departments to expand the number of collection points in the County. It could also allow collection points at private resale distribution points in order to increase sales and reduce transfer costs. Such combination of collection and resale points is not allowed currently without a solid waste handling permit – the process and requirements for obtaining this permit could possibly be simplified. Consolidating collection and resale points would enable material to be hauled to buyers in trucks larger than those used to collect it, thus providing economies of scale for distribution. In addition, combined collection and resale points would enhance the visibility of yard waste recycling.

3. Increase use of compost

- **Promote compost use.** Continue and expand public education efforts to include written materials promoting the use and benefits of compost. This will be particularly important if the feedstocks include animal waste or food waste. Consumers may have concerns about possible odors or health risks associated with manure.
- **Urge public procurement of compost.** Encourage public agencies and the Washington State Department of Transportation to purchase more compost. Publicly procured compost could be used, for example, as road fill or to mitigate soil erosion.
- **Explore mandating compost use to prevent run-off.** Review City and County codes to consider requiring builders to use compost to address water run-off. Work with the City of Redmond to highlight its recent efforts as an example.

4. Promote use of animal waste

A significant amount of work needs to be done to prepare for a change in existing handling procedures for animal waste. Challenges range from technical processing work to market development. These efforts will continue to require the involvement of all King County Department of Natural Resources staff involved in the current cross-team project. The following actions would help the County effectively address animal waste recycling issues:

- **Conduct market study.** The King County Marketing Commission should conduct a market study to identify consumer acceptance levels for compost blended with manure. The study should analyze current preferences for various manure products and the levels at which manure is blended with other ingredients in each of these products. The study should also explore how to market compost with manure most effectively – specifically, which consumer segments to target, what end-use applications benefit most from compost with manure, and how to increase demand among key consumer segments.
- **Launch promotion campaign.** The Commission should follow the above market study with a focused promotion plan aimed at increasing demand for compost products containing manure.
- **Develop pilot project for sales.** The Commission should work with compost facilities, and retail and wholesale outlets to design and implement a pilot project for selling compost products containing manure. This project could include, for example, demonstration gardens.
- **Explore end-use in landscaping.** The Commission should survey landscapers to gauge their willingness to use compost with manure. It should explore possible ways to move large quantities of this product into commercial landscaping applications.

Addendum: A note on biosolids

Biosolids offer a range of benefits when land applied as part of agricultural production. A description of these advantages is included below since some readers may be unfamiliar with them. The Water Environment Federation points out the value biosolids offer for plant growth¹¹:

“Biosolids can provide essential plant nutrients, water, and organic matter which can improve the physical condition of soil and render it a more favorable environment to manage nutrients and water. Biosolids contain all the elements essential for the growth of higher plants. Because nitrogen and phosphorus are the most abundant major plant nutrients in biosolids, the material's agricultural use is almost exclusively as a supplemental source of nitrogen and phosphorus fertilizer.

Biosolids also contain all essential plant nutrients, with the possible exception of potassium, to satisfy most crop requirements. As with the addition to soils of other organic materials, such as hay and animal manures, the addition of organic matter accompanying successive biosolids additions improves the physical properties of soils. This, in turn, exerts a positive influence on water penetration, porosity, bulk density, strength, and aggregate stability.

Farmers earn productivity from their crops by using biosolids. Taxpayers save money when their local jurisdictions land apply biosolids instead of paying ever-increasing landfill fees. The benefits of biosolids recycling, combined with several rounds of research by federal agencies and independent laboratories, provide a safe and economical recycling practice.”

¹¹ <http://www.wef.org/docs/biofact/explanation.html>, Water Environment Federation, 1997.

Chapter Five: Paper

Definition

In this chapter, we examine markets and opportunities for four specific substreams of recyclable paper:

- *Cardboard*¹
- *High grade paper*²
- *Mixed waste paper*³
- *Newspaper*⁴

Methodology

From July to August 1998, we collected information on paper markets and opportunities through three main tasks. First, using 1996 as a base year, we acquired reported estimates from King County and the City of Seattle on tons disposed of and recycled. (In Appendices A through H, we include these reported estimates.) Second, we held a focus group on July 29, 1998 with representatives of leading King County recycling collection firms, industry experts and a recycling economist.⁵ Third, we reviewed major industry publications, and performed telephone and in-person interviews with processors to address issues that had arisen in the focus group and to gather additional information.

¹ This category includes Kraft linerboard, containerboard cartons and shipping boxes with corrugated paper medium (unwaxed). It also includes Kraft (brown) paper bags, but excludes waxed and plastic-coated cardboard, solid boxboard and bags that are not pure unbleached Kraft.

² High grade includes printing and writing papers, both groundwood and thermo-chemical pulps. These consist of white ledger, colored ledger, computer cards, bond, copy machine paper and carbonless paper. They exclude glossy coated paper such as magazines, bright papers and pure groundwood publications such as catalogs. High grade also includes computer paper – continuous-feed computer printouts and forms of various types, excluding multiple-copy carbonless paper.

³ This category includes magazines, phone books, junk mail, used envelopes, other material with sticky labels, construction paper, blueprint and thermal copy paper (NCR paper), fax paper, bright-dyed paper (fiesta or neon colors), paperback books and groundwood catalogs. It also consists of other low-grade recyclable papers used in packaging, including chipboard and other solid boxboard.

⁴ Newspaper consists of printed groundwood newsprint and other mineral bleached groundwood. It also includes some glossy paper, typically used in newspaper insert advertisements, unless found separately.

⁵ Participants included Don Davidson (Rabanco Recycling), Jeff Morris (Sound Resource Management), David Shatz (BFI) and Steven Spence (Paper Recycling International, a Stone Container/Waste Management Joint Venture).

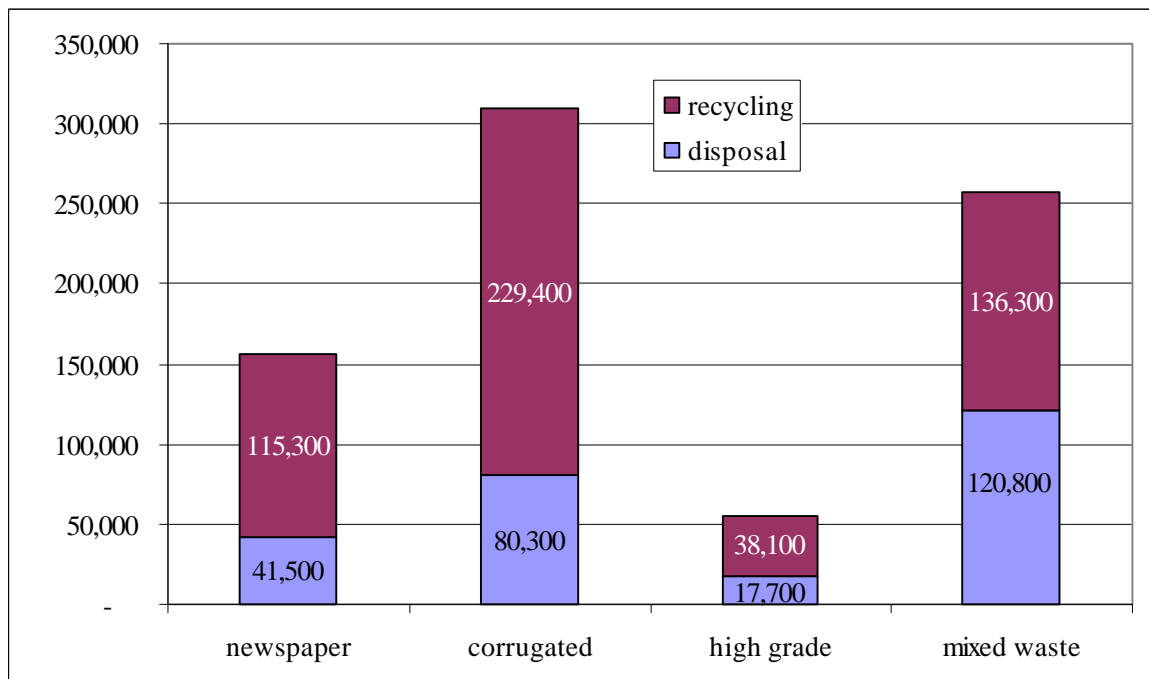
Market conditions

Supply

Figure 5-1 below illustrates the supply of each targeted paper category that is disposed of and recycled. These data suggest four important points:

- **Current recycling rates high.** King County enjoys high recycling rates for each of the four paper categories, with an average of 67 percent across all grades.
- **Increased diversion possible.** A large percentage of most paper grades is recovered from both residential and commercial waste streams. However, waste composition studies indicate that significant amounts of paper from all grades remain in the waste stream and could be targeted for recycling.
- **Largest share of paper disposed of is mixed waste paper.** Cardboard has the most tons generated and recycled of all four paper categories. Mixed waste paper, though, represents the category with the most disposal – at about 46 percent. Of the paper disposed of, recycled newspaper and high grade paper make up only around 16 percent and seven percent, respectively.
- **Substantial recoverable cardboard remains in waste stream.** Of the estimated 80,300 tons of cardboard disposed of, industry experts believe that a sizable share is suitable for recycling.

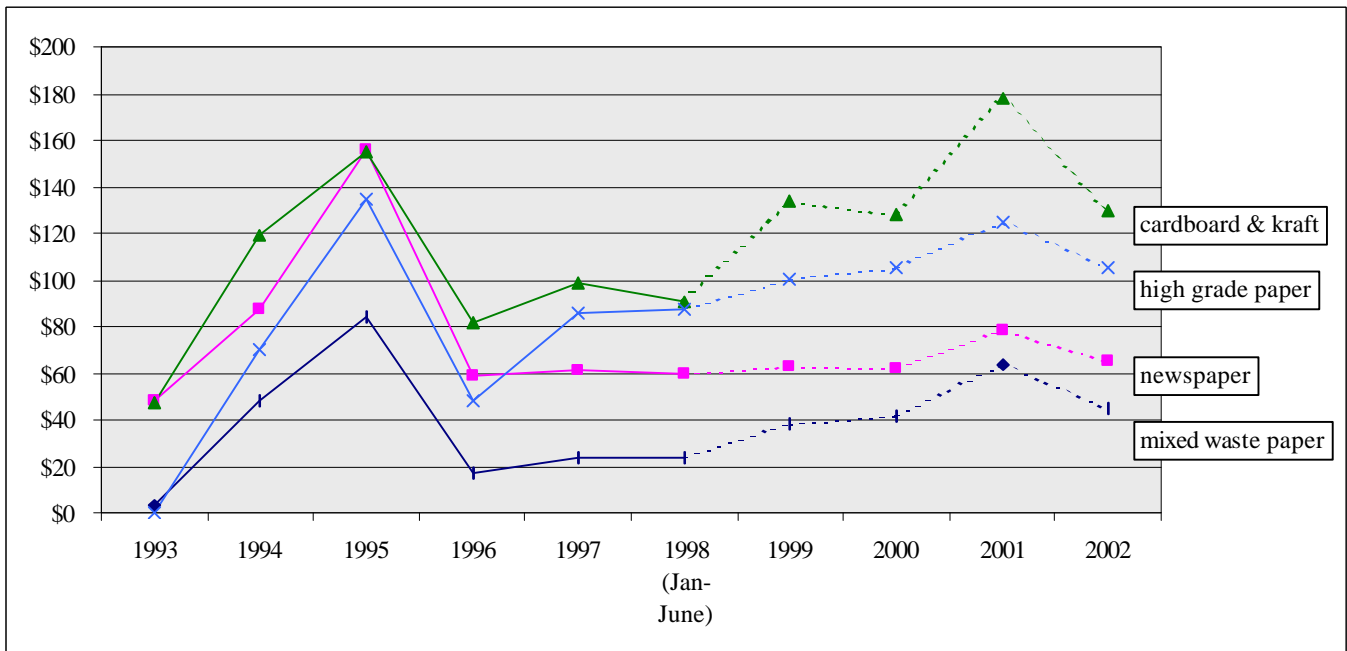
Figure 5-1: Estimated quantities of recyclable paper disposed of and recycled in King County and Seattle (1996 tons)



Our research suggests that markets for paper grades tend to be greatly influenced by global factors.

- Global markets impact prices and demand for King County fiber.**
 Transactions of paper fiber occur on markets throughout the world. Although most recycled paper generated in King County flows to end users in Puget Sound or the Northwest, international market forces also affect pricing and demand. Global prices, for example, limit prices that King County recyclers can receive for their paper fiber. If buyers can purchase imported fiber for less than local recycled paper, they will do so – this alternative keeps domestic prices in check. Figure 5-2 illustrates actual prices since 1993 and projected prices through 2002 for the four types of paper from King County.

Figure 5-2: Actual and projected prices for four paper grades from King County and Seattle (1993 to 2002)



- Asia crisis has led to rise in world supply.** One striking result of the Asian economic crisis has been that many Asian suppliers have flooded the market with low-priced virgin fiber in an attempt to boost revenues.
- Wood chip prices affect recycled paper prices.** Prices for recycled paper tend to vary with wood chip prices because both commodities are used as feedstock for similar end products. Lower virgin chip prices drive down prices for recycled paper.

- **Local supply growing but demand dropping in short run.** With a strong economy, King County has generated increasing quantities of paper and collected sizable amounts of this supply for recycling. However, demand has fallen globally as economic crises have reduced Asian, Russian and other buyers' willingness to pay for recycled fiber. Nevertheless, continued restrictions on federal timber harvests and other global factors are expected to maintain the long-term upward trend for virgin fiber pricing. At some point, a renewed focus on secondary fiber sources and diversity of supply is likely.
- **Recycling of office paper and cardboard falling.** Although substantial recycling of paper takes place, recovery rates of office paper grades have dropped since 1996. Lower market values have made recovery of these grades less cost-effective. Small commercial generators dispose of a significant amount of low-grade office paper and cardboard when market values fall since disposal becomes less costly than recycling.

Infrastructure

Collection systems in King County are highly developed. We have found that:

- **Collection occurs widely.** Mixed waste paper and newspaper are collected in curbside recycling programs throughout King County. Many programs also allow for curbside collection of cardboard.
- **Source separation varies and affects paper grade.** Curbside collection systems vary and influence the grade of paper collected. Co-mingled collection produces lower grades of paper due to contamination.
- **Many drop-off options for newspaper.** Despite the current low value for recycled newspaper, drop boxes remain located throughout the County for collection. Buy-back centers also accept newspaper for recycling.
- **Cardboard collected mainly from large generators.** Commercial recyclers collect cardboard from generators of large quantities. Large commercial generators often bale cardboard on site and in some cases ship directly to end users. Smaller commercial establishments have fewer opportunities for paper recycling. Only a few cities in King County include commercial recycling programs in their solid waste and recycling programs. Nevertheless, important efforts are underway in suburban cities, in King County (through its Green Works program) and through the Seattle Business and Industry Recycling Venture. These programs provide technical assistance to businesses and help link them with recycling service providers.
- **Recyclers perform most sorting and baling.** Recycling facilities sort and bale post-consumer paper fiber for shipment to buyers, which typically include paper mills in the Northwest and overseas.
- **“Mosquito fleet” shrinking.** Small independent recycling operations, commonly known as the “mosquito fleet,” have dropped in number and market share as prices and demand have fallen. The mosquito fleet primarily collects cardboard and tends to swell in size when market prices make it worthwhile to seek cardboard from commercial customers.

End Markets

Buyers of recycled paper fiber generated in King County all appear to be located outside County lines, mainly in Washington and Oregon. Table 5-1 shows estimated flows of recycled paper from King County to end users.

Table 5-1: Estimated share of each recycled paper type that is purchased by buyers according to location (1998)

type of paper	King County	Puget Sound	WA	Other Northwest	Other N. America	Overseas	TOTAL
newspaper			75%	10%		15%	100%
corrugated		20%	10%	60%		10%	100%
high grade			5%	80%		15%	100%
mixed waste		65%		5%		30%	100%

- **Many regional buyers exist.** The Northwest has numerous paper mills. Each uses different grades and amounts of post-consumer fiber in their processes – ranging from zero to as high as 100 percent. Appendix K lists U.S. and Canadian paper mills along the West Coast.
- **Most mixed waste paper flows to one nearby newsprint mill.** Abitibi, a newspaper production mill in Pierce County, purchases an estimated 65 percent of King County’s total recycled mixed waste paper. Very little other domestic demand appears to exist for mixed waste paper, which leaves this market largely vulnerable to that single nearby buyer. The mill reportedly is the only one of its kind on the West Coast that uses post-consumer mixed waste paper in the production of newsprint.
- **Cardboard and newspaper stay mainly in the Northwest.** Mills in Washington and Oregon but outside of King County purchase most recycled cardboard and newspaper collected in the Northwest. Export markets account for only a small amount of these paper grades.
- **Recycled paper competes with virgin fiber.** The primary substitute for post-consumer fiber is virgin fiber in the form of wood chips. In the early 1990s, there was a push to use mixed waste paper in place of wood chips, but this practice dropped off when the price of wood chips entered its continuing slump.
- **Estimated large potential for sales to China.** With its tremendous population, industry players regard China as the single greatest potential market for North American recycled paper.
- **Indonesia flooding market with low-priced fiber.** Indonesia reportedly built a system of pulp mills within the last several years, financing much of this investment with debt. Given the country’s current economic crisis, these mills have been selling pulp at low prices in an effort to generate revenues for debt payments. Suppliers of North American fiber, both virgin and recycled, have lowered prices in an attempt to compete with Indonesia’s low-priced fiber.

- **Japan adding to global supply.** Until recently, Japanese suppliers sold fiber to Japanese buyers for manufacturing of paper products. The struggling Japanese economy has led to lower domestic consumption and resulted in a jump in fiber exports to Indonesian pulp mills. For the first time, U.S. fiber is competing with Japanese fiber in export markets, which has continued to pull prices downward.
- **North American exports to Asia plummeting.** Partly as a result of the events in Indonesia and Japan above, North American fiber exports to Asia have plunged by an estimated 40 percent during the past year.

Consumer Demand

- **Strong domestic demand but excess supply.** Despite recent stock market volatility, the strong U.S. economy has fueled sizable consumer demand for finished goods and packaging products made from fiber. During the past few years, however, the supply of paper products appears to have outpaced demand.
- **State economic slowdown could lower demand.** The state government and independent economists recently projected lower economic growth in Washington over the next few years. This slowdown may result in some decrease in demand for recycled paper products in the state. In turn, lower demand would likely lessen market values for these products and affect local recycling programs.
- **Pressure for mills to contain costs.** Consumers tend to prefer high quality products at low prices. Since prices of finished paper products fluctuates little, mills try to carefully control costs in order to maximize profits. Mills will use the most cost-effective feedstock available to achieve this goal.
- **Government procurement practices disputed.** In spite of policies that encourage many levels of government purchase recycled paper, industry representatives argue that few governmental agencies actually conform with these requirements when purchasing copier paper.
- **Newspaper recycling loop strong.** Newsprint consistently contains a fairly high percentage of post-consumer fiber.

Barriers and Opportunities

Barriers

- **Use of mixed waste paper as feedstock faces capital barrier.** Mills require sizable capital investments in new equipment before they can use recycled paper as a feedstock. Most mills currently do not have the capability to make the kinds of products that the Steilacoom mill produces from mixed waste paper. These mills cannot alter existing processes quickly or easily.
- **Need diverse collection infrastructure for market stability.** The diversity of collectors has continued to shrink through consolidation among waste hauling and recycling firms. In efforts to maximize shareholder returns, many of these companies have sought to minimize operational costs. Industry specialists speculate that such cost pressures may compel collectors to stop handling low-value commodities such as mixed waste paper and, thus, limit the domestic supply of mixed waste paper to mills.

Opportunities

- **Tangible new uses for recycled paper exist.** There are numerous uses for paper fiber beyond traditional paper product categories. Proven uses include insulation, hydro-mulching and molded-paper packaging. Manufacturers have been cautious about moving toward production of these items, however, because of the required fixed investment in equipment.
- **Additional cardboard could be diverted.** Opportunities for increasing collection of cardboard from small commercial generators will divert additional tonnage. Examples of such opportunities include educating these generators on available options for recycling cardboard, encouraging groups of generators to share collection points and creating new drop-off sites located near clusters of generators.

Trends

- **Possible increase in paper collection.** The City of Seattle is about to invite bidding on a new collection contract. Industry experts surmise that, if this new contract doubles the collection frequency of recyclables in South Seattle to twice each month, the volume of paper collected in the City could grow as much as five to 10 percent.
- **Portland supply may result in lower prices.** Industry specialists argue that the possible addition of mixed waste paper to Portland's curbside recycling program will increase supply and may substantially force Northwest mixed waste paper prices downward.

- **Russian virgin wood supply expected to depress prices further.** Russia's economic crisis has reportedly spurred aggressive harvesting of its forests in an effort to generate cash from the timber sales. Industry sources expect that this addition of large quantities of low-priced wood chips will further depress the world's fiber markets.
- **U.S. recyclers increasingly wary of Asian banks.** Indonesia, China and South Korea have imported notable volumes of North American post-consumer fiber historically. However, for some time, questionable banking practices in these countries have raised concerns about the reliability of transactions and contracts with their financial institutions. Given the recent economic crisis in Asia, U.S. recyclers have become especially reluctant to expose themselves to risks associated with these banks.
- **Consolidation among Korean fiber buyers.** Mergers and acquisitions in the Korean fiber industry have reduced the number of fiber buyers from 10 to just three in 1998. It is unclear how this increased concentration will affect demand for U.S. post-consumer fiber – some in the Northwest recycling industry speculate that this trend may result in lower sales.
- **U.S. economic downturn could also force prices down.** If the U.S. economy incurs a slowdown in the fourth quarter of 1998, and if demand for paper products drops, these events would likely further depress prices for post-consumer paper fiber.
- **Simultaneous slowdown in U.S. and state economies might exacerbate drop in demand.** If the expected Washington economic slowdown occurs at the same time as a national economic downturn, this might depress in-state demand for recycled paper products to an even lower level. Tumbling markets for recycled paper possibly could have very negative effects on local recycling programs.

Opportunities for public sector action

1. Diversify mixed waste paper market

Situation. Of the tons of target materials recycled in King County, mixed waste paper represents a significant share. The fact that only one Puget Sound end user, a newspaper mill, exists makes the market for this commodity vulnerable. Should the mill discontinue using recycled mixed waste paper as a feedstock, King County recyclers would have to sell all of the mixed waste paper at lower prices to more distant buyers. A possible new supply of mixed waste paper from Portland and Seattle – if Seattle initiates bi-weekly collection in South Seattle – threatens to increase downward pressure on prices. Other area mills could adopt technology that would enable them to use this material as a feedstock; however, high fixed costs remain a barrier.

Opportunity. An opportunity exists to diversify the Puget Sound end market by facilitating the use of mixed waste paper as a feedstock at other mills. King County could also promote the development of secondary markets for uses such as molded pulp and landscaping (e.g., hydromulch and animal bedding). These actions would help to lessen the dependency of local recyclers on the one mill and provide an alternative to foreign markets.

2. Monitor newspaper, cardboard and high grade paper markets

Situation. Global markets tend to influence prices and demand for these commodities considerably. The Asian and Russian economic crises have contributed to a jump in supply, as cash-starved countries sell off natural resources in attempts to generate revenues. Demand worldwide has also fallen, adding to downward pressure on prices.

Opportunity. Since world markets greatly affect prices and demand for paper fiber, it appears that King County generally has little ability to influence market development at this time. The County should continue to monitor these markets for possible future public sector action. The one clear exception is mixed waste paper, for which an opportunity for public sector action exists.

Chapter Six: Plastics

Definition

This market assessment report focuses on four types of plastics:

- *#1 PET bottles* – all bottles made from polyethylene terephthalate (PET), consisting of soft drink, juice, liquor and other types of bottles
- *#2 HDPE bottles* – all bottles made of high density polyethylene (HDPE), typically used to contain milk, detergent and other liquids
- *other rigid containers* – all other rigid containers with SPI codes 1 through 7, such as tubs, many yogurt containers and other bottles
- *film* – all film, bags and thin plastic packaging, including wrappings, vacuum-formed packaging, bubble packs and other films, as well as plastic strapping and other thin flexible plastic packaging; also includes shower curtains, plastic sheeting, trash bags and other thin plastic products

Methodology

From July through September 1998, we collected information on plastics markets and opportunities through three main tasks. First, using 1996 as a base year, we acquired reported estimates from King County and the City of Seattle on tons disposed of and recycled. (In Appendices A through H, we include these reported estimates.) Second, we reviewed major industry publications, consulted with a recycling economist, and performed telephone and in-person interviews with processors to gather additional information.

Market conditions

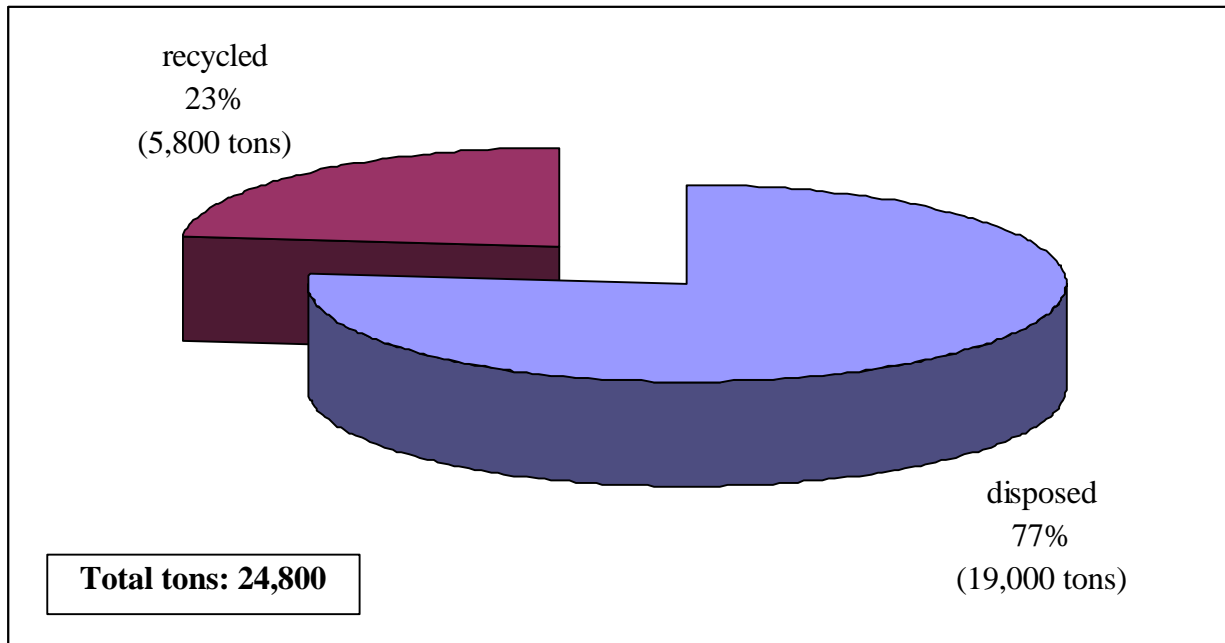
Supply

- **At least 23 percent of King County’s plastic containers are currently being recycled.** This recycling rate is estimated for 1996, based on reported quantities recycled and waste characterization data. A total of 5,300 tons of these plastics (not including film) were reported as recovered in 1996 with 19,000 tons estimated as disposed. These data are summarized in Figure 6-1. This recycling level compares to a national rate of 24.5 percent in 1996 and 23.7 percent rate in 1997, as reported by the American Plastics Council.¹

¹ Given the high level of participation in the curbside recycling programs in the County, it might be expected that the plastics recycling rate for the County would be higher than that for the country as a whole. After all, the County’s recycling rate for all materials is substantially above the national average. The lack of variation for plastics suggests the need for further analysis to validate the data and the comparison with the national statistics.

- **Virgin plastic supply is growing, driven by new uses.** The amount of plastic generated continues to increase each year. The market drivers for many types of plastics are new uses, as plastic replaces glass, paper and even metal in some cases. Sales of both plastic containers and films are expanding faster than the rate for other forms of packaging, indicating that plastics is gaining market share in this competitive industry. However, it is important to note that plastics recycling is not increasing at the same rate as virgin sales, accounting for the decline in the recycling rate.

Figure 6-1: Estimated quantities of PET, HDPE & other rigid bottles disposed of and recycled in King County and Seattle (1996 tons)



- **The supply of PET bottles is growing the fastest.** PET has become the package of choice for most juice and soft drink manufacturers. Many prefer PET because it is lightweight compared to glass, has high oxygen barrier properties (which is good for sodas and seltzers) and can be molded into distinctive containers to enhance brand identity in the marketplace. Sales of single service juice and sodas packaged in PET bottles have exploded in recent years as have sales of “custom” bottles, such as Ocean Spray Cranberry Juice. A growth rate in sales of 11 percent occurred between 1996 and 1997, and growth has averaged 9.5 percent annually since 1990. These trends have greatly increased the supply of PET available for recycling in the Puget Sound region.
- **Most plastic bottles are made with either PET or HDPE resins.** According to recent American Plastic Council (APC)/Society of the Plastics Industry (SPI) data, these two resins account for more than 90 percent of plastic bottles produced in the United States.

- **Over the next several years, new types of plastics packaging are expected to be produced that may make sorting and reclaiming plastics more difficult.** For example, PEN plastic, a close cousin of PET, is expected to gain market share in bottle applications over the next 3-5 years.² PEN plastic must be separated from PET for recycling. However, the technology does not yet exist to cost-effectively sort these two types of plastics.

Multi-layer or composite packaging (e.g., bottles made with several different kinds of plastic) is also expected to gain market share. For example, in some parts of the country single service milk containers are being sold in an HDPE bottle with a PVC sleeve (label). This package is extremely appealing to consumers (as evidenced by sales), but is difficult to recycle as the PVC must be separated from the HDPE.

These and other developments will provide challenges to the current plastics recycling infrastructure that simply separates HDPE from PET plastics, with all other materials discarded as contamination.

- **The supply of plastic film generated dwarfs that of plastic bottles and rigid containers.** Plastic film comprises 4 percent of the municipal solid waste stream according to 1996 King County and Seattle waste characterization data.³ In contrast, plastic bottles and containers account for only 1 percent of total waste disposal. These data imply that aggressive efforts to develop markets for plastic film could significantly increase the overall recycling rate in the region.
- **Commercial collection of LDPE and HDPE film is growing.** Plastic film generated by large commercial establishments, such as department stores, is being collected in greater and greater quantities. Stores bale this material on-site to reduce transportation costs associated with this light, bulky and difficult to handle material – bales offer a compact means of shipping film. Baled plastic, in turn, is either consolidated by processors or shipped directly to end users.
- **Collection of “other rigid” plastic containers is limited.** Currently, no curbside or drop off programs in King County accept plastic containers other than #1 and #2 bottles. In fact, in the entire Northwest only a few programs (all based in Oregon) collect the full range of plastic containers, including yogurt cups and margarine tubs, for recycling. However, many programs now collect all plastic bottles (#1-#7), including the City of Portland, Clark County, the City of Olympia and Whatcom County. Typically, all #3-#7 plastic bottles are baled and shipped to Garten Services in Oregon for processing.

²PEN is the acronym for polyethylene naphthalate.

³ Includes construction, demolition and landclearing data.

Infrastructure

The infrastructure that exists in the Northwest to recycle plastics is adequate but limited. This infrastructure consists of the following:

- **Collection:** Waste Management, Waste Connections, Rabanco and RST Disposal collect plastic bottles at the curb in King County. These plastics are now integrated into this collection system, although improvements in efficiencies may be possible. The collection system for plastic film is less well developed. Most commercial recyclers will take film from large generators. However, businesses or institutions that generate only small quantities of film have difficulty recycling this material.
- **Sorting:** The plastic bottles collected at the curb are sorted into separate grades (e.g., PET clear, PET colored, HDPE natural, HDPE colored) at several facilities in King County. This sorted material is then baled and shipped to reclaimers or end users, most of who are outside the region. Three Material Recovery Facilities (MRFs) sort plastics in the region. Waste Management, Fibres International, and Tacoma Recycling operate these facilities.

These facilities all sort plastic bottles into their separate grades manually. One facility, operated by Garten Services in Salem, Oregon, automatically sorts plastic containers. This facility has the capacity to separate all seven major resin types and distinguish between containers and bottles using laser sensors.

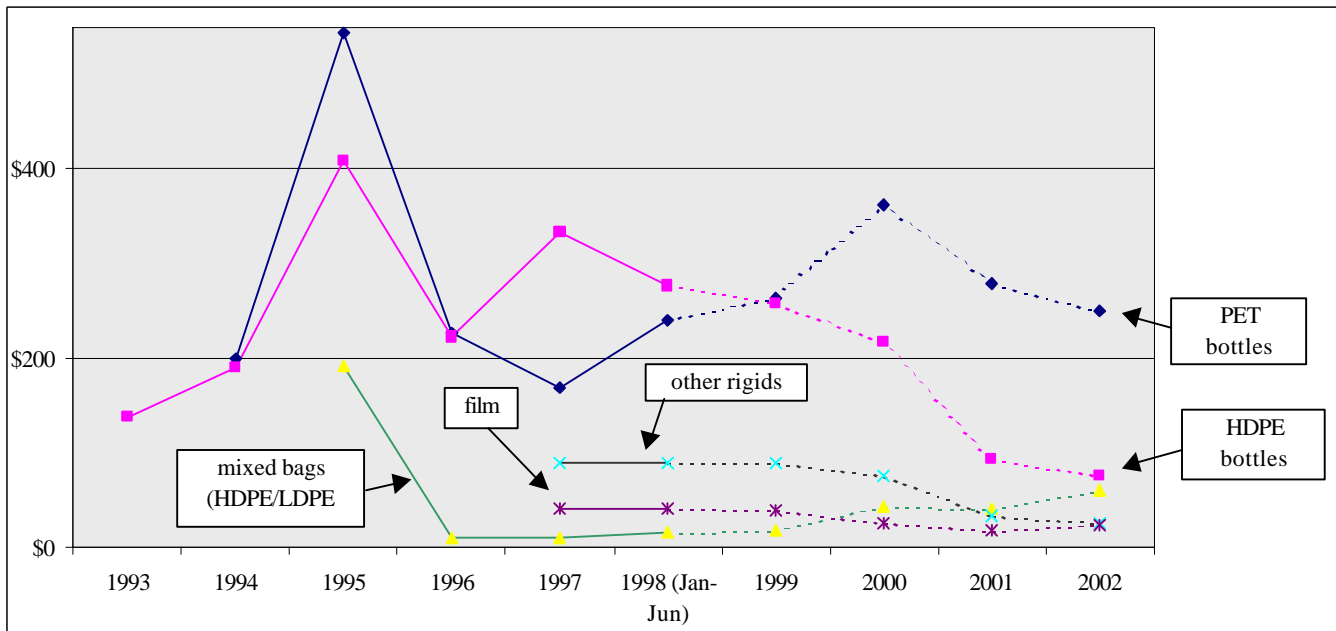
Plastic film is typically separated by type at the point of generation and then collected, consolidated and baled by recyclers. One MRF in Oregon is currently experimenting with separating plastic film from regular commercial garbage for recycling.

Prices

PET bottles have consistently held the highest price until 1996 and are expected to rise again above HDPE prices in the next two years. HDPE has remained the second-highest priced resin. A spike in prices occurred in 1994-1995 and, since then, prices have settled to levels generally higher than those in 1993. Figure 6-2 illustrates actual prices since 1993 and projected prices through the year 2002.⁴

⁴ Prices are for “pure” loads, i.e., cleaned, separated by polymer and baled. The current and projected prices presented in Figure 6-2 were developed using June 1998 data. Since then, prices have dropped substantially to \$150-180 per ton for both PET and HDPE. Some observers predict that prices will stay low for the next one to two years as new capacity comes on line and the impact of the world economic slowdown continues to be felt (see Barriers, below).

Figure 6-2: Actual and projected prices for four plastic resins from King County and Seattle (1993 to 2002)⁵



- Reclamation:** In the reclamation stage of plastics recycling, plastics are ground into small pieces (flaked), washed, and, in many instances, extruded into plastic pellets (repelletized). Only one reclaimer operates in the region – Merlin Plastics, located in British Columbia. Merlin Plastics reclaims HDPE and PET turning the HDPE into pellets and the PET into clean flake. This clean material is then shipped to end markets – plastic processors making new products and/or packaging.

End Markets

A wide range of markets exist for recycled plastics collected from King County:

- Baled HDPE is shipped to Merlin Plastics as well as to reclaimers in the Southwest and California.** The largest markets for HDPE from King County besides Merlin include Orion Pacific in Texas, Talco in California and Ecoplas also located in California. These firms reclaim HDPE and sell recycled resin to plastic processors.
- Most of King County’s PET is exported.** Overseas buyers purchase most of the PET recycled from King County. Much of this PET ends up in China where it is used as polyester to make clothing and other textile products. Approximately 25 percent of the PET recovered from King County is shipped to the Southeast United States where it is processed for use in fiber applications such as carpeting. Wellman is one large buyer of PET from recycling programs.

⁵ Prices are not available for all years for all resins.

- **PET from curbside programs must compete with PET from bottle bill programs in the recycled plastic marketplace.** The PET collected from King County competes directly with PET obtained from bottle bill states, such as Oregon. Typically, bottle bill PET is cleaner and less contaminated and so brings a higher price in the marketplace. Buyers in the Southeast prefer bottle bill PET. Most curbside material collected here, which is not bottle bill PET, is exported to Asia.
- **Plastic film is shipped to markets in the Southwest and overseas.** Currently there is very little end use demand for plastic film in the region although that could change in the near future (see below). Most of the film collected here is handled by Re-Sourcing Associates of Seattle for Boise Cascade and shipped to Asia for processing. There, it is made into low-end applications such as garbage cans and athletic shoe soles. Some material is also shipped to the Virginia-based TREX, for plastic lumber production. Before Re-Sourcing Associates entered the market as a handler, much of the film from the region was shipped to relatively well-developed markets in California. These markets still exist and continue to receive some of the plastics collected in the region.
- **Very few markets exist for 3-7 plastics and #1 and #2 non-bottle rigid containers.** These plastics are shipped to Garten Services in Salem Oregon which charges to accept the lower-value other rigid containers (#3 through #7) but pays for bales of plastic when #1 and #2 bottles are co-mingled with the other rigids. Markets for these plastics when they are sorted and baled by resin type are extremely limited.

Table 6-1 summarizes the flow of baled plastics from King County to reclamation markets.

Table 6-1: Approximate flows of plastic grades to reclaimers, by location (1998)

Plastic resin type	King County	Puget Sound	WA	Other N. America	Overseas	TOTAL
HDPE bottles				100%		100%
PET bottles				25%	75%	100%
film				25%	75%	100%

As can be seen, there is very little demand for recycled plastics in King County or the broader Northwest region. This is because the region does not support a large plastic processing and manufacturing sector. Instead, most plastic packaging and products are manufactured in the Southwest, the Southeast, and the Midwest. However, there are some regional plastic processors who do use recycled resins:

- **Graham Packaging buys recycled HDPE.** Graham Packaging uses some post-consumer HDPE, but this amount represents only 2.5 percent of the HDPE repelletized in the Northwest. Graham Packaging is the only company in Puget Sound known to use post-consumer HDPE. The company manufactures motor oil bottles with recycled content.
- **No King County companies are known to purchase post-consumer PET.**

- **Several plastic processors in King County use post-industrial material.** Several companies process post-industrial plastic for re-manufacturing. These companies use post-industrial plastic when its price falls below that of virgin materials in order to reduce feedstock costs. Unlike post-consumer plastic, post-industrial resin does not typically require washing.
- **Boise Cascade may emerge as a very large end market for plastic film.** Boise Cascade is currently in the research and development stage of producing a new composite building product made with 40-50 percent recycled plastic film.⁶ The company has initiated a pilot project to source plastic film from this region through a contract with Re-Sourcing Associates of Federal Way. If the pilot project and R&D effort prove successful, Boise will be seeking approximately 8 million pounds per month of polyethylene films (both HDPE, LDPE and LLDPE).⁷ At these levels, Boise will be able to use all the plastic film that can feasibly be recovered in the region.

Demand for recycled plastics collected from King County is affected by a wide variety of factors. Markets for plastics are international in scope, with demand and price a function of such factors as the cost of oil, economic activity in Asia, virgin production capacity and plastic production in the United States. In recent months, prices for both PET and HDPE have fallen substantially, in large part because of the Asian economic crisis. Industry experts expect markets to remain poor or worsen for the foreseeable future. They cite several factors, including the fact that some Asian companies are exporting virgin resin at very low prices to the United States for the first time. This influx of low-cost resin is expected to put further downward pressure on already depressed domestic markets for virgin and recycled plastics.

Consumer Demand

Recycled plastics ultimately are made into a wide variety of products and packaging applications. Recycled resin competes primarily on price with virgin and “off-spec” alternatives. In addition, some product and package manufacturers advertise their use of recycled resin to consumers. These users are sometimes willing to pay more for recycled resin than virgin in order to maintain minimum recycled content percentages. Some major end uses for recycled resins include:

- **Detergent bottles** – recycled HDPE is used to make new detergent and other non-food grade pigmented bottles. Typically, these bottles have 25 percent recycled content, which the manufacturer advertises to the consumer.
- **Plastic lumber** – recycled HDPE and mixed plastics are used to manufacture decking, dimensional lumber, picnic tables, docks, and other related marine and outdoor equipment. Plastic does not rot, fade, or degrade and thus offers superior performance to wood in certain applications. Demand for TREX decking products, made with recycled plastic film, has surged in recent years underscoring the emergence of this industry as a viable end market for recycled plastics.

⁶ This product is 100 percent recycled and also include 50 to 60 percent recycled wood.

⁷ LLDPE is linear low-density polyethylene.

- **Fiber products** – Recycled PET is used to make fleece clothing and fiberfill for winter coats and sleeping bags. Demand for these products has increased dramatically in recent years, due in part to the marketing efforts of Patagonia and Malden Mills. As noted earlier, most recycled PET is used to make carpet products.
- **Pipe** – Recovered HDPE and PVC are a low-cost feedstock for the production of plastic pipe used in construction applications. This market is quite large. However, recycled resins must compete with low cost virgin resins, so the market share for recycled plastics is quite small.
- **Garbage bags and grocery sacks** – In California, a strong market exists for recycled HDPE and LDPE resins to manufacture plastic bags. This market is driven by California State law, which requires recycled content in these bags. In King County, Larry’s Markets uses recycled resin to make its plastic bags even though the cost is higher than virgin. This demand is driven by the grocer’s environmental commitments.

The bottom line is that recycled resins must compete on performance and price for market share. As with other products, recycled plastics must provide clear benefits to users in order for long-term viable markets to develop and be sustained. Over the last five to ten years, recycled plastics have gained acceptance as a valued feedstock to produce many different products and packages. However, demand varies with the price of virgin resin. When prices fall for virgin plastics they also decline for recycled resins. At times, the price in the market can be below the cost to handle and reclaim recycled materials. It is at these times that recyclers, handlers and reclaimers are under the greatest stress and problems with plastics recycling tend to receive the greatest attention from solid waste officials.

Barriers

Key barriers to the further development of markets for recycled plastics include:

- **Northwest lacks a critical mass for plastic processing and large-scale manufacturing.** The region’s relatively small population and consumer goods production base means that few plastic processors are located in this region that can use recycled resins. (Note: Large quantities of engineering grade plastics are used to make aircraft and computer parts, but these differ from the plastics collected for recycling.) Recycled plastic must be shipped to manufacturers elsewhere, which adds to the cost of reclaiming and limits the ability of post-consumer resin to compete with virgin resin.
- **Growing processing capacity in Canada.** Reportedly, Dow and Union Carbide/Nova Chemical will bring on line more than 1 billion pounds of processing capacity to manufacture virgin polyethylene in Alberta next year. This is expected to drive down prices for virgin HDPE and LDPE resin, which, in turn, would depress demand for post-consumer resin.

- **Preference for virgin plastics.** Plastic package and product manufacturers have for the most part continued to use virgin resin in their operations. Virgin resins typically provide better performance characteristics. They are unlikely to use recycled plastics unless its cost is significantly below that of virgin materials.
- **Imported resins leading to a glut of supply and lower prices.** First-ever imports of virgin resin from Asia have led to increased competition and lower resin prices. This, too, will depress demand for post-consumer recycled plastic.
- **Lack of infrastructure and end markets for rigid containers other than #1 and #2 bottles.** As noted earlier, there is only one processor in the region capable at this time of efficiently sorting #3-#7 plastics and injection grade containers (e.g. tubs and cups). In addition, reclamation capacity and end markets for these materials are limited.

Opportunities for public sector action

The ability of King County and other regional governments to substantially influence recycled plastic markets is considered limited because of 1) the small size of the plastics industry in the Northwest and 2) the global nature of markets for plastic resins. Over the past decade, the public sector has invested substantial resources in an effort to develop local markets for recycled resins. These activities resulted in many plastic manufacturers using recycled resins on a test basis. However, few if any of these companies are currently consuming recycled feedstock on a regular basis apparently as they perceive greater advantages in terms of price and performance associated with using virgin resin.

Considering this experience and the market assessment findings presented earlier, opportunities for public sector action include:

- **Monitor the changes in plastic packaging – be prepared to provide technical assistance if new types of plastics are generated that complicate existing recycling programs.** As noted earlier, developments in plastics packaging could make the existing handling and reclaiming less viable. The public sector could become involved, potentially working with industry, to develop methods to adapt to these changes so that existing plastics recycling programs are not undermined.
- **Expand supply.** The potential exists to supply more plastic film and #1 & #2 bottles to existing markets. Education and promotion programs could be targeted at increasing the recovery rate for these plastics from both the residential and commercial sectors. Efforts to collect more plastic film could be coordinated with the Boise Cascade pilot film recycling program.
- **Increase efficiency and quality of supply.** King County will be well positioned to cope with a downturn in recycling markets, if the plastics collected from this region are the lowest cost, highest quality available. The public sector could undertake an effort to assess the overall quality and efficiency of its plastic collection and handling programs relative to competition. Based on the results of this assessment, efforts to assist recyclers to improve efficiencies and quality could be implemented.

- **Facilitate the development of processing capacity and markets for injection grade and #3-7 plastics.** The City of Seattle’s decision to possibly add these plastics to its curbside collection program creates both the need and opportunity to develop adequate infrastructure and end markets. This effort would involve working with the private sector and potentially other local governments to establish a cost-effective handling and reclaiming system and identify potential end markets. It may be that if a critical mass of these plastics is collected regionally, an economically viable infrastructure and markets will result.
- **Provide technical assistance to plastic manufacturers located in the region.** As noted, earlier efforts to assist plastics manufacturers convert to using recycled feedstock appear to have had limited long-term success. Nonetheless, the potential exists to work regionally to increase this use. Public sector action could be focused on identifying interested companies and providing technical assistance for feedstock conversion.
- **Expand the purchase of products and packaging made with post consumer plastics.** Procurement policies directed at purchasing more recycled plastic products, particularly in landscaping and construction applications, could substantially increase the demand for these products regionally. Also, promotional efforts to encourage the public and businesses to buy clothing or other plastic products with recycled content could result in increased demand. These efforts could be undertaken regionally to maximize the potential impact on the marketplace. The potential exists to form partnerships with the private sector to promote the purchase of clothing with post consumer plastics. In particular, this region supports a very active outdoor recreation industry. Partnerships to promote the purchase of post consumer fleece clothing and fiberfill products could both increase demand for these products and raise awareness among the public of the need to recycle as many plastics as possible.

Recommended Public Sector Market Development Actions

Of these potential actions, several are recommended for implementation:

1. **Help ensure a sufficient supply of post-consumer film.** If the Boise Cascade project does move forward, the public sector should mobilize to ensure that enough plastics are collected cost-effectively to make this enterprise a long-term success. Market development efforts for film would dramatically change the level of recycling of this high volume material. Actions could include implementing education programs targeted at the commercial sector and contracting with service providers to collect plastic film at the curb.
2. **Monitor developments in the plastic packaging and recycling industries.** The public sector should carefully watch changes in packaging and recycling practices for plastics and be proactive about seeking solutions before major problems occur. Activities could include providing service providers with information about the recyclability and “best management practices” for new types of plastics that are expected to enter the waste stream in the near future.
3. **Facilitate the development of infrastructure and markets for injection grade and #3-#7 plastics.** If the City of Seattle decides to add these plastics to its collection program, with the rest of King County potentially following suit, actions should be taken now to address infrastructure and marketplace needs. Specifically, the public sector should identify existing and potential options for processing and marketing these plastics. If appropriate, technical assistance efforts should be implemented to expand the options for cost-effective handling and end use of these plastics.
4. **Promote recycled content plastic products, procure more of them.** Activities that result in increased purchases of recycled plastics by consumers should continue, as a means to help ensure the long-term viability of the plastics recycling industry.

Chapter Seven: Textiles

Definitions

We define textiles as follows: fabric materials including natural and synthetic textile materials such as cottons, wools, silks, woven nylon, rayon, polyesters and other materials. This category includes clothing, rags, curtains and other fabrics. We do not include in our definition nonrecyclable products such as carpets, upholstery, shoes and other leather items.

We also use the following terms to describe various players in the textiles industry:

- *collectors*: organizations, typically nonprofits, that pick up donations of clothing from residences
- *retailers*: stores that sell second-hand clothing; these stores have been run historically by nonprofits but for-profit companies recently have emerged
- *vendors*: firms that sort, grade and re-sell or dispose of recycled textiles – commonly lower-grade material passed on by retailers or collectors
- *brokers*: companies that broker the sale of recycled textiles to retailers in lesser developed countries or end users such as carpet manufacturers or car makers

Methodology

From July to August 1998, we collected information on textiles markets and opportunities through two main tasks. First, using 1996 as a base year, we acquired reported estimates from King County and the City of Seattle on tons disposed. (In Appendices A through H, we include these reported estimates.) Seattle and King County do not record textiles recycling data because they do not play a role in textiles collection, processing, remanufacturing or resale. The nonprofit and private organizations that comprise the textiles recycling industry are not required to report on quantities handled, which makes estimating tons recycled extremely difficult. Second, we reviewed major industry publications, and performed telephone and in-person interviews with processors to gather additional information.

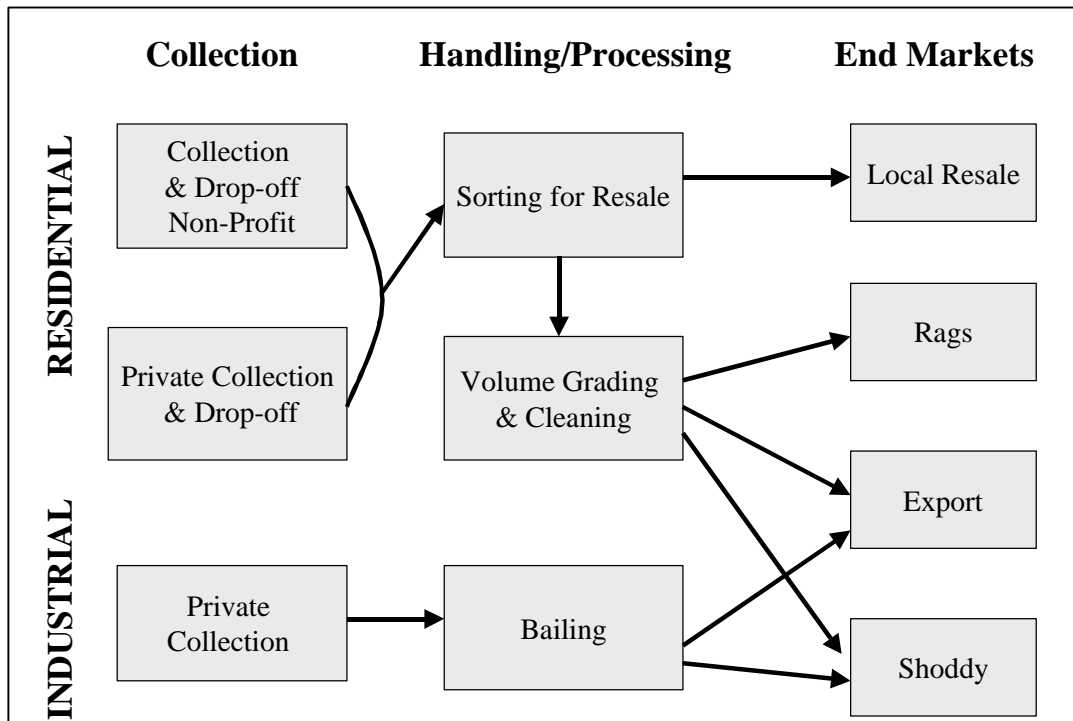
Market conditions

Overview

Textiles recycling in King County generally takes place in the manner described below. Figure 7-1 illustrates these flows.

- **Collection.** Residents either take textiles to drop-off sites run by nonprofits or nonprofits pick up these items directly from residences.¹
- **Resell, send to vendors or dispose.** These nonprofits typically sell most of their collections in retail outlets they operate – in at least one case, though, a nonprofit resells all of its collections exclusively to a for-profit organization that resells them in its chain of outlets. Nonprofit collectors also donate material they consider un-sellable to other charities, send it to vendors (e.g., clothing graders/sorters/rag manufacturers) or dispose of it.
- **Sort for resale again, or sell to manufacturers or brokers.** Vendors then sort the textiles again for sale to producers of shoddy², industries needing wiping cloths or textile brokers.

Figure 7-1: Flow chart of textiles recycling in King County



¹ A small amount of textiles is also collected at King County Special Recycling Events.

² “Shoddy” is a textile industry term. It refers to fluff – finely ground used textiles that are bonded together in a non-woven fashion and used in low-end applications such as automotive trunk liners and seat cushions.

- **Post-consumer vs. post-industrial.** Much of the material entering the textiles recycling stream is post-consumer – typically, clothing that consumers buy but later donate to second-hand stores. Other textiles also enter the recycling stream from industrial sources, such as scraps of material waste from manufacturing processes, and are referred to as post-industrial.
- **Sorted items for specific markets and “original collection” textiles have highest value.** Several items such as blue jeans, shoes, cotton shirts, etc. have a high value if they are sorted and sold to the particular markets that desire them. Some processors occupy a very specific niche, accepting only *one* type of recycled textile material. For others in the industry, “original collection” – collected and bundled textiles that have not yet been sorted – generally have the highest value. Here, buyers assume that at least some high quality or expensive material remains in the load.
- **Flows stay in area, mainly.** Most recycled textiles remain within the Puget Sound area. The main exception to this is brokers, who sell a vast majority of their material overseas. Brokers in the Northwest sell almost exclusively to Asia.

Supply

- **Retail sales by item, bulk sales by pound.** Material collected is sold by the item in thrift stores, and in bulk by the pound to all other players involved in textile recycling.
- **Most collection in summer and early fall; prices stable year-round.** Nonprofits collect the majority of material during the summer and early fall. Prices for items sold in retail stores normally remain rather constant throughout the year. The quantity of material collected *and* items sold have grown in the past few years but recently have slowed and begun to flatten.
- **Bulk prices vary widely.** Market prices for textiles sold in bulk fluctuate greatly.
- **Problem: illegal “dumping.”** Some second-hand textiles stores have reported increasing incidents whereby refuse is dumped in their drop boxes. Such dumping not only can contaminate textiles in the drop boxes but also adds to garbage disposal costs for the organization.

Market for retail

- **Developed retail market.** Retail markets in King County appear to be highly developed, with a significant number and diversity of retailers. Table 7-1 below lists the major thrift stores in King County and Seattle.
- **Evidence of market growth and potential.** The number of thrift stores has increased. Substantial growth in recycling appears to have taken place over the past several years, and industry players speculate that room exists for further expansion.

- **Rise of for-profit retailers.** In the past decade, for-profit thrift stores, most notably Value Village and Shop & Save, have developed a strong presence around the County. With the rise of for-profit competition, some nonprofit retailers have modified their missions. For example, the Chicken Soup Brigade no longer considers its retail outlets solely a means of selling clothing to the poor, but now also seeks to generate revenue from retail sales that it can use to provide services to them.
- **Market growth fueled partly by consumer attitudes.** Many consumers’ attitudes surrounding thrift stores have changed. Buying used clothing is now seen as acceptable for those in almost any economic class. Trends of buying 1970s “retro” clothing have emerged.

Table 7-1: List of major thrift stores in King County and Seattle (1998)

Organization	Number of Retail Stores
Goodwill	8
St Vincent De Paul	7
Value Village	10
Shop and Save	11
American Cancer Society	7
Salvation Army	4

Market for sales to clothing vendors

- **Several vendors nearby.** Only one vendor exists in King County but two others, located in Pierce and Snohomish Counties, also service the area.
- **Prices falling sharply.** Sale prices to vendors have dropped from highs of 14 to 16 cents per pound to 5 to 6 cents per pound.
- **Some collectors now must dispose of bulk textiles.** Under current market conditions, one collector and retailer has found it most cost effective to landfill material that it would otherwise sell to vendors. Low demand overseas reportedly has driven down prices such that many vendors no longer pay some collectors and retailers for bulk items. Thus, collectors and retailers face a choice – either transport unsold items to vendors or dispose of it in landfills. Landfills sometimes represent the closer and, therefore, cheaper option. The one collector mentioned above currently disposes of 157,500 pounds per month compared to “virtually none” five months ago.

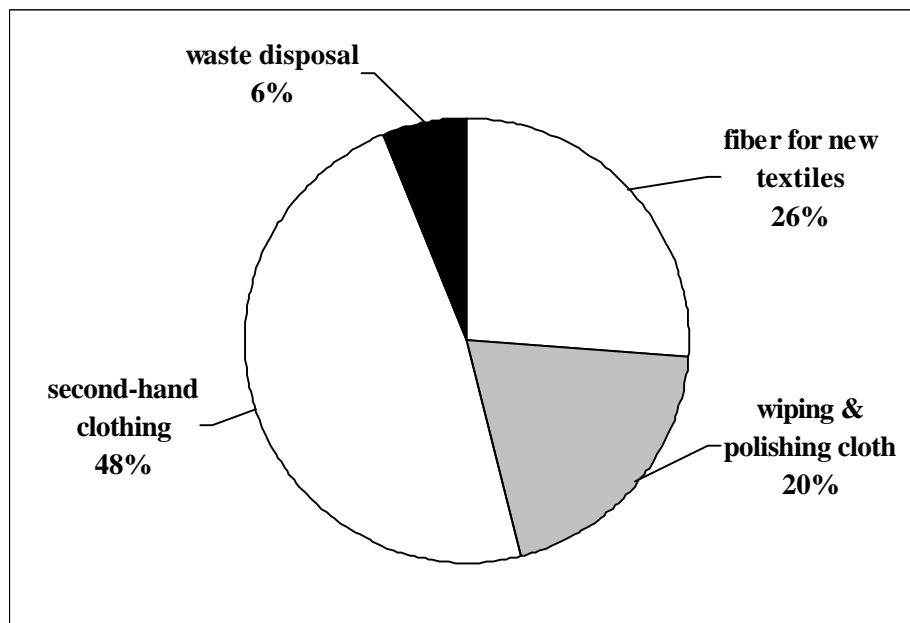
Market for sales to brokers

- **High volatility, current slump.** The market fluctuates greatly and is currently down. Industry experts regard economic crises overseas, particularly in Asia, as key drivers for the present low demand and prices.

End markets

Figure 7-2 illustrates end uses of post-consumer and post-industrial textiles once they have been collected and enter the recycling stream, according to national data. Recent reports suggest that waste disposal now accounts for a significantly larger share of these items, given falling demand abroad. Since many post-consumer textiles flow back into retail sales to other consumers, this section focuses on end markets for post-industrial textiles.

Figure 7-2: What happens to recovered textiles?³



- **Market strong, growing for post-industrial textiles.** Industry experts report that the current supply is sufficient but demand has fallen recently due to the Asian economic crisis, the General Motors strike and the low price of crude oil. General Motors accounts for a sizable share of the domestic shoddy market, and uses this material for items such as siding, insulation, sound proofing and seat cushions. The low price of crude oil has reduced the cost of manufacturing polyester which has, in turn, lowered the value of recycled polyester.
- **Incentive to recycle post-industrial polyester waste.** Despite the fact that industries must pay for recycling of post-industrial polyester, it reportedly saves them about 1.5 cents per pound over landfill disposal.

³ Source: Institute for Local Self-Reliance. Includes both post-consumer and post-industrial textiles.

- **Significant diversion and opportunity for more.** One recycler in King County diverts an estimated 2.5 million pounds or 1,250 tons of polyester from landfills each year. This company expects future expansion and suggests that opportunities exist for other companies to become involved in post-industrial polyester recycling in the Puget Sound region.
- **Where post-industrial textiles go.** Post-industrial recycled textiles are baled and sold to processors and manufacturers of shoddy in the Eastern United States, southern California and Asia. No known local or in-state buyers exist.
- **Possible market potential for manufacturing or processing.** One collector speculates that a substantial market potential exists for manufacturing products from post-industrial textiles. Reportedly, hundreds of thousands of pounds of shoddy per month are shipped back into the state for use by aerospace and shipbuilding companies.
- **Feasibility study could help potential manufacturers or processors.** The County could encourage a manufacturer or processor to locate in King County. Two possibly helpful actions would be studying the economic viability of recycling textiles for shoddy and exploring ways to help a manufacturer or processor obtain financing for a facility and shredding equipment.

Issaquah: a case study in curbside textile collection

Test Program: Oct 23, 1992 and March 10, 1993

The City of Issaquah conducted a test program in which it collected textiles as part of its curbside recycling efforts. This two-day program included the following features:

- **Source separation by residents.** The city asked residents to separate and tag bags of textiles for collection as either “recyclable” (i.e., material that is not wearable) and “reusable” (i.e., clothing that could be worn again).
- **Delivery to nonprofit and vendor.** The city delivered reusable materials to a local nonprofit thrift store and recyclable bags to a vendor based in the County.
- **Low participation rates.** In previous curbside recycling programs for other commodities, participation rates had started at about 20 to 25 percent, and had reached more than 90 percent within two months. For the two test dates of the textiles recycling program, participation started at 6 percent but fell to 3.2 percent. City officials note that the program did, however, collect a substantial quantity of material from the residences that participated.

Monthly Curbside Collection- Fall 1993-Spring 1995

Following the test program, Issaquah incorporated textile collection in its curbside recycling program. The city ultimately discontinued this effort after approximately two years. Whereas there were initially very few private sector textile collections, at the program’s conclusion, many more opportunities existed for residences to recycle. Nonprofit collectors had expanded operations considerably and few residences participated in the program.

Opportunities for public sector action

Low need but room for limited action

Situation. Collection and retail sales of recycled textiles in King County account for much of the material that might otherwise be thrown away. This industry has grown extensively throughout the County. Little need exists for public sector action to help further market development.

Opportunities. Three, limited opportunities should be considered:

- *Crackdown on illegal “dumping”* – Some nonprofits complain that they often have waste material “dumped” on them illegally through their drop-off boxes. This can contaminate textiles in the drop boxes and places on these nonprofits the burden of paying for disposal of waste they did not generate. County and other local law enforcement agencies could investigate the magnitude of this problem and work with nonprofits on a case-by-case basis to identify possible means of prevention.
- *Transportation* – Low current market prices for bulk textiles make transportation costs from collectors or retailers to other vendors prohibitive. The County could possibly help to divert textiles from the waste stream by helping collectors, retailers and vendors explore ways to facilitate transportation of this material.
- *Explore post-industrial processing or manufacturing market.* Considerable tons of shoddy that originate in King County flow back into the County each month from processors located outside the state. The public sector should consider conducting a feasibility study to examine the potential viability of locating a processing or manufacturing facility in the County. Demand for such products may exist in local aerospace and shipbuilding industries.

Chapter Eight: Wood

Definition

In this chapter, we examine markets and opportunities for two major substreams of wood waste, each with subcategories of their own:

- *urban wood*¹
 - *clean urban wood*²
 - *mixed urban wood*³
- *green wood*⁴
 - *landclearing debris*
 - *brush*

Note that urban wood does not include yard waste, as defined in this report. Yard waste, addressed in Chapter Four, consists only of brush with a diameter of less than four inches.

Methodology

From July to August 1998, we collected information on wood waste disposal, recycling and existing market opportunities. First, using 1996 as a base year, we acquired reported estimates from King County and the City of Seattle on tons disposed of and recycled. (In Appendices A through H, we include these reported estimates.) Second, we held a focus group on August 3, 1998 with representatives of leading area firms active in the collection and recycling of King County generated wood waste, and an industry expert.⁵ Third, we reviewed major industry publications, and performed telephone and in-person interviews with processors to address issues that had arisen in the focus group and to gather additional information.

¹ Urban wood is a broad category of wood waste generated through mostly commercial activity, including pallets, crates and other wood packing, construction scrap, demolition wood waste, and wood from secondary manufacturing such as cabinet or furniture trimmings. This category includes small trimmings - dimensional lumber, panelboard and engineered wood products - that have generally been kiln dried and have a moisture content of less than 25 percent.

² Clean urban wood is urban wood waste that has not been painted, stained or otherwise treated. It can be source segregated from non-wood materials for recycling purposes, although it may contain ferrous metals in the form of nails and screws.

³ Mixed urban wood may include all types of urban wood waste, including wood that has been painted or stained. This category may be somewhat co-mingled with non-wood materials, as in the case of demolition wood debris. This type of wood waste is increasingly being considered recyclable, with the development of extensive sorting and processing technologies for high-grading.

⁴ Green wood is unmilled wood of any species. It may include bark, green organic waste (e.g., leaves), dirt and other inorganic grit contamination, and generally has a moisture content of greater than 40 percent. This category includes landclearing debris, consisting principally of stumps, limbs, roots and other woody materials remaining after land has been cleared for development. It also includes brush such as whole small diameter trees, tops, prunings or other woody vegetation. Unlike stumps, brush has a greater amount of green organic waste than recoverable wood fiber.

⁵ Participants included Kim Ducote (Rabanco Recycling), Nick Harbert (Waste Management of Seattle), Bob Sargent (Rainier Wood Recyclers), Terry Gillis (Recovery One) and John Yeasting (Re-Sourcing Associates).

Market conditions

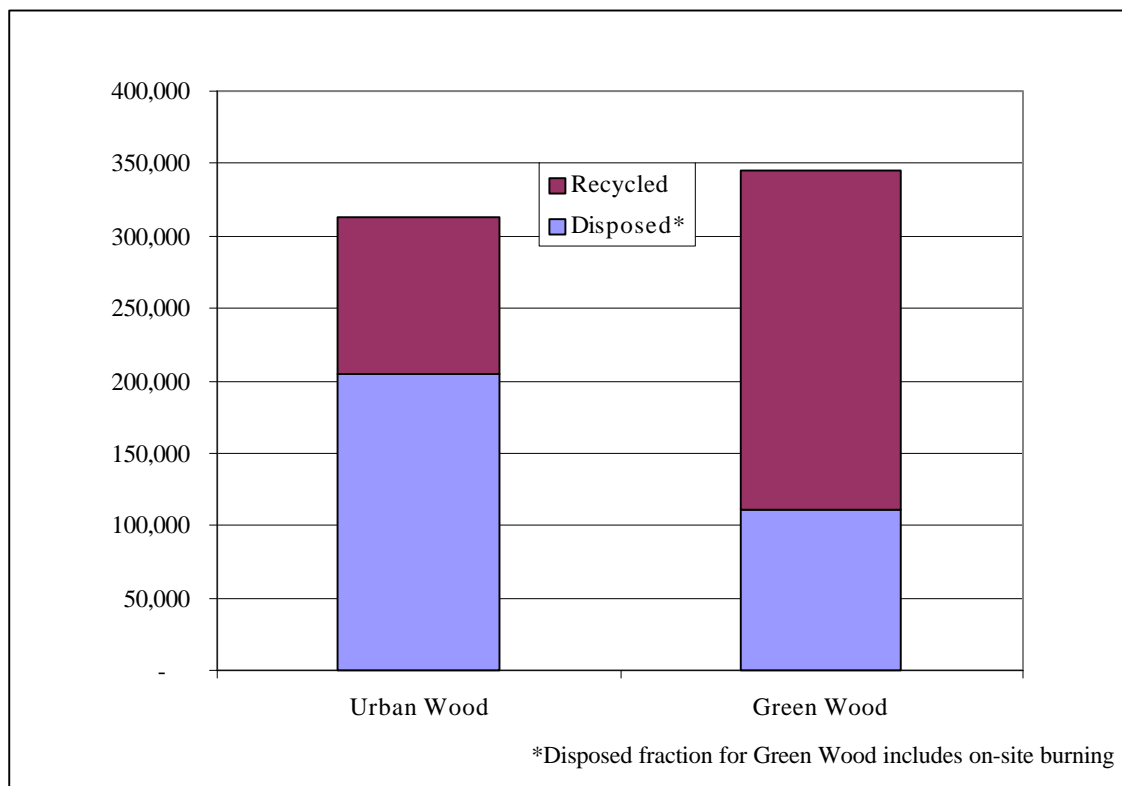
Supply

Figure 8-1 below illustrates the supply of each targeted wood category that is disposed of and recycled. These data suggest the following key points:

- **Wood waste is major component of the waste stream.** Total wood waste generation in King County is estimated at more than 650,000 tons annually. Just over half of this total consists of green wood, principally landclearing debris. Much of this has not historically shown up in King County waste stream accounting – typically, it has been burned, left to rot, or processed on-site. This on-site processing has involved chipping or grinding the wood so that it can be either land applied or hauled away for use as hog fuel.⁶
- **Considerable current on-site recovery of green wood waste.** Burn bans and other regulations restricting long-term piling of green wood waste serve to encourage recovery at most major landclearing sites in King County. The current recycling rate for green wood is estimated to be 68 percent.
- **Greater urban wood recycling possible.** The infrastructure for urban wood waste recycling has just begun to develop. Although many large commercial businesses and construction firms have implemented wood recycling, there remains a substantial amount that could be recycled.
- **Recycled chip demand and pricing are driven by virgin supply.** Virgin chip prices drive prices for recycled wood chips, particularly in fiber applications. Perhaps more important, demand is highly volatile with frequent price changes. Certain mills will only consider recycled wood fiber when a serious shortage of virgin supply exists. As wood recycling matures, and mills become better informed about what recycled wood is and how it can be processed, this situation may stabilize. Recycled wood fiber can be processed from either green or urban wood.
- **Largest share of wood disposed of is mixed urban wood.** Few recycling opportunities currently exist for generators of mixed urban wood waste in King County. Two reasons are cited for this: markets are more limited for this stream, even when cleaned, and solid waste regulations restrict the handling of materials such as painted wood.
- **Local supply tied to economic growth.** Much of the wood waste stream – especially construction scrap and landclearing debris – is driven directly by regional growth and construction activity. Other components of the wood waste stream, such as pallets and crates, are directly tied to shipments of goods. A slowdown in the current strong economic growth of the region can be expected to affect supply.

⁶ Hog fuel, also commonly referred to as *biomass*, is green or urban wood burned to generate steam, heat and/or electricity.

Figure 8-1: Estimated tons of recyclable wood disposed of and recycled in King County and Seattle (1997)



Infrastructure

On-site recovery of green wood, and collection systems for certain types of clean urban wood in King County are highly developed. We have found that:

Substantial wood recovery and processing infrastructure exists within King County and the surrounding region. The Pacific Northwest has been the focus of several articles in national periodicals for its wood recycling infrastructure, particularly its processors. This infrastructure can be summarized as follows:

- **Thirteen fixed-site receiving locations for wood waste recovery exist within King County.** These locations include materials recovery facilities (MRFs) and permitted wood recyclers, and are broken down by type of wood accepted:
 - 8 receiving locations for clean urban wood wastes only
 - 1 receiving location for both urban wood and landclearing debris
 - 4 receiving locations for landclearing debris only

- **There are 8 locations active in some type of wood waste processing within King County.** These include MRFs that perform wood sorting, facilities that perform basic size reduction and comprehensive processing facilities. Appendix K lists wood recycling facilities in and near King County. In short, these consist of:
 - 1 fixed-site processing mill (more than \$2.5 million in capitalization)⁷
 - 2 fixed-site clean wood sort line installations
 - 5 locations using basic mobile grinding equipment only
- **Mobile grinding contractors operate “tub grinder” type units for on-site processing within King County.** Much of this material is converted to hog fuel on-site, and loaded into chip trailers for direct hauling to area boiler operators. Some processed material is left on-site for subsequent use as mulch or landscape material.
- **Major processing mill in Port of Tacoma.** This mill, with \$6 million in capitalization, receives significant mixed urban wood waste from King County.
- **Various other sites in nearby counties.** Various processing sites in Pierce and Snohomish Counties receive small amounts of wood waste from King County. These sites generally take landclearing or urban wood, and tend to send processed material on to many of the same mills that receive wood from King County processors.

End Markets

King County and Western Washington enjoy a diverse marketplace for recovered wood fiber when virgin prices are high, due to the existence of several levels of potential users.

- **Fiber markets represent best value-added opportunity.** These markets for commodity-grade wood chips are regional to international in size and pricing dynamics (see Table 8-2). Demand is volatile, due to differences in the physical attributes of recycled wood particles and those of virgin wood chips. As processing becomes more sophisticated and fiber users become more familiar with recycled fiber, stability of these markets is expected to improve.
- **Biomass fuels: low value, high capacity.** Much of the wood recycling infrastructure serving King County originated to serve biomass markets. These markets are local to regional in size and pricing dynamics, limited by transportation costs. Volatility exists with variations in seasonal demand and availability of alternative fuel sources.

⁷ This is one of two mills in the area with the largest capitalization values. Capitalization is noted here to give readers an idea of fixed costs required for large-scale mills. The other mill with high capitalization is located at the Port of Tacoma and is mentioned below.

Table 8-2: Current and potential feasible market channels for King County wood waste

End-Use Application	Market Location:				
	King County	Puget Sound	WA	Other NW	Other Domestic
Hog Fuel / Biomass	■	■	□	□	□
Mulch / Landscape	■	□	□		
Other mid-value uses	■	■	□		
Pulp & Paper			■	□	□
Panelboard Production			□	■	□
Composites Manufacturing			□*	□	□
■ = Actual Current Market Channels □ = Potential Market Capacity					
* A national forest products company has plans to open a manufacturing facility in Western Washington in the year 2000, sourcing urban wood waste supply.					

- **Mid-value markets offer stability.** With some volatility in both high-value and low-value markets, the importance of mid-value markets for King County wood waste is emphasized. Mid-value applications include:
 - mulch and landscaping
 - road bedding – interim road surfaces for construction sites and rural areas
 - animal bedding
 - compost bulking agent and/or carbon source

Some area processors have had success combining one or more mid-value markets with larger hog-fuel or fiber market opportunities, to develop a more stable market position.

- **Re-use operations capture value.** Not to be overlooked, wood salvage and re-sale operations are growing. Salvage activity for large timbers and beams has increased dramatically in recent years. Such salvage activity does not represent large tonnage diversion, but does complement broader wood recycling. At least two operations in King County successfully market salvaged lumber of various sizes. Other Western Washington operations outside King County have developed extensive salvage and re-milling operations, and have made significant progress in the development of grading standards for such materials to meet building codes.

Consumer Demand

- **Consumer demand, limited influence.** Consumer demand for wood recycling has grown along with a broader awareness of recycling opportunities. This is most evident in the success of local programs to accept clean urban wood waste from self hauls. Builders are also becoming increasingly aware of the “green” consumer, and have begun to integrate recycling and recycled content materials with marketing. Even so, consumers still are rarely actively involved in recycling-related decisions during construction of a home and other commercial activities that generate wood wastes.
- **Recycled wood buyers are large commercial users.** Large commercial users that have minimal interactions with consumers purchase most recycled wood. However, an indirect effect of consumer demand exists with some users, especially in pulp and paper markets, where recycled wood can qualify as “post-consumer” content in finished paper products.
- **Limited consumer access to mulch and landscape products.** These items, produced from processed wood wastes, can be sold directly to consumers. Consumer satisfaction with these products is reportedly strong. However, these products are relatively new and currently lack channels for distribution. One possible retail channel would be through landscaping supply firms.
- **Public sector procurement can lead the way.** State and local governments purchase large amounts of certain products for which processed recycled wood products could be substituted, such as landscaping mulch and road bed materials. After implementing procurement policies, success stories could lead the way to expanding private demand for products.

Barriers and Opportunities

Barriers

- **Limited capacity for mixed urban wood waste.** Generators of mixed urban wood waste have very limited access to recycling for construction, demolition and landclearing wood that requires more sorting than clean wood streams. Demolition projects often generate large amounts of wood, with no source segregation ability due to limited space or time constraints.
- **Few “one-stop shop” receiving locations.** Few facilities exist that will receive different grades of wood wastes at differential tipping fees, a feature desired by generators. As facilities have evolved, they have each captured particular niches of the receiving market. Single generators often create different grades of wood waste, and must haul it to different locations for recycling. Facilities that could accept mixed wood waste at a slightly higher tipping fee would be able to improve diversion rates and broaden acceptance among generators.

- **Standards for clean or recyclable urban wood sometimes unclear.** In some instances, generators bring loads they believe to be clean to a transfer facility only to be informed that it does not meet recycling requirements and must be disposed. Providing mixed wood collection at transfer stations could eliminate this problem in most cases.
- **No standardized product grades or quality standards exist.** End-users have no uniform standards to consider in looking at secondary fiber sources. While many processing operations have become increasingly sophisticated in their abilities, there remains wide variation in physical attributes of processed materials between operations.

Opportunities

- **Several new wood manufacturing technologies on the horizon.** There are a number of emerging product applications, involving the reconstitution and engineering of wood fiber in new ways. These advancements in engineering have two important implications for the wood products industry that will influence value-added recycling opportunities:
 - **Lower capital requirements for individual mills.** The development of specialty manufacturing technologies and niche product applications will mean that smaller mills can be developed in or near urban areas.
 - **Better ability to utilize a more diverse raw material supply.** Commodity grade panelboard mills of today rely on very specific fiber particles that must be sliced from whole logs to meet manufacturing requirements. Engineered products show potential to utilize smaller fiber particles, such as flaked or fiberized cellulose, that opens the door to processed wood waste.
- **New composites create expanded secondary fiber opportunities.** In addition to new manufacturing technologies being applied in wood production, there are new composites emerging that involve wood fiber combined with a variety of other materials such as plastic or cement. These types of applications show the potential to produce high quality products, with less reliance on fiber specifications such as wood species and level of contamination. This additional class of forest products offers an array of opportunities for recycled wood waste.
- **Marketing of mulch products can be expanded.** There is real potential, within a tremendous market for decorative bark in the Pacific Northwest, for recycled wood to compete as an environmentally sound alternative. Capturing even a very small market share through decentralized bulk sales, perhaps through partnership with a landscape supply firm, could represent a substantial opportunity for area wood waste processors. This is especially true for those handling green wood waste.
- **Additional fiber recovery can be achieved through sorting operations.** Technologies today allow for effective separation of recyclable wood fiber from relatively mixed loads of construction and demolition debris. Such processing facilities combine manual and mechanical separation techniques. This may represent the only way to capture much of the wood from demolition sources, as many projects preclude on-site segregation of waste material due to physical space and time limitations.

Trends

- **Local supply growth expected to slow.** Regional growth and construction activity drives much of the wood waste stream. Area processors expect the current growth in supply to slow, and perhaps decline slightly during the next decade. Mobile grinding contractors doing on-site processing may feel the effects of this slowdown the most.
- **Renovation and demolition may sustain wood waste supply.** While area processors anticipate a long-term slowing in development-related wood wastes, they also recognize that renovation and demolition wood waste streams increase as regional housing and infrastructure grow older. Since these activities generate more waste per square foot than construction, this may well offset a decline in development-generated wood waste.
- **Hog fuel demand expected to remain reasonably stable.** While more conversions by hog fuel users to cleaner burning fuels may further reduce the number of buyers for biomass fuels over the coming five to ten years, newer cogeneration facilities are expected to maintain or increase usage. Most of the boilers likely to shut down due to age have already closed and the more contemporary facilities are able to mitigate emissions. The biggest users of hog fuel in the area include forest products manufacturers, which often use hog fuel to burn internal residual wood waste.
- **Virgin wood supply scarcity expected to increase.** This now global market is expected to continue experiencing short-term downturns in pricing, driven in part by surges in supply from economically troubled countries such as Russia and Indonesia.⁸ However, continued restrictions on federal timber harvests and other global factors are expected to maintain the long-term upward trend for virgin fiber pricing. At some point, a renewed focus on secondary fiber sources and diversity of supply is likely.

Opportunities for public sector action

1. Stimulate more integrated receiving facilities

Situation. Few facilities accept multiple grades of wood waste at different fees. Individual generators may create various grades of wood waste, and currently have to take it to different locations for recycling. In some cases, generators bring loads they believe to be clean to a transfer facility, only to be informed that it does not meet recycling requirements and must be disposed.

Opportunity. Facilities that could accept two or three different grades of wood waste, at tip fees that offer an incentive for segregation, would be able to improve diversion rates and acceptance of wood recycling among generators. Sorting and processing technologies today allow for effective separation of recyclable wood fiber from relatively mixed loads of construction and demolition debris. Sorting could either be applied at MRFs or at contractor processing facilities where manual and mechanical separation techniques can be applied cost effectively.

⁸ See Chapter Five for further discussion of global paper and wood fiber markets.

This may represent the only way to capture much of the wood from demolition sources, as many projects preclude on-site segregation of waste material due to physical space and time limitations. An additional benefit of a more comprehensive recovery system for mixed wood waste is better preparedness for disaster-related debris management. The public sector should explore ways of creating incentives for integration of receiving facilities.

2. Promote industry organization and standardization

Situation. There are real differences between recycled wood particles and virgin wood “chips,” including chemical and physical properties, and levels and types of contaminants. This is a fundamental barrier to recycled wood achieving greater market penetration as a high-value secondary fiber source.

Opportunity. The level of understanding of technical variables in wood processing among individual processors is improving. Consequently, there exists an opportunity for the public sector to champion information sharing and development of a classification system in partnership with private industry. A collaborative education and marketing outreach program could target mainstream paper and forest products organizations. Information could be shared concerning how recycled wood can be processed to adjust the shape and size of recycled wood particles, effective contamination removal procedures, and aggregate supply availability. This knowledge could greatly improve the perception of this recycled material stream as a potential raw material source among major fiber users. This effort should also include a move towards standardization of recycled fiber grades, with a focus on terminology for sizing and specifications for contamination levels.

3. Promote mid-value uses and procurement

Situation. Market volatility exists in both high-value fiber markets and low-value fuel markets. Wood processors must have diverse and stable market outlets for material if they are to remain viable and offer cost competitive alternatives to disposal.

Opportunity. Several mid-value applications for recycled wood can provide stability to wood processors. These applications include uses such as mulch, landscaping and engineered products. Decorative bark applications represent a tremendous market that enjoys both wholesale and retail market channels in the Pacific Northwest. Recycled wood has the opportunity to compete as an environmentally sound alternative to bark. Capturing even a small market share through decentralized bulk sales – perhaps through partnerships with landscape suppliers – could substantially benefit area wood waste processors. The County can help to build demand for these mid-value products by adding them to procurement specifications and actively encouraging their procurement.

**Appendix A: Estimated Glass Disposal and Recycling
in King County and Seattle (1996 Tons)**

	Residential				Commercial				Self-Haul	TOTAL			
	disposed	recycled curbside	recycled drop off or events	TOTAL recycled	disposed	contract recycled	other commercial recycled	TOTAL recycled	disposed	disposed	recycled	generated	% recycled
King County	7,400	16,200	1,000	17,200	5,800	3,100	-	3,100	2,600	15,800	20,300	36,100	56%
clear	3,800	-	-	-	2,800	-	-	-	1,100	7,700	-	7,700	0%
green	1,600	-	-	-	1,200	-	-	-	800	3,600	-	3,600	0%
amber	2,000	-	-	-	1,800	-	-	-	700	4,500	-	4,500	0%
mixed	-	16,200	1,000	17,200	-	3,100	-	3,100	-	-	20,300	20,300	100%
Seattle	6,300	12,300	200	12,500	3,900	-	2,000	2,000	500	10,700	14,500	25,200	58%
clear	3,600	-	-	-	2,300	-	-	-	300	6,200	-	6,200	0%
green	1,500	-	-	-	800	-	-	-	100	2,400	-	2,400	0%
amber	1,200	-	-	-	800	-	-	-	100	2,100	-	2,100	0%
mixed	-	12,300	200	12,500	-	-	2,000	2,000	-	-	14,500	14,500	100%
TOTAL	13,700	28,500	1,200	29,700	9,700	3,100	2,000	5,100	3,100	26,500	34,800	61,300	57%

**Appendix B: Estimated Gypsum Disposal and Recycling
in King County and Seattle (1996 Tons)**

	Residential				Commercial				Self-haul	CDL	TOTAL		
	disposed	recycled curbside	recycled drop off	TOTAL recycled	disposed	recycled curbside	recycled brokered	TOTAL recycled	disposed	disposed	disposed	recycled	generated
King County	1,100	-	-	-	6,000	-	-	-	7,100		14,200	-	14,200
Seattle	1,500	-	-	-	3,200	-	-	-	-		4,700	-	4,700
TOTAL	2,600	-	-	-	9,200	-	-	-	7,100		18,900	-	18,900

**Appendix C: Estimated Metals Disposal and Recycling
in King County and Seattle (1996 Tons)**

	Residential				Commercial				Self-Haul	CDL	TOTAL		
	disposed	recycled curbside	recycled drop-off or events	TOTAL recycled	disposed	franchise/contract recycled	other commercial recycled	TOTAL recycled	disposed	disposed	disposed	recycled	generated
King County	8,300	3,800	300	4,100	14,400	900	224,100	225,000	6,600	7,800	37,100	229,100	266,200
aluminum cans	1,500	1,100	100	1,200	1,400	400	5,200	5,600	300	-	3,200	6,800	10,000
aluminum scrap	700			-	800			-	600	300	2,400	-	2,400
white goods	-			-	-		100	100	-	-		100	100
steel food cans	3,100	2,700	200	2,900	2,100	500		500	800	-	6,000	3,400	9,400
other ferrous	3,000			-	10,100		218,800	218,800	4,900	7,500	25,500	218,800	244,300
Seattle	5,300	3,000	3,000	6,000	8,300	-	2,100	2,100	2,600	8,900	25,100	8,100	33,200
aluminum cans	1,100	1,500		1,500	700	-	700	700	100	100	2,000	2,200	4,200
aluminum scrap	100			-	200	-		-	200	400	900	-	900
white goods	-			-	-			-	-	-		-	-
steel food cans	2,100	1,400		1,400	1,300	-	200	200	100	700	4,200	1,600	5,800
other ferrous	2,000	100	3,000	3,100	6,100	-	1,200	1,200	2,200	7,700	18,000	4,300	22,300
TOTAL	13,600	6,800	3,300	10,100	22,700	900	226,200	227,100	9,200	16,700	62,200	237,200	299,400
aluminum cans	2,600	2,600	100	2,700	2,100	400	5,900	6,300	400	100	5,200	9,000	14,200
aluminum scrap	800	-	-	-	1,000	-	-	-	800	700	3,300	-	3,300
white goods				-	-	-	100	100	-	-	-	100	100
steel food cans	5,200	4,100	200	4,300	3,400	500	200	700	900	700	10,200	5,000	15,200
other ferrous	5,000	100	3,000	3,100	16,200	-	220,000	220,000	7,100	15,200	43,500	223,100	266,600

**Appendix C: Estimated Metals Disposal and Recycling
in King County and Seattle (1996 Tons)**

% recycled
86%
68%
0%
100%
36%
90%
24%
52%
0%
0%
28%
19%
79%
63%
0%
100%
33%
84%

Appendix D: Estimated Organics Disposal and Recycling in King County and Seattle (1996 Tons)

	Residential			Commercial			Self-Haul	CDL	TOTAL			
	disposed	recycled curbside	recycled drop-off or events	disposed	franchise/contract recycled	other commercial recycled	disposed	disposed	disposed	recycled	generated	% recycled
King County	80,700	83,800	2,400	72,500	6,100	3,600	29,600	2,000	184,800	95,900	280,700	34%
food waste	56,300	-	-	55,900	-	3,600	7,900	100	120,200	3,600	123,800	
yard waste	12,600	83,800	2,400	14,600	6,100	-	20,100	1,900	49,200	92,300	141,500	65%
compostable paper	-	-	-	-	-	-	-	-	-	-	-	
animal waste	11,800	-	-	2,000	-	-	1,600	-	15,400	-	15,400	
Seattle	49,100	59,800	13,100	61,600	-	9,100	5,200	3,000	118,900	82,000	200,900	41%
food waste	29,000	2,400	-	42,900	-	5,300	1,400	200	73,500	7,700	81,200	
yard waste	5,100	57,400	13,100	5,200	-	3,800	3,600	2,700	16,600	74,300	90,900	82%
compostable paper	15,000	-	-	13,500	-	-	300	-	28,800	-	28,800	
animal waste	-	-	-	-	-	-	-	-	-	-	-	
TOTAL	129,800	143,600	15,500	134,200	6,100	12,700	34,800	4,900	303,700	177,900	481,600	37%
food waste	85,300	2,400	-	98,800	-	8,900	9,200	300	193,600	11,300	204,900	
yard waste	17,700	141,200	15,500	19,800	6,100	3,800	23,700	4,600	65,800	166,600	232,400	72%
compostable paper	15,000	-	-	13,500	-	-	300	-	28,800	-	28,800	
animal waste	11,800	-	-	2,000	-	-	1,600	-	15,400	-	15,400	

All quantities of animal waste here are 'reported' quantities (see chapter 4 for adjusted estimates of total generation). "Animal waste" for Seattle is actually the broader category of "animal by-products," which consists overwhelmingly of animal feces.

"Compostable paper" is not included as a category in King County disposal or recycling data. It represents about 7% of Seattle municipal solid waste -- for King County, this share would account for approximately 54,600 tons.

**Appendix E: Estimated Paper Disposal and Recycling
in King County and Seattle (1996 Tons)**

	Residential				Commercial				Self-Haul	CDL	TOTAL		
	disposed	recycled curbside	recycled drop-off or events	TOTAL recycled	disposed	franchise/contract recycled	other commercial recycled	TOTAL recycled	disposed	disposed	disposed	recycled	generated
King County	62,700	65,900	3,500	69,400	83,100	42,500	188,100	230,600	16,200	4,400	166,400	300,000	466,400
newspaper	12,500	31,500	1,000	32,500	10,900	8,200	32,900	41,100	2,800	200	26,400	73,600	100,000
cardboard & kraft	14,200	6,300	800	7,100	25,600	18,300	93,600	111,900	6,000	3,300	49,100	119,000	168,100
high grade/computer	3,000	-	-	-	8,600	-	23,300	23,300	600	100	12,300	23,300	35,600
mixed waste/office	33,000	28,100	1,700	29,800	38,000	16,000	38,300	54,300	6,800	800	78,600	84,100	162,700
Seattle	34,700	61,400	1,000	62,400	47,800	-	156,700	156,700	6,200	5,200	93,900	219,100	313,000
newspaper	9,000	28,000	100	28,100	5,200	-	13,600	13,600	400	500	15,100	41,700	56,800
cardboard & kraft	8,900	12,400	400	12,800	16,400	-	97,600	97,600	2,600	3,300	31,200	110,400	141,600
high grade/computer	900	800	-	800	4,000	-	14,000	14,000	200	300	5,400	14,800	20,200
mixed waste/office	15,900	20,200	500	20,700	22,200	-	31,500	31,500	3,000	1,100	42,200	52,200	94,400
TOTAL	97,400	127,300	4,500	131,800	130,900	42,500	344,800	387,300	22,400	9,600	260,300	519,100	779,400
newspaper	21,500	59,500	1,100	60,600	16,100	8,200	46,500	54,700	3,200	700	41,500	115,300	156,800
cardboard & kraft	23,100	18,700	1,200	19,900	42,000	18,300	191,200	209,500	8,600	6,600	80,300	229,400	309,700
high grade/computer	3,900	800	-	800	12,600	-	37,300	37,300	800	400	17,700	38,100	55,800
mixed waste/office	48,900	48,300	2,200	50,500	60,200	16,000	69,800	85,800	9,800	1,900	120,800	136,300	257,100

**Appendix E: Estimated Paper Disposal and Recycling
in King County and Seattle (1996 Tons)**

% recycled
64%
74%
71%
65%
52%
70%
73%
78%
73%
55%
67%
74%
74%
68%
53%

**Appendix F: Estimated Plastics Disposal and Recycling
in King County and Seattle (1996 Tons)**

	Residential			Commercial			Self-Haul	CDL	TOTAL			
	disposed	recycled curbside	recycled drop-off or events	disposed	franchise/ contract recycled	other commercial recycled	disposed	disposed	disposed	recycled	generated	% recycled
King County	18,400	1,000	-	30,800	300	2,900	4,100	1,300	54,600	4,200	58,800	7%
#1 bottles	1,200			700			300	-	2,200	-	2,200	
#2 bottles	1,900			1,100			500	200	3,700	-	3,700	
other rigids (#3-#7)	2,700			2,600			700	200	6,200	-	6,200	
film	12,600			26,400			2,600	900	42,500	-	42,500	
Seattle	10,200	900	-	14,900	700		800	2,000	27,900	1,600	29,500	5%
#1 bottles	500			300			-	-	800	-	800	
#2 bottles	500			300			-	200	1,000	-	1,000	
other rigids (#3-#7)	2,500			2,300			200	100	5,100	-	5,100	
film	6,700			12,000			600	1,700	21,000	-	21,000	
TOTAL	28,600	1,900	-	45,700	1,000	2,900	4,900	3,300	82,500	5,800	88,300	7%
#1 bottles	1,700	-	-	1,000	-	-	300	-	3,000	-	3,000	
#2 bottles	2,400	-	-	1,400	-	-	500	400	4,700	-	4,700	
other rigids (#3-#7)	5,200	-	-	4,900	-	-	900	300	11,300	-	11,300	
film	19,300	-	-	38,400	-	-	3,200	2,600	63,500	-	63,500	

Recycling rate, excluding film from disposal, is **26%**.

Recycling rate, excluding film from disposal, is **19%**.

Overall recycling rate, excluding film from disposal, is **23%**.

Recycling data in these columns is available for all plastics only, and includes primarily #1 and #2 bottles.

**Appendix G: Estimated Textile Recycling and Disposal
in King County and Seattle (1996 tons)**

	Residential				Commercial				Self-haul	CDL	TOTAL		
	disposed	recycled curbside	recycled drop-off	TOTAL recycled	disposed	recycled curbside	recycled brokered	TOTAL recycled	disposed	disposed	disposed	recycled	generated
King County	6,600	-	-	-	4,600	-	-	-	2,100		13,300	-	13,300
Seattle	3,000	-	-	-	3,000	-	-	-	-		6,000	-	6,000
TOTAL	9,600	-	-	-	7,600	-	-	-	2,100		19,300	-	19,300

**Appendix H: Estimated Wood Disposal and Recycling
in King County and Seattle (1996 Tons)**

	Residential				Commercial				Self-Haul	CDL	TOTAL			
	disposed	recycled curbside	recycled drop-off or events	TOTAL recycled	disposed	franchise/contract recycled	other commercial recycled	TOTAL recycled	disposed	disposed	disposed	recycled	generated	% recycled
King County	14,000	-	-	-	20,600	-	108,600	108,600	31,300	54,000	120,000	108,600	228,600	48%
clean wood	4,200	-	-	-	11,200	-	108,600	108,600	11,900	33,600	60,900	108,600	169,500	64%
pallets & crates	-	-	-	-	-	-	-	-	-	2,900	2,900	-	2,900	
dimension lumber	4,200	-	-	-	11,200	-	-	-	11,900	21,500	48,700	-	48,700	
panelboard	-	-	-	-	-	-	-	-	-	9,300	9,300	-	9,300	
remanufacturing scrap	-	-	-	-	-	-	-	-	-	-	-	-	-	
other untreated	-	-	-	-	-	-	-	-	-	-	-	-	-	
treated, coated or contaminated	5,400	-	-	-	7,800	-	-	-	14,400	14,600	42,300	-	42,300	0%
roofing/siding	700	-	-	-	-	-	-	-	1,800	5,700	8,200	-	8,200	0%
large yard waste	3,800	-	-	-	1,600	-	-	-	3,300	-	8,600	-	8,600	0%
Seattle	3,500	-	900	900	15,000	-	1,300	1,300	24,100	44,100	86,600	2,200	88,900	2%
clean wood	1,900	-	900	900	10,200	-	1,300	1,300	12,800	20,700	45,700	2,200	47,900	5%
pallets & crates	300	-	-	-	6,300	-	-	-	900	3,800	11,300	-	11,300	
dimension lumber	-	-	-	-	3,200	-	-	-	8,900	12,000	24,100	-	24,100	
panelboard	-	-	-	-	-	-	-	-	-	4,900	4,900	-	4,900	
remanufacturing scrap	-	-	-	-	-	-	-	-	-	-	-	-	-	
other untreated	1,600	-	-	-	700	-	-	-	3,000	-	5,300	-	5,300	
treated, coated or contaminated	1,600	-	-	-	4,700	-	-	-	11,300	17,700	35,300	-	35,300	0%
roofing/siding	-	-	-	-	-	-	-	-	-	3,100	3,100	-	3,100	0%
large yard waste	-	-	-	-	-	-	-	-	2,500	2,500	-	-	2,500	0%
TOTAL	17,500	-	900	900	35,600	-	109,900	109,900	55,400	98,100	206,600	110,900	317,500	35%
clean wood	6,100	-	900	900	21,500	-	109,900	109,900	24,700	54,400	106,600	110,900	217,500	51%
pallets & crates	300	-	-	-	6,300	-	-	-	900	6,700	14,200	-	14,200	
dimension lumber	4,200	-	-	-	14,500	-	-	-	20,800	33,400	72,900	-	72,900	
panelboard	-	-	-	-	-	-	-	-	-	14,200	14,200	-	14,200	
remanufacturing scrap	-	-	-	-	-	-	-	-	-	-	-	-	-	
other untreated	1,600	-	-	-	700	-	-	-	3,000	-	5,300	-	5,300	
treated, coated or contaminated	7,000	-	-	-	12,500	-	-	-	25,600	32,300	77,600	-	77,600	0%
roofing/siding	700	-	-	-	-	-	-	-	1,800	8,800	11,300	-	11,300	0%
large yard waste	3,800	-	-	-	1,600	-	-	-	3,300	2,500	11,200	-	11,200	0%

clean wood recycling = 64%

NOTE: Recycling amounts are reported only as "wood" or "clean wood," without further detail.

This column includes construction and demolition primarily, as well as some landclearing data.

clean wood recycling = 51%

clean wood recycling = 51%

King County Wood Waste Generation

	Annual Generation	Monthly Generation	Annual Recycling	Monthly Recycling	Annual Disposal	Recovery Rate
Urban Wood						
Clean Urban Wood	203,500	16,958	97,750	8,146	105,750	48.0%
Mixed Urban Wood	111,400	9,283	10,550	879	100,850	9.5%
Subtotals	314,900	26,242	108,300	9,025	206,600	34.4%
Green Wood						
Landclearing & Brush	345,000	28,750	234,500	19,542	110,500	68.0%
Total Wood Waste	659,900		342,800			51.9%

Values above stem from reported data only.

These data include estimates from further research.

Appendix H (continued)

Quantitative Methodology Detail: Wood Waste Generation Estimates

1. First, using 1996 as a base year, we acquired reported estimates from King County and the City of Seattle on tons disposed of and recycled.
2. Input collected at the August 3, 1998 focus group of leading area firms active in the collection and recycling of King County generated wood waste was corrected for variations in unit types and time periods, and then aggregated by wood waste type.
3. Telephone and in-person interviews were conducted with processors to address aggregate quantity estimates for generation, recycling and disposal volumes by wood waste type.
4. The following principal adjustments were made to the data reported by King County and City of Seattle:
 - Green wood category was added. Recycled quantities were first estimated, based on current throughput estimates, processing capacity and utilization estimates, and estimated fractions of supply generated within King County.
 - The clean wood recycled quantity estimate was adjusted downward by 10 percent and re-allocated to green wood recycled, based on the assumption that unclear reporting caused some green wood to be counted as clean wood.
 - The mixed urban wood generation quantity estimate was increased by 10 percent to allow for demolition wood waste handled through alternative commercial channels and not counted in C&D composition counts.
 - The mixed urban wood recycled quantity estimate was established based on an estimate of 20 percent of the quantity of material handled by a processor in Pierce County having been generated within King County.
 - Green wood generation estimate was established based recycled quantity estimates, plus estimates from area processors as to quantities that are still burned or otherwise left on-site. Discussions with PSAPCA representatives confirmed order of magnitude estimates for burning activity outside urban burn ban zones. The corresponding disposed quantity estimate for green wood, thereby includes material burned on-site, and does not necessarily end up in landfills.

Appendix I



ARROW METALS CORPORATION

July 29, 1998

To Our Valued Customers:

During the past eight months, our industry has seen more upheaval in scrap metal prices than in the last 10 years combined. These are unsettling times for our customers and for us here at Arrow Metals.

We want to take this opportunity to address some of the more frequently asked questions asked of us recently. While we certainly do not have all the answers, we do follow markets pretty closely and have spoken to a wide variety of important players in this industry.

Q In a booming economy, why are iron and steel scrap prices so depressed? Shouldn't they be a lot higher, with all the cars, buildings and appliances being produced?

A The major purchasers of this scrap off of the West Coast of the United States, particularly South Korea, Indonesia and Malaysia are in a deep economic crisis. Today, their currencies are worth a fraction of their values one year ago. This makes American scrap prices too high for these countries. They simply cannot afford to buy at the old levels. (See figures attached.)
The net result is that these countries are buying a lot less here, and what they do buy is sold to them at much lower price levels.

Q Yes, but what about our domestic steel mills right here at home? Don't they need scrap for their furnaces?

A Yes, they do, but scrap is a commodity, just like grain and pork bellies, and prices are set on world markets. With the Asian countries buying so much less from us, all this scrap has to find a home here in the USA. In short, there are more sellers than buyers right now, and the old rule of "supply and demand" sets the current lower prices.

Q How long will these lower prices be around? Should we not see some upswing pretty soon?

A Unfortunately, we have no answer for this question. It took a long time for these countries to get into the crisis they are now in, and there seems to be no "quick fix" to help them out of this crisis. Generally, experts seem to be predicting that the first true



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signs of a slow recovery *might* be seen in about one year. Of course we hope that we will see some improvement a lot sooner than that.

Q What about the much lower prices for nonferrous metals such as copper and aluminum?

A Here too, markets are depressed to their lowest level in years. Vastly increased production for both metals, combined with the economic crisis in Japan (now in its third year), made these prices tumble to their lowest level in 12 years. The Japanese are now actually offering aluminum scrap for *export* from their country.

Q When will these prices level off? Are they getting lower still?

A We certainly do not have a crystal ball, and neither do the so-called experts in this industry. However, the general consensus seems to be that prices for nonferrous metals appear to be leveling off somewhat at this time, while iron and steel prices have not hit bottom yet, and are expected to fall further in August.

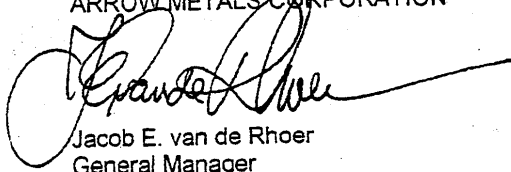
Arrow Metals Corporation will continue to serve its customers with a clean yard, friendly service and competitive prices, as well as reliable container service for its container accounts.

While we are not in control of world markets, we are in control of our continued efforts to make us a reliable, convenient facility to recycle your scrap metals for many years to come.

We appreciate your loyalty and continued support, which we never take for granted. Please contact us with any questions or suggestions you may have.

Sincerely,

ARROW METALS CORPORATION



Jacob E. van de Rhoer
General Manager

Appendix J: Western US and Canadian Recovered Paper Mills (Source: Franklin Associates)

United States

Name	Location	State	Product Description
Ponderosa Paper Products, Inc.	Flagstaff	AZ	Tissue & Towel
Stone Container	Snowflake	AZ	Newsprint
Stone Container	Snowflake	AZ	Linerboard
B.J. Fibers	Santa Ana	CA	Market Deinked Pulp
California Paperboard	Santa Clara	CA	Boxboard, Medium
Chinet	Sacramento	CA	Molded Pulp
Domtar Gypsum	San Leandro	CA	Gypsum Board Liner
Fontana Paper Mills	Fontana	CA	Roofing Feit, Medium
Galylord Container	Antioch	CA	Medium, Linerboard
Inland Container Corp.	Newark	CA	Medium, Linerboard
Inland Container Corp.	Ontario	CA	Linerboard, Medium
Jefferson Smurfit/CCA	Santa Clara	CA	Boxboard, Medium
Jefferson Smurfit/CCA	Vernon	CA	Boxboard, Medium, Linerboard, Tube Stock
Kimberly Clark	Fullerton	CA	Tissue and Towel
L.A. Paper Box & Board Mills	Los Angeles	CA	Boxboard
Leatherback Industries	Hollister	CA	Roofing Feit
Lunday-Thagard Roofing Co.	South Gate	CA	Roofing Feit
Newark Pacific Paperboard	City of Commerce	CA	Chipboard, Boxboard, Gypsum Liner
Newark Sierra Paperboard	Stockton	CA	Boxboard
PABCO Paper	Vermon	CA	Roofing
Packaging Co. of California	City of Industry	CA	Molded Pulp Egg Trays
Packaging Co. of California	Red Bluff	CA	Molded Pulp
Paper-Pack Products	La Verne	CA	Hospital Pads, Tissue
Sierra Tissue	Pomona	CA	Wadding, Tissue
Simpson Paper Co.	Anderson	CA	Coated and Uncoated Freesheet
Simpson Paper Co.	Ripon	CA	Uncoated Freesheet
Smurfit Newsprint	Pomona	CA	Newsprint
Sonoco Products Co.	City of Industry	CA	Chipboard
Specialty Paper Mills	Santa Fe Spring	CA	Medium, Linerboard, Chipboard
USG Industries	South Gate	CA	Gypsum Board Liner
Willamette Industries	Oxnard	CA	Medium
Republic Paperboard	Commerce City	CO	Boxboard, Linerboard, Gypsum Liner
Potlatch Corp.	Lewiston	ID	Bleached Board
Stone Container	Missoula	MT	Linerboard
Leatherback Industries	Albuquerque	NM	Roofing Feit
McKiniey Paper	Prewitt	NM	Linerboard
Armstrong Industries	St Helens	OR	Ceiling Tiles
Evanite Fiber Corp.	Covallis	OR	Impreganated Papers
FCR	Clackamas	OR	Insulation
Georgia-Pacific	Toledo	OR	Linerboard, Medium, Kraft Paper
International Paper	Gardiner	OR	Linerboard, Medium
James River	Clatskanie	OR	Tissue & Towel
James River	Halsey	OR	Tissue & Towel
Simpson Paper Co.	Weat Linn	OR	Coated Freesheet
Smurfit Newsprint	Newberg	OR	Newsprint
Smurfit Newsprint	Oregon City	OR	Newsprint
Weyerhaeuser Paper Co.	North Bend	OR	Medium
Weyerhaeuser Paper Co.	Springfield	OR	Linerboard

Appendix J: Western US and Canadian Recovered Paper Mills (Source: Franklin Associates)

Name	Location	State	Product Description
Willamette Industries	Albany	OR	Linerboard, Kraft Paper
Abitibi Consolidated	Steilacoom	WA	Newsprint
Boise Cascade Corp.	Vancouver	WA	Coated & Uncoated Freesheet
Daishowa America	Port Angeles	WA	Directory Paper
Bosie Casdade Corp.	Wallula	WA	Meduim, Uncoated Freesheet
Grays Harbor Paper	Grays Harbor	WA	
Inland Empire Paper Company	Spokane	WA	Newsprint
James River	Camas	WA	Uncoated Feesheet, Tissue
Jefferson Smurfit/CCA	Tacoma	WA	Chipboard, Core Stock, Linerboard
Longview Fibre Company	Longview	WA	Kraft Paper, Linerboard, Medium
North Pacific Paper	Longview	WA	Newsprint
Ponderay Paper	Usk	WA	Newsprint
Port Townsend Paper Co.	Port Townsend	WA	Linerboard, Kraft Paper
Simpson Tacoma Kraft	Tacoma	WA	Linerboard, Kraft Paper, Pulp
Sonoco Products Co.	Sumner	WA	Chipboard
The Chinnet Company	Wenatchee	WA	Molded Pulp
Weyerhaeuser Paper Co.	Longview	WA	Bleached Board
Weyerhaeuser Paper Co.	Longview	WA	Medium

Canada

Alberta Newsprint	Whitecourt	ALB	Newsprint
IKO Industries Ltd.	Calgary	ALB	Building Papers
Crown Packaging	Burnaby	BC	Building Papers
Finlay Forest Industries	Mackenzie	BC	Newsprint
Fletcher Challenge	Campbell	BC	Newsprint, Kraft Paper, Linerboard, Medium
Island Paper Mills	New Westminster	BC	Recycled Coated and Uncoated Freesheet
MacMillan Bloedel	Port Alberni	BC	Newsprint
Newstech Recycling	New Westminster	BC	Market Deinked Pulp

Appendix K: Table of Wood Recycling Facilities In or Near King County

Facility	Type of Activity			Types of Wood Handled		
	Receiving	Sorting	Process	Clean Urban	Mixed Urban	L/C Debris
Cedar Grove Compost Maple Valley	X	X	X	X		X
City of Seattle - North Transfer Station Seattle	X			X		
City of Seattle - South Transfer Station Seattle	X			X		
King Co. Enumclaw Transfer Station Enumclaw	X			X		X
Rabanco - Black River Renton	X			X		
Rabanco - 3rd & Lander Seattle	X			X		
Waste Management - Eastmont Seattle	X	X		X		
RST Disposal - C&D Transfer Station Auburn	X	X		X	X	
Northwest Wood & Fibre Recovery Auburn	X	X	X	X		
Rainier Wood Recyclers Kent	X		X	X	X	X
Rainer Wood Recyclers Fall City	X		X			X
Goodnight Constr. / Sunset Materials Maple Valley	X		X			X
Lloyds Enterprises Federal Way	X		X			X
Shear Construction Buckley	X		X			X
FACILITIES OUTSIDE KING COUNTY						
Fife Sand & Gravel Fife / PIERCE COUNTY	X			X		
Goodnight Construction Monroe / SNOHOMISH COUNTY	X		X			X
Pacific Topsoils Bothell / SNOHOMISH COUNTY	X		X			X
Phoenix Organic Products Arlington / SNOHOMISH COUNTY	X	X	X	X		X
Recovery One Tacoma / PIERCE COUNTY	X	X	X	X	X	
Wolford Construction Woodinville / SNOHOMISH COUNTY	X		X	X		X
Weyerhaeuser Co. Everett / SNOHOMISH COUNTY	X			X		