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DEPARTMENT OF
PUBLIC WORKS

OFFICE OF THE DIRECTOR

CITY OF SACRAMENTO
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May 21, 1991

Budget and Finance Committee/Transportation
and Community Development Committee
Sacramento, California

HONORABLE MEMBERS IN SESSION;

SUBJECT: INFORMATIONAL REPORT REGARDING THE ECONOMICS OF RESIDENTIAL RECYCLING

SUMMARY:

At the request of Councilmember Kim Mueller, the Office of Economic Development, within the Planning and Development Department, conducted a study of the economics of residential recycling in Sacramento. A detailed report presenting the information gathered and analyzed by the Economic Development staff titled "*The Economics of Recycling: Sacramento, A Case Study*" is presented for Committee information.

BACKGROUND:

Subsequent to the City Council's decision to implement a residential curbside recycling program, Councilmember Kim Mueller requested that staff examine the economic benefits of utilizing non-profit agencies to process and/or market recyclable materials. The Public Works Department forwarded the request to the Office of Economic Development, as their staff possessed the necessary qualifications to evaluate economic issues.

In researching the question of non-profit involvement in the recycling effort, Economic Development staff determined that it was not possible to separate that question from the overall economic picture. Therefore, they prepared an in-depth case study of the economic issues involved in establishing a recycling program, from processing methods to markets. The report concludes that revenues from collected materials will not cover the costs of operating the residential curbside program. However, the report also acknowledges that social benefits, such as avoiding future clean-up costs or increased disposal fees, outweigh the revenue gap.

Once the Economic Development staff had prepared a draft, the report was distributed to various City departments for review and comment. The following staff members reviewed the draft and contributed suggestions:

David Affleck, Deputy City Treasurer
Roberta Larson, Administrative Services Officer
Betty Masuoka, Director of Finance
Lupe Marnach, Senior Employee Relations Representative
David Pelsler, Solid Waste Division Manager
Robbin Randolph, Assistant Director of General Services
Sabrina Thompson, Deputy City Attorney
Reginald Young, Deputy Director of Public Works

The report is now presented for Committee information.

FINANCIAL:

There is no financial impact as a result of this report.

MBE/WBE:

There are no goods or services being purchased.

POLICY CONSIDERATIONS:

This report is presented for information only. Should the Committee decide to pursue any of the alternatives outlined in the report, the policy considerations would be addressed at that time.

RECOMMENDATION:

This report is presented for Committee information.

Respectfully submitted,

Robert P. Thomas
Acting Director of Planning and Development

Respectfully submitted,

Melvin H. Johnson
Melvin H. Johnson
Director of Public Works

Approved for Committee Information:



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May 21, 1991
All Districts

**THE ECONOMICS OF RECYCLING
SACRAMENTO: A CASE STUDY**

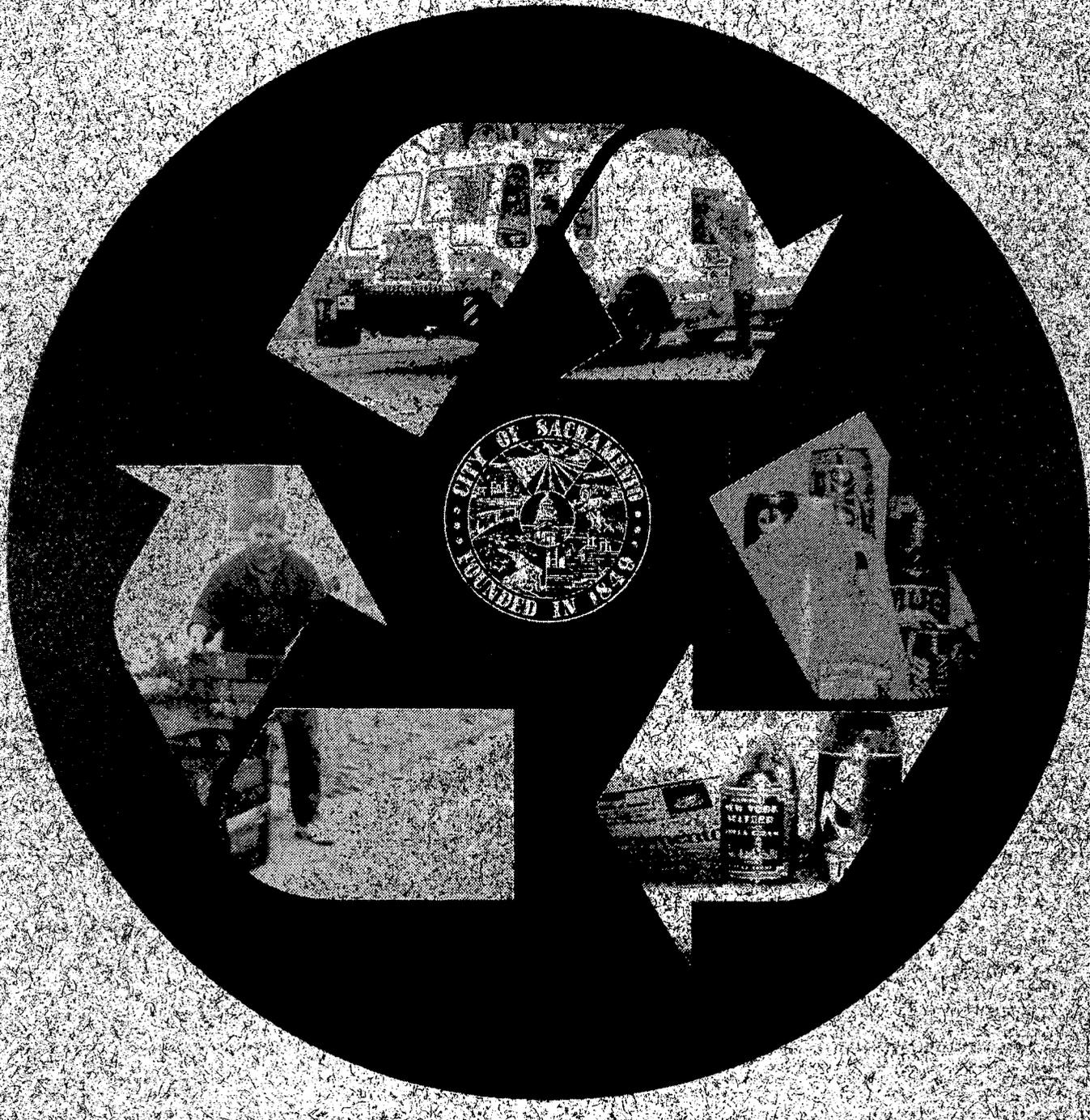
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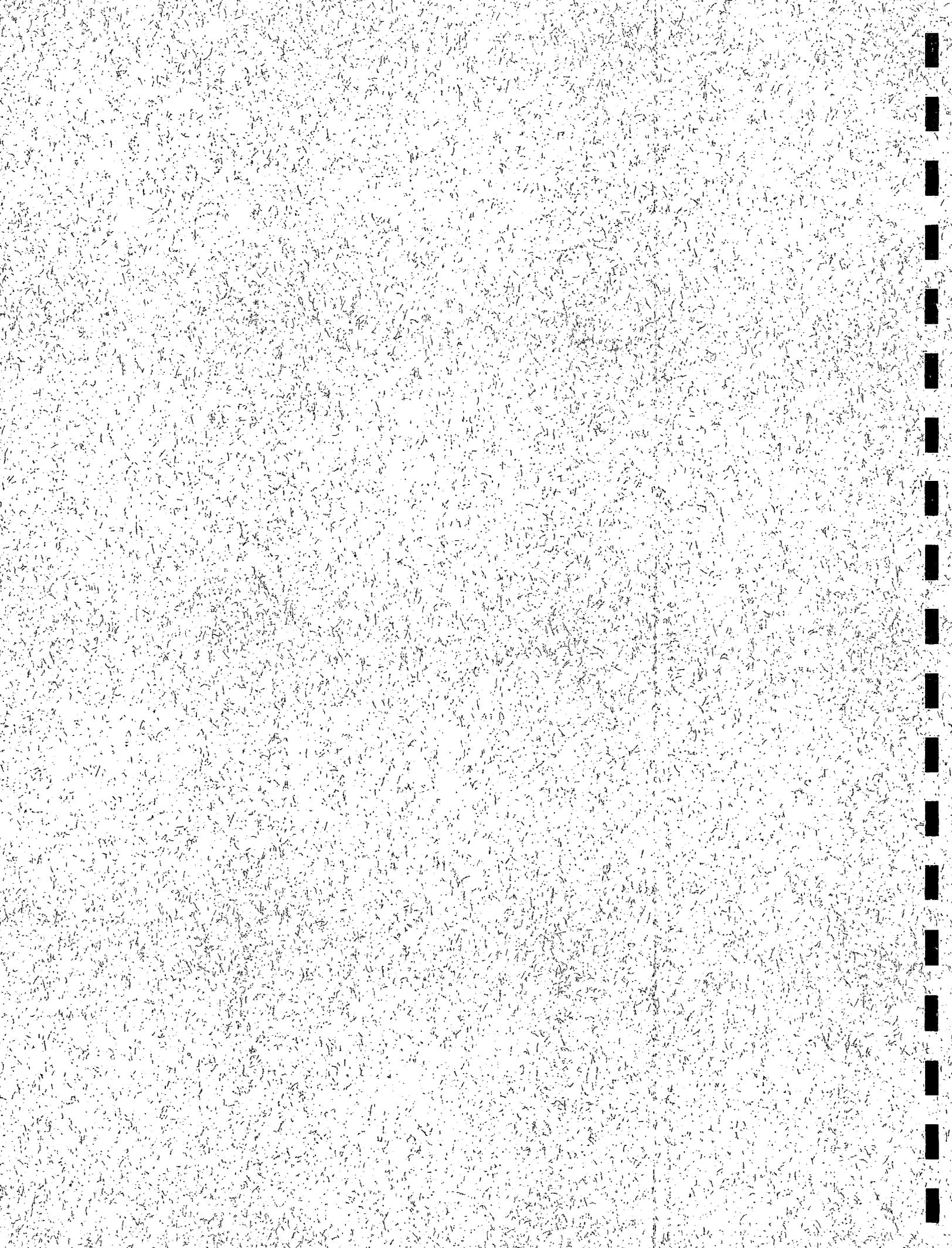
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THE ECONOMICS OF RECYCLING

SACRAMENTO: A CASE STUDY



OFFICE OF ECONOMIC DEVELOPMENT
DEPARTMENT OF PLANNING AND DEVELOPMENT
CITY OF SACRAMENTO, CALIFORNIA



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THE ECONOMICS OF RECYCLING

SACRAMENTO: A CASE STUDY

OFFICE OF ECONOMIC DEVELOPMENT
DEPARTMENT OF
PLANNING AND DEVELOPMENT
CITY OF SACRAMENTO
JANUARY 1991



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ACKNOWLEDGMENTS

The Office of Economic Development thanks the following people and organizations for their assistance with this report.

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EXECUTIVE SUMMARY

In March of 1990, Sacramento's City Council approved a resolution for residential curbside recycling in an effort to meet state legislation and to diminish the waste going into Sacramento's landfill. Many issues related to this effort were debated by the Council, including the utilization of a commingled system. Beyond the discussion of the collection process, Councilmembers wanted to know further information on economic issues related to recycling. Questions were posed about the marketplace related to purchases by reclaimers, values of the recyclables and how to attract reclaimers, and what, if any, would be the impact of such a program upon nonprofit organizations currently collecting recyclables.

Sacramento, like other communities across the country, have been learning that the best way for implementing a curbside recycling program is to build an economic strategy to support the recycling effort. However, State Legislation (AB939) took this option away from the City of Sacramento and required almost immediate action.

The research staff who worked on this report concluded that recycling and source reduction of solid waste is one of the most dynamic opportunities facing municipalities and counties today. Government officials are hard pressed to deal with everchanging conditions. Legislative changes multiply while the redemption values for the recyclable materials decrease. Yet the limitations on recycling have not diminished its current popularity and importance. This paper proposes options on processing, reclamation and on market development which should be investigated further by the City in its residential curbside recycling program.

MARKETS FOR RECYCLABLE MATERIALS

The key to successful recycling has been to identify the waste stream from the community and then to identify the markets which can redeem the material before implementing the program. The City's Public Works staff estimates that the citywide recycling effort will reclaim approximately 25 tons daily from the residential recycling program. Plastics such as PET and HDPE, aluminum cans, steel cans, glass, printing paper, newsprint and cardboard could be recycled in the program. Though some of

these markets are in their infancy, the industries are growing quickly. It has been found that the successful programs have obtained secure, long-term contracts with buyers. City staff should investigate this opportunity further, especially with reprocessors and manufacturers of PET and HDPE who are looking to site in California. Another option is the formulation of long-term contracts with reclaimers to ensure stable prices from the consistent supply.

PROCESSING

Any type of collection program will require processing to prepare the recyclables for the market.

In the examination of other recycling programs in California cities, it was determined that many contract for the functions of processing and marketing to private companies. The City of Burbank staff suggests that the contractor's expertise in brokering the materials is a very important feature, for without it the program will not be successful. To accomplish this effort, cities across the country are building Material Recovery Facilities (MRFs). A MRF is a facility where separation, processing and marketing of the recyclables occurs. The systems used at MRFs increase the quality of the collected materials for better resale value. Thus, by providing consistent high-quality materials to its markets, the City can develop stable, long-term ties to the buyers. Whether the facility is publicly owned or privately owned, it will add to the economic base of the area by creating jobs and increasing the tax base of the surrounding property will help to diversify the local economy.

From the investigation, the City might consider building a MRF which will accommodate the needs of both the City and surrounding areas. A regional facility serving these needs can take advantage of the economy of scale and decrease the costs per unit of material processed.

The City's Public Works Department, Solid Waste Division staff suggests that the City seek a qualified marketing specialist to perform those activities necessary to selling the recyclable materials because of the complexity and scope of Sacramento's marketing needs. This option is supported by research staff.

Local nonprofit organizations involved in recycling must not be forgotten when the City tries to reach its recycling goals. The groups will be able to fill niches which the City may

not participate in with its large-scale recycling project. The City should take advantage of the opportunities to give consideration and assistance to nonprofit organizations in order to promote community involvement. Research staff believes that nonprofit organizations and their donators should have the opportunity to take their recyclables to the MRF, thus crediting the values to their accounts. The City will then be able to record the type of material being recycled, along with its tonnage and location of collection. The opportunity should also exist for nonprofit organizations and individual citizens to use the MRF as a drop-off center.

RECLAMATION AND END USE

Throughout this research effort, City staff pondered the question of how to attract reclaimers. For instance, if Sacramento processed over 100 tons per day of recyclables, does this quantity, with the subsequent quality of the processed material, create a favorable market for reclaimers?

In setting up the research methodology, staff found that due to the infancy of this industry and the lack of ventures by other local governments, the state legislation has caught local officials off guard with AB939. This, then, has caused many to do primary research in an effort to understand the options available and how to develop opportunities not currently available in the marketplace.

Certainly it would seem logical from the standpoint of size alone that Sacramento, being one of the largest metropolitan areas on the west coast, would support reclaimers. However, it has been found that in order to attract reclaimers, the sales of the recyclable products they produce must reach specific benchmarks in the region or state before a manufacturing facility is sited.

MARKET DEVELOPMENT STRATEGY

Research staff has outlined a four-point approach called the "Market Development Strategy." This strategy involves the following categories:

- ▶ Procurement
- ▶ Attraction and Expansion
- ▶ Contingency Plans
- ▶ Promoting Legislation

These four points were borne out of the interviews and research done by staff in their investigation to find out what efforts have been successful and which options are appropriate to enhance the City's chances of locating recycling manufacturers.

Procurement

Procurement practices by the City and other government agencies can instigate the development of markets by stimulating a demand for recycled products. The City of Sacramento's procurement practices can set an example for private sector firms and other public agencies in their efforts to promote recycling-conscious purchasing. The City of Sacramento currently has a procurement policy which gives a five percent preference to vendors using recycled products and targeting the content of recycled materials in the products. The following are options which can be used to promote the use of recyclables.

From the public sector side:

- ▶ Prepare a guide to purchasing and using recycled products for City departments including a list of available products, how to obtain them, how to minimize costs, and how the departments can adapt their operations and equipment to use recycled paper and other recycled/recyclable products.
- ▶ Continue to identify recyclable items that can replace nonrecyclable materials and products for the City's General Services Department buyers to potentially use in future purchases.
- ▶ Enable City's General Services Department to pay more for materials and products with the highest percentages of recyclable content.
- ▶ Ensure that specifications for bids do not discriminate against recyclable or recycled products.
- ▶ Require a graduated increase in the minimum content regarding recycled materials in city contracts, i.e. glassphalt.
- ▶ Investigate the feasibility of using recycled paper for City grants, contracts, and other printed agreements.

- ▶ Explore the availability of regional buying pools with other local governments and industries and recommend the creation of such elements for cost savings in the purchase of particular recycled materials and products.
- ▶ Prepare standards which require City and Sacramento Housing and Redevelopment Agency construction projects to have a minimum percentage of recycled materials utilized.

These options involve promotional activities regarding private sector participation:

- ▶ Promote the City's insight on purchasing recyclable materials and products to local businesses.
- ▶ Prepare a model procurement policy regarding recycling for use by local businesses and promote its use through local chambers of commerce, i.e. Metropolitan, Black, Hispanic, Filipino.
- ▶ Prepare a guide to purchasing and using recycled products for private firms.
- ▶ Provide City Council recognition for those that do recycle.

Examples of legislation promoting procurement of recycled products are AB4, AB1306 and SB2195. These acts encourage the University of California to purchase recycled paper products, the Department of Transportation to use recycled materials in paving roads, and the State of California to purchase compost, recycled plastics and retreaded tires (Appendix A). These efforts should help increase the sales of recyclable products in Sacramento, and illustrate an environment which is looking for business and industry involved in recycling.

Attraction and Expansion Activities

This section entails the retention and attraction of businesses involved in the manufacturing of products from recycled materials. Sacramento, like other California cities, is just beginning to look at attracting this type of industry. The Institute for Local Self Reliance estimates that reuse of recycled materials where they are collected could produce 57 new businesses, 1500 new jobs and add over \$280 million to the local economy in a city of 1,000,000. Given this, the importance of this industry is certainly

evident. Secondly, this is a new industry creating new jobs for Sacramentans. Therefore, as part of the effort to retain and attract these types of manufacturers, the Office of Economic Development has outlined the following options:

- ▶ Have staff from the Department of Planning and Development earmark appropriate zoning for these industries to locate (M-2 zoning).
- ▶ Formulate a Response Team Program to assist in siting facilities (i.e., Office of Economic Development acts as permit liaison).
- ▶ Target specified companies which do or could utilize high volumes of recycled materials; request SACTO to assist with this effort while on their recruiting trips (when and where possible).
- ▶ Site manufacturers in the Florin-Perkins/Power Inn Enterprise Zone (state program, M-2 zoning), allowing companies to take advantage of the tax credits and incentives.
- ▶ Have City staff work to achieve the approval and certification of a State Recycling Development Market Zone in one of the industrial areas, such as the Florin-Perkins/Power Inn area, thus complementing efforts with the Enterprise Zone.

Contingency Plans

Contingency plans identify alternative markets, uses or processing options for materials whose market demand is weak or unstable.

- ▶ Identify materials where market demand is exceptionally weak, particularly where the loss of one market might compel the landfilling of these materials.
- ▶ Identify alternative uses for materials with weak markets, and identify any procurement policies, legislation, or economic development efforts needed to diversity markets for such materials.
- ▶ Establish trigger mechanisms to direct recycled materials to other uses once the value of materials falls below established standards.

- ▶ Explore potential coordination of the sale of recycled materials with other cities in order to leverage bargaining power with domestic and export mills or industries.
- ▶ Explore possibilities for short-term stockpiling of materials in case of weak markets.
- ▶ Pursue joint marketing agreements with cities and counties in the Sacramento area and set price benchmarks with them at which point the cities and counties may voluntarily withhold materials from buyers until prices increase beyond the benchmark.
- ▶ Seek standby contracts with buyers so that alternative markets can be utilized if the optimal market for a given material weakens.
- ▶ Formulate a work plan with local universities to develop a technology transfer program for new products and new markets for recycled materials, and explore the development of an award program.
- ▶ Create a program to encourage the private sector to develop new products, new markets and new uses for materials recycled in the city.

Promoting Legislation

Another strategy element aimed towards recycling is promoting local, state and federal legislation. Government can take a role which encourages the production of goods and services that increase economic activity yet discourage those that entail external diseconomies. In the case of air and water pollution, when a company or individual dumps waste into the water or air, other firms or individuals often must pay all or part of the cost(s) of putting the water or air back into a usable state. Thus, the disposal of these wastes entail external diseconomies. Unless the government prohibits certain kinds of pollution or enforces specific quality standards or charges polluters in accordance with the amount of waste they dump into the environment, there will be undesirable levels of pollution. Therefore, the City can take an active position in examining the following options in an effort to promote recycling and subsequent market development.

- ▶ Require public agencies which generate "confidential" wastepaper to use shredders so the paper can be recycled. Encourage private businesses to do the same.

- ▶ Support processing fees or deposits to be placed on recyclable materials which have no redemption values.
- ▶ Examine the use of federal and state fees or surtaxes on virgin materials used in production.
- ▶ Examine federal and state legislative action which would mitigate environmental damage from production using virgin material.
- ▶ Encourage the establishment of minimum content laws in the state.
- ▶ City policies should be continued to reduce the wastepaper stream from City departments through increased efforts.

THE BOTTOM LINE

Research by the Glass Packaging Institute found that the revenue from a typical city recycling program comes from material redemption. Sacramento's projected revenues from its source-separated curbside recycling program of 25 percent of the residential households will amount to \$40,000 a year. Avoided landfill costs are projected at \$58,000. The capital expenditures for the collection of the materials will total \$1.01 million. Ongoing expenditures associated with the curbside program will approximate \$510,000 a year. It is obvious the revenues from the collected materials will not cover the costs of the program. However, City Council direction to reduce diseconomies by looking beyond to the social costs, which will eventually realize themselves as clean-up costs or as increased fees for landfills sited outside of the urban area, will more than outweigh these costs. Cities like Austin, San José, and Charlotte have recycling programs that are not expected to be cost effective for ten years. Nevertheless, developing an economic strategy for the City's program will add new businesses, jobs and will have an overall positive impact on the Sacramento economy.

PREFACE

Economic Growth -- defined as an increase in total economic output per capita -- has been associated with an increase in the level of pollution. This is not surprising, since practically all the items that are produced must eventually be thrown away in one form or another. Thus, as output per capita goes up, the level of pollution is likely to go up as well. But it is important to recognize that pollution is not tied inextricably to national or local output. Although increases in national output in the past have been associated with increases in pollution, there is no reason why this correlation should continue.

To analyze the ramifications of this activity and find a solution, researchers must ask: How much does it cost to undertake an antipollution program? Who pays? Economists and ecologists have worked together on developing policies controlling pollution through emission fees, pollution rights, subsidization and direct regulations.

In recent years, some people have suggested that economic growth be curtailed in order to reduce pollution: Zero Economic Growth is their goal. Very few economists seem to favor such a policy. Opponents of Zero Economic Growth point out that more productive activity would be to help produce the equipment required to reduce pollution. With the proper public policies in place, society should be able to increase output without increasing pollution.

However, there are different kinds and sources of pollution, many of which are not well understood. One method of control that might be effective for curbing air or water contamination might not be suitable for reducing landfill wastes. Each class of pollution problems must be analyzed separately and a specific control system created for it.

What about technology as a solution? Many environmentalists, including ecologists and economists, view technology as the culprit, and believe the rate of technological change should be slowed. Certainly technological change has made more and stronger external diseconomies. Technological change also results in ecological changes, some of which are harmful. For example, detergents have contained phosphates which induced water pollution by causing heavy overgrowth of algae in our waterways.

However, technology is also a potential hero in the fight against pollution. The creation of new technology is a significant method of reducing the harmful side effects of pollution. Contrary to the views of some, pollution is not the product of some mindless march of technology. Pollution is due basically to economic, social and political choices. Technology will play a vital role in rescuing society from its own effluence. Society's most fundamental need, if it is to survive, is to create a value system that will allow for the assessment of the various parts of the environment. Through the wisdom of California's legislators, counties and municipalities are having to undertake this action, and rightly so. The average American is responsible for much more pollution than the average citizen of other countries. It was once estimated that the United States, with less than one-tenth of the world's population, produces about one-third of the world's waste discharged into the air and water. By the generators being required to bear the marginal costs of pollution, an efficient level of waste disposal can be obtained. This is why recycling is one step further in bringing the ecology back into balance. Finally, as philosopher Lewis Mumford once stated, "Any square mile of inhabited earth has more significance for man's future than all of the planets in the solar system."

INTRODUCTION: RESIDENTIAL CURBSIDE COLLECTION

In March of 1990, Sacramento's City Council approved a resolution calling for residential curbside recycling in an effort to meet State legislation and to diminish the waste going into Sacramento's landfill.

Many issues related to this effort were debated, including the utilization of a commingled system versus a source-separated system. Beyond the discussion of the collection process, councilmembers wanted to know further information on economic issues related to recycling. Questions were posed about the marketplace related to purchases by reclaimers, values of the recyclables, how Sacramento can attract reclaimers and end users, impacts on nonprofit organizations currently collecting recyclables, and how these groups can be integrated into the City's recycling program.

As a growing city, Sacramento is facing a shortage of space for landfills. California State Law AB939, Sections 41780-41794 (Appendix A) now requires cities to reduce their solid waste going into landfills by 25 percent by 1995, and 50 percent by the year 2000. In its Resolution 89-685 (Appendix A), the City of Sacramento has established goals of reducing its solid waste disposal 30 percent by 1992, 40 percent by 1995, and 70 percent by 1999. Composting will be able to divert a significant amount of waste and the 25 percent target will be met. However, the City may not be able to meet the 50 percent target, let alone the 70 percent target set by the City, unless it also recycles paper, glass, metals and plastic.

Approximately 260,000 tons of solid waste are disposed of in Sacramento's city landfill every year. By 1992 the landfill is expected to be full. The city's solid waste will then have to be taken to the county landfill and disposal costs will increase sharply. However, by diverting the materials which can be recycled from the waste stream, the City will be able to slow this action until a later date.

The following table reports the amount of recyclable materials in the city's and county's waste streams. The graph shows the composition of Sacramento's residential waste stream.

Sacramento's Residential Waste Stream

	City Waste Stream Tons Per Year, 1989	County Waste Stream Tons Per Year, 1988
Total	261,566	753,600
Residential*	130,349	250,797
Residential Recyclables**	29,720	117,569
Residential Recyclables at 31% recovery rate serving the entire city	9,213 (25 tons a day) (3.5% of total waste stream)	36,446 (100 tons a day) (4.8% of total waste stream)
Residential recyclables during pilot program of 24,000 households at 31% recovery rate	2,303 (6 tons a day)	Not Applicable

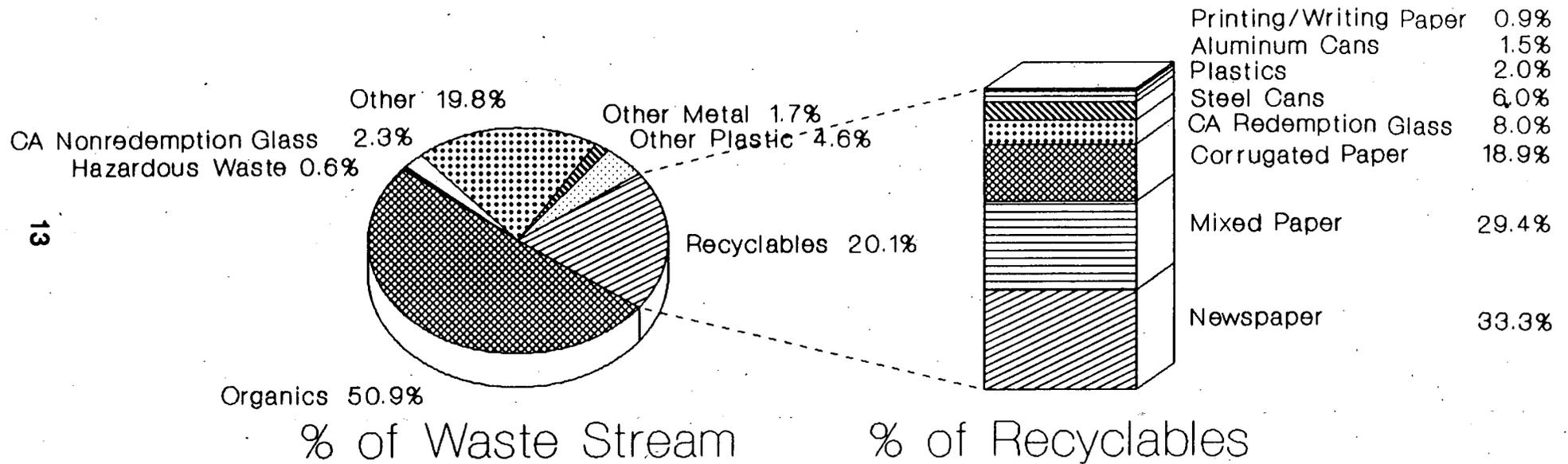
* Not including garden refuse

** Includes:

Newsprint	HDPE	Refillable glass
Old cardboard	PET	California redemption glass
Office paper	LDPE	California nonredemption glass
Mixed paper	Tin cans	Aluminum cans
Polystyrene	Tires	Bi-metal cans

Source: City of Sacramento, 1990

SACRAMENTO RESIDENTIAL WASTE STREAM COMPOSITION, APRIL 1989



13

Source: City of Sacramento

Sacramento has decided to use recycling as a way to divert recyclable materials from the residential waste stream. The City will service a curbside collection of recyclables for its residents. A pilot curbside recyclable program, serving 24,000 households in the City, will begin in 1991. As stated in the City of Sacramento Program Alternatives and Implementing Plan for Curbside Recycling, Sacramento is expecting its recovery rate to be 31 percent of the waste stream's recyclables during a weekly collection program.¹ "The proposed recycling program could be phased in to serve all City households in five years," indicates the Solid Waste Division.² The tonnages given in the previous table illustrate that 9,213 tons of recyclables, or 3.5 percent of the total waste stream can be potentially diverted when the entire city is receiving curbside pickup. Note that the figures are based on 1988 and 1989 waste volumes. In five years, when the curbside program is expected to be in full service, the recovery rate can be expected to have increased due to rising public awareness and participation in recycling.

Collection is only the beginning of the recycling process. The other three phases of recycling are:

Processing
Reclamation
End Use

To a considerable extent, environmental issues can be caused and solved by economics. Economics play an important role in any attempted solution. Questions arise over market factors leading towards the processing, reclamation and end use of recyclable materials:

- ▶ Should a Materials Recovery Facility be built in Sacramento to process the materials?
- ▶ Should a broker specialist be hired to market the collected materials?
- ▶ Can reprocessors and end-use manufacturers be attracted to Sacramento?

In addition to answering these questions, this paper will summarize the current markets of the most commonly recycled materials. A discussion is also presented on the opportunities the City can offer to nonprofit organizations in recycling. The objective of this study is to assist the City of Sacramento's Department of Public Works in taking actions for the market development of recyclable materials and recruitment of reclaimers and reprocessors to Sacramento through an economic development strategy. An examination of the Glossary will familiarize the reader with many of the terms used in this report and will be very useful in understanding the material.

METHODOLOGY

THE OPTIMAL AMOUNT OF POLLUTION

When asked how much pollution there should be in the Sacramento economy, many will respond, "None." Is that a correct answer? There is no correct answer relative to positive economics, because when we ask how much pollution there should be, we are entering the realm of normative economics. We are asking people to express their values. There is no way to scientifically disprove somebody's value system. The only way we can approach a discussion of the "correct" amount of pollution that can be allowed is to consider one basic fact: Pollution is ultimately tied up with the concept of scarcity.

Therefore, based on methodologies associated with economic problem solving, economists have found that the methods fall into three categories:

- ▶ Tradition - For much of recorded time, tradition was the basic principle of economic organization. Tradition is a host of procedures, inherited from the past, hallowed by religion and/or enforced by law, guided by the behavior of individuals and groups.
- ▶ Command - Commands are imposed by political authorities on society to determine how the economic question can be answered.
- ▶ Price System - Consumers are free to buy what they please, firms are free to sell what they please, and resource owners are free to use resources as they please.

POLLUTION IS A SCARCITY PROBLEM

What is at issue here? Is it that there is not enough pollution to go around? Certainly not. The scarce resource is the environment's capacity to absorb or disperse pollution so that the pollution will have no economic effect; that is, the environment's capacity to cleanse itself of pollution. And unless this is done through source reduction, it is evident our environment will never be able to accomplish this task. Therefore the resource which we ultimately rely on, our ecology, is scarce. Since pollution abatement and resource reduction require the use of this scarce resource, research staff looked at this issue of recycling as it relates to the pollution issue from a positive economic view.

According to classical economic theory, the operation of a free market assures that the price system will automatically allocate resources to their most socially efficient uses. But because of government intervention through price setting procedures, municipal disposal services, and tax breaks to virgin resources, the market changes. Therefore the Office of Economic Development has applied three analytical approaches to this examination: 1) social and private marginal costs; 2) benefit-cost; and 3) cost effectiveness.

Finally, in the Appendix there are three topics which are discussed that directly affect the solutions to the economic development side of Sacramento's Curbside Recycling Program. Industry's energy-cost savings are analyzed to describe how being environmentally conscious is also economical. Price elasticity is discussed in terms of volatility and its impact on the city in its efforts to have revenues equal expenditures from its recycling program. Also there is an insightful discussion on the social cost of pollution.

MARKETS FOR RECYCLABLE MATERIALS

What communities across the country have been learning about mandatory curbside recycling programs is that the best plan for implementing a program is to build an economic strategy that will help support the recycling program. The key is to first identify the markets for the materials before implementing the program. The trend of having to landfill collected recyclable materials is inevitable if there is no market for the materials. It's important to remember the diverted materials are not recycled until they have reached the marketplace.

The Glass Packaging Institute has found that only "about 45% of the average program's revenue comes from material sales."³ As illustrated in the report, City of Sacramento, Program Alternatives and Implementing Plan for Curbside Recycling, Sacramento's projected revenues from its source-separated curbside recycling program of 25 percent of the City's residential households are \$40,000 per year. Avoided landfill costs are projected at \$58,000. The capital expenditures for the collection of the materials total \$1.01 million. The ongoing expenditures of a source separation program is approximately \$510,000 a year.⁴ Obviously the revenues from the collected materials will not cover the costs of the program. It should be noted, however, that other cities -- Austin, Texas; San José, California; and Charlotte, North Carolina, to name a few -- have recycling programs that are not cost effective and are not anticipated to be so for the next ten years.⁵

Though curbside collection is currently not cost-recovery oriented, developing an economic strategy for the program will more than compensate. Neil Seldman from the Institute for Local Self Reliance describes how using the recycled materials where they are created could produce 57 new businesses, 1500 new jobs, and over \$280 million to a local economy in a city of one million people.⁶ Harriet Barlow of Blue Mountain Center in New York developed the following concept:

Garbage-Based Industrialization:

*Waste materials + unemployed labor + expertise + capital =
resource conservation and human productivity*

While finding markets for recyclable materials, the type of market, quality specifications and transportation factors should be considered. The willingness of a buyer to accept materials over an extended period of time provides a stability to the market. It is therefore important to obtain secure, long-term contracts with buyers. The buyer will either be a manufacturer or a broker. It is suggested that it is better to deal directly with an end user than to go through a broker. Working with a manufacturer "offers maximum control and stability and also establishes a relationship with an individual buyer."⁷

Specifications from the purchasers of the materials should be considered when processing the recyclables in order to generate the highest revenue possible. There is more than one market for most materials and the quality of the materials should meet more than one of those markets' specifications so as not to limit the marketability of the product. It has been found that "the most successful recycling programs in place today have spent the time and money necessary to understand the standards of quality required by the market and how quality relates to the buyer's operations."⁸

Transportation factors are important in determining cost effectiveness of the program. Scrap prices tend to be more price sensitive to transportation costs than virgin materials. R.W. Beck, environmental consultants to the County of Sacramento, found in their research on transportation regarding the recyclable materials that the estimated transportation costs for recyclables are equal to, and in some cases exceed, the value of the materials. It is recommended by R.W. Beck that Sacramento should "market their recyclables, to the greatest extent feasible, with local brokers and recycling [manufacturers]."⁹

The rest of this chapter will be a discussion on each type of material, an overview of its national and local condition, and the specifications of the quality of the materials required by reprocessors.

PLASTIC

There are three kinds of plastic that can easily be collected and recycled through curbside pickup: polyethylene terephthalate (PET), high-density polyethylene (HDPE), and mixed plastics.

In their study of local markets for recycled materials on the North Coast of California, consultants Gainer & Associates describe the role plastics have in the waste stream and the packaging industry:

In the United States, plastics are the fastest growing component of the municipal solid waste stream, increasing from 2.7% by weight in 1970 to 7.3% in 1986, when some 100.3 million tons were disposed. It is estimated that by the year 2000, plastics will compose over 9% of the waste stream by weight. This, however, underestimates the burden which plastics place on landfills, since plastics are estimated to compose up to 25% of the landfilled waste stream by volume.

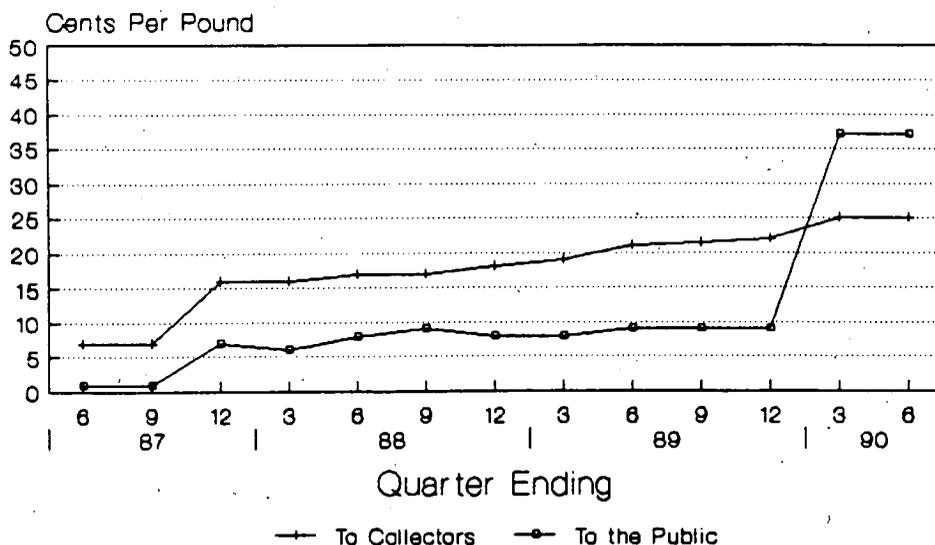
Plastic is a popular manufacturing material because of its great diversity. It can be engineered to suit a wide variety of specialized uses, often with much less expense than competing materials like glass and metal. In the past decade, plastic has replaced glass and metal in packaging applications on a broad scale, and some estimate that by 2000, plastic may replace 50% of all metals. In 1986 it was estimated that containers and packaging comprised 57% of all plastic material in the national waste stream.¹⁰

However, according to the United States Department of Commerce, Office of Basic Industries, the plastic bottle industry will still be hampered for the next four years, due to the inability of existing technology to change significantly and the controversy over plastic recyclability.¹¹ "Many manufacturers who use virgin plastic resins are reluctant to use secondary resins. Reasons for this include the relatively low cost of virgin resin, poor perception of secondary resin quality, and the perception that products made with secondary resins will be seen as inferior by consumers."¹² However, these perceptions are changing and the demand for recyclable plastics has been getting stronger in California and the United States.

PET (Polyethylene Terephthalate)

PET represents only .1 percent of Sacramento's residential waste stream.¹³ PET is mostly identified as plastic soda containers. Under state law AB2020, PET has Redemption Value in California. Since January 1, 1990, manufacturers are required to pay 35 cents a pound in redemption fees beyond that of the statewide average price of 23 cents a pound for the plastic, totaling a value of 58 cents a pound going to collectors. The following graph from the California Integrated Waste Management Board shows the increases in the prices paid to collectors (not including Redemption Values) and to the public for PET beverage containers.

Used PET Plastic Beverage Container Prices June 1987 - June 1990



Public prices include CA Redemption
Value from 9/87 to present quarter
Source: CA Integrated Waste Mgmt. Board

However, also effective January 1, 1990, California's plastic industry group, the Plastic Recycling Corporation of California (PRCC), reduced the scrap value it pays to curbside recycling programs. The California Integrated Waste Management Board reports that the industry has decided to pay curbside collectors only 1 cent per pound over the Redemption Value. This is because curbside collectors do not have to pay the residents the Redemption Value. Therefore the PRCC felt 36 cents per pound paid to curbside collectors would adequately cover the operational costs of the curbside collection. The industry also felt paying any more to curbside collectors would be just subsidizing the collection of the other recyclable materials collected in the curbside program.¹⁴

Outside California, PET only sells for \$100 a ton. Recycled PET reclaimers can buy the plastic from other states cheaper than from California recyclers. However, recyclers in California have to accept PET according to the AB2020 state law. It is then difficult for the collectors to sell the PET to reclaimers at California prices. The recyclers feel the handling costs are too high and the redemption fees are too low to bother expanding

their current level of PET collection. Because of its high bulk, the storage and shipment of plastic containers to market is known to be costly.

The market for PET has been strong in the United States. Manufacturers in the country are beginning to specialize in PET packaging, since it is recyclable. Right now Sacramento recyclers sell PET to Independent Paper Stock, which sells it to PRCC.¹⁵ Recently, most of the PET recovered in California has been shipped to processors on the east coast, as opposed to overseas markets.

There have been PET processors surveying Sacramento in the past. The PRCC has been trying to attract a major company to California to jointly construct and operate a PET/HDPE reprocessing facility. The value of reprocessed PET is considerably more than for whole, baled bottles (which is how California sells the PET to end users now). "Granulated secondary plastic becomes slightly more valuable when it is extruded into pellets."¹⁶ However, it is suggested by Gainer & Associates that if the quantity of plastics recycled is not great, then the capital costs of extruding equipment could override the value added to the processed plastic. The reprocessed PET will then be sold to plastic molders in California as well as other states. However the volumes collected are not great enough in the area yet to attract processors. Despite the difficulties collectors have been having, the increase in redemption value has been increasing the recovery of PET and therefore has increased the chances of a reprocessing facility siting in California.¹⁷ After PET processors and manufacturers begin siting in California, collectors will be able to recycle PET more cost effectively. Contaminants that can affect PET recycling are nonplastic objects, such as caps, and also other resins of plastic. "One bottle of a differing resin type can render an entire batch of [granulated plastic] unsuitable for manufacture, so it is imperative to keep resin types separate" when preparing them for market.¹⁸

HDPE (High-Density Polyethylene)

HDPE such as milk and juice containers represent .3 percent of Sacramento's residential waste stream.¹⁹ The market for HDPE is slow now because of the low volumes collected in programs. HDPE currently has no California Redemption Value. The quality specifications are the same as for PET. There are no reproducers for HDPE in proximity to Sacramento. There is a need in Sacramento for brokers who will find markets for the city's HDPE. Eaglebrook Plastics from Chicago and Midwest Plastics from Edgerton, Wisconsin, have surveyed California to establish HDPE processing facilities. As with PET,

R.W. Beck has found the industry would first like to see more encouragement of recycling HDPE before siting in the state.²⁰

Mixed Plastics

There is currently a limited use for mixed plastics in California. The applications for mixed plastics still need to be researched and developed more. There are no buyers for mixed plastics in the vicinity of Sacramento. However, R.W. Beck reports there have been companies surveying the San Francisco region.²¹ Since there is such difficulty in sorting the numerous types of plastics, the domestic market for mixed plastics is expected to grow. There are potential quality problems with oil, pesticides and other chemicals which are stored in the plastic containers.

Other Plastics: LDPE, PVC, PS

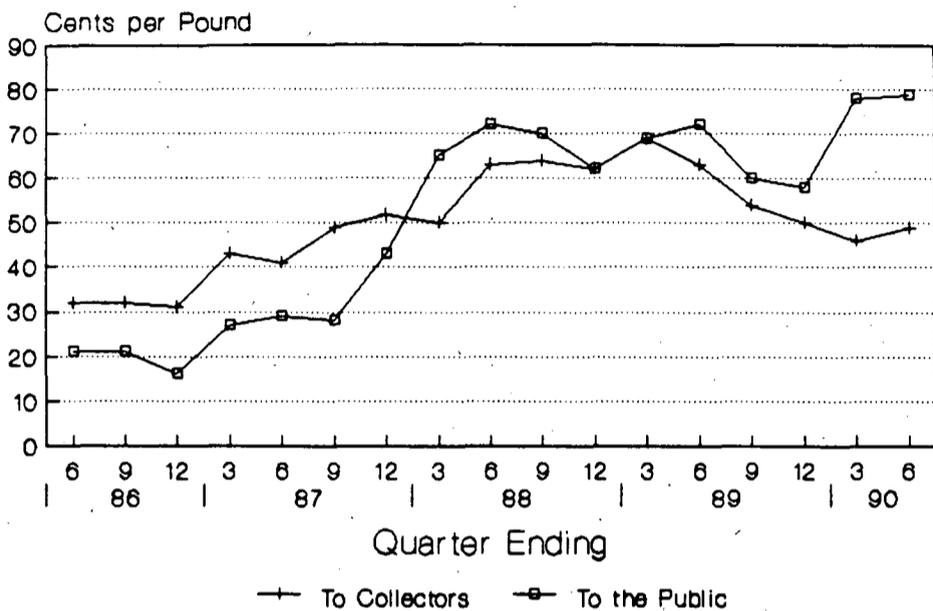
As reported by the Council for Solid Waste Solutions, other plastics (one example is low-density polyethylene (LDPE)), do not currently lend themselves for curbside pickup. LDPE is the thin packaging plastic used for such products as grocery bags. The market for polyvinyl chloride (PVC) is still new in the United States. It is reported that Occidental Chemical Corporation will buy post-consumer PVC from anywhere in the United States. Polystyrene (PS), such as styrofoam food containers, is also recyclable. The National Polystyrene Recycling Company was formed by the eight largest polystyrene manufacturers to facilitate the recycling of the material. The organization is planning to site polystyrene recycling plants in the Los Angeles and San Francisco areas. Again polystyrene can be recycled in larger quantities in other programs, such as at food service businesses, than in a curbside recycling program.²² Gainer and Associates describes how "with few exceptions [firms which do process these other plastics] deal only with pre-consumer manufacturing scrap. Those dealing with post-consumer waste plastics are often financially supported by the plastic industry itself."²³

ALUMINUM CANS

Aluminum is one of the most valuable and stable recyclable materials. The United States recovers approximately 50 percent of its aluminum cans.²⁴ Aluminum cans compose .3 percent of Sacramento's residential waste stream.²⁵ Aluminum cans are another kind of material which has California Redemption Value through the AB2020 law. The California Integrated Waste Management Board reports that the Redemption Value for recycled aluminum cans is now 65 cents a pound.²⁶ Evidence has shown, though, that as Redemption Value rises, the volume of materials collected from curbside programs will

not be significantly affected. The prices for aluminum in California are the highest in the nation. In California, manufacturers buy the material from the collectors for 49 cents a pound beyond the Redemption Value.²⁷ Therefore, curbside collectors currently receive a total of \$1.14 a pound for aluminum cans. The value is expected to remain high for the next four years. The following graph, illustrates the seasonal fluctuations in the prices paid to collectors and to the public for used aluminum beverage containers.

Used Aluminum Beverage Container Prices June 1986 - June 1990



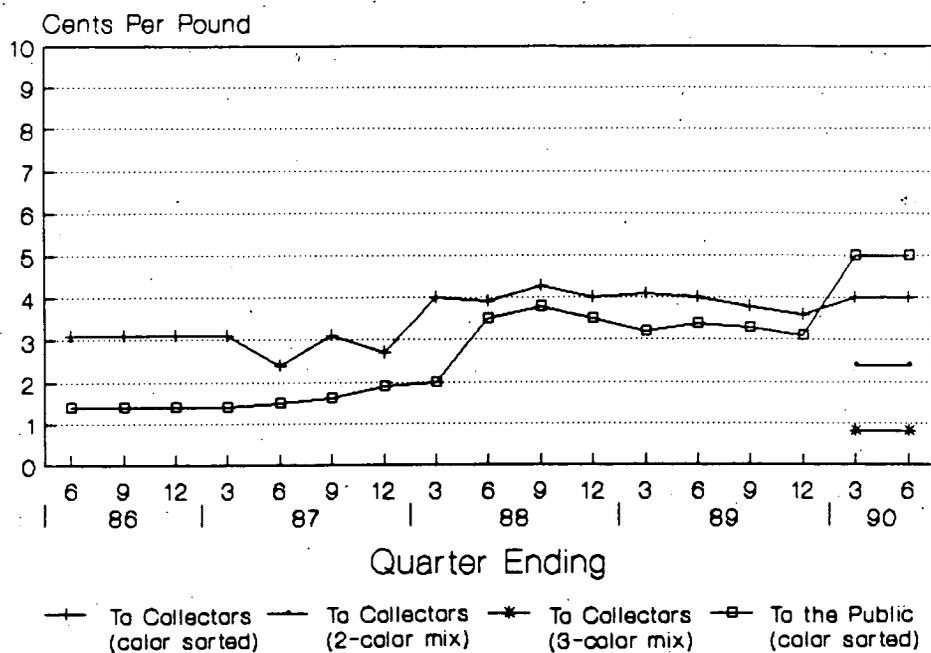
Public prices include CA Redemption Value from 9/87 to present quarter
Source: CA Integrated Waste Mgmt. Board

As a metal, aluminum's market is more stable than other recycled resources. Factors that could affect the value of aluminum are the U.S. industrial output, the strength of the American dollar and other international market factors. Also, since recycled aluminum is a substitute for primary aluminum, price fluctuations in primary aluminum will cause the market for recycled aluminum cans to fluctuate. This was illustrated in 1989 when the softening of the primary aluminum market affected the recycled aluminum market negatively. Recycled aluminum containers also have seasonal price fluctuations during the winter months when the weather hinders the collection of recyclables and so the supply is lower than normal.²⁸

Aluminum generates approximately 7 percent of Sacramento County's revenue from its curbside program. The quality expected by the market is that the cans be empty, free from other metals and food residue, and not be wet. The major aluminum production companies which operate remelting facilities are located out of state in such areas as Alabama, Indiana, Tennessee, and Washington. The Department of Conservation has found that 90 percent of all recycled aluminum cans are recycled to produce hot metal for canstock sheet, which is not made in California.²⁹ So aluminum cans are generally recovered in California by local recycling centers such as A & A Recycling and Waste Systems, Alcoa Recycling Company, Inc., Contain-A-Way, Independent Paper Stock Company, and Reynolds Aluminum Recycling Company. The companies then ship the materials out of state. There are, however, metal fabricators located in Sacramento. These companies can be given assistance in using recycled aluminum in their products.

STEEL CANS

Used Glass Container Prices June 1986 - June 1990



Public prices include CA Redemption
Value from 9/87 to present quarter
Source: CA Integrated Waste Mgmt. Board

Because of the AB2020 law, glass prices are expected to keep growing. California plans to keep increasing the redemption fees until the recycling rate of glass is 65 percent. These high prices are causing California glass to be too expensive for bottlers. It is cheaper for California bottlers to import glass from out of state. So even though the price for recycled glass is very good, it is increasingly becoming more difficult to sell the glass to reclaimers in California. Stephen Green from The Sacramento Bee reports how recyclers are resorting to collecting the Redemption Fees and then dumping the glass into landfills because they cannot sell it. This is allowed under state law.³⁴ An oversupply of cullet is also noticed in the state. This oversupply will continue as cities increase their recovery of glass. It is suspected by the California Integrated Waste Management Board that the market will not correct itself and will require government intervention. Content legislation is one suggestion by the State to help the problem.³⁵

As stated earlier by the United States Department of Commerce, Office of Basic Industries, glass will benefit from the problems the plastic industry is having, since glass is the likely candidate for the substitution of nonrecyclable plastic containers.³⁶ However, with rising Redemption Values, bottlers are becoming more selective of the

materials they buy. The market now depends on the quality of the material. The quality requested is that the colors of the glass be separated; the glass must be clean; there is to be only a minimum amount of metal rings and closures present; and labels do not matter. Also, ceramic, lead glass or laboratory glassware, stone, dirt, heat resistant glass, metals, plate windows or safety glass may not be present. Many buyers will not buy loads of glass with more than 10 percent breakage in them. Mixed cullet from broken glass is more difficult to market than segregated, clean glass.³⁷ If the glass is broken it is harder to determine its quality. On the other hand, for the manufacturing process the recycled glass is eventually broken down into cullet anyway. Glass manufacturers almost always use a percentage of cullet in their production. Using cullet reduces energy consumption and extends the life of the furnace for the manufacturers. The key to the manufacturing process is to maintain a consistent blend of virgin materials and cullet. Therefore, it is very important the manufacturers are ensured a consistent quantity and quality of recycled glass from collectors and processors.

Recently there have been widespread problems with marketing two- and three-colored glass.³⁸ Some curbside collectors handling three-color mixed glass have been having difficulties marketing the mixed glass and have had to pay certified processors to accept the glass. The glass processor charges \$15 to \$25 a ton to take the mixed glass.

Sacramento is in close proximity with a manufacturer in Tracy, the Owen-Brockway Glass Manufacturing Plant. Another company, E.N.C.O.R.E., located in Richmond, actually rewashes wine and champagne bottles for reuse by regional wineries. The glass industry also supports recycling because it ensures supplies. The supplies will be greater and more reasonably priced. The industry suggests the municipalities should leave the processing and marketing up to private companies because it requires specialized knowledge and substantial investments.³⁹

PAPER

"In the United States, paper products constitute the largest component of the municipal waste stream, estimated at 35.6% nationally in 1986. Wastepaper also offers the most diverse manufacturing possibilities among the recyclable waste materials."⁴⁰

The paper industry is expecting to have continuing strong growth. According to the United States' Department of Commerce, Office of Forest Products and Domestic

Construction, current-dollar shipments of paper and allied products were \$130 billion in 1989.⁴¹ Gainer & Associates describe in its study how the paper industry is expanding:

These high profits have helped to sustain a trend toward modernization in the industry, leading to a higher than average capital investment. Paper makers have proposed adding 6.1 million tons of annual capacity over 1988-90, a rate more than 10% greater than in the past 20 years.

This flurry of capital spending has resulted in a shift to new equipment and technologies, further reinforcing the trend toward large scale production. By 1982, 75% of all paper and board production capital stock was less than 10 years old, and accelerated capital expenditures indicate this trend is continuing.

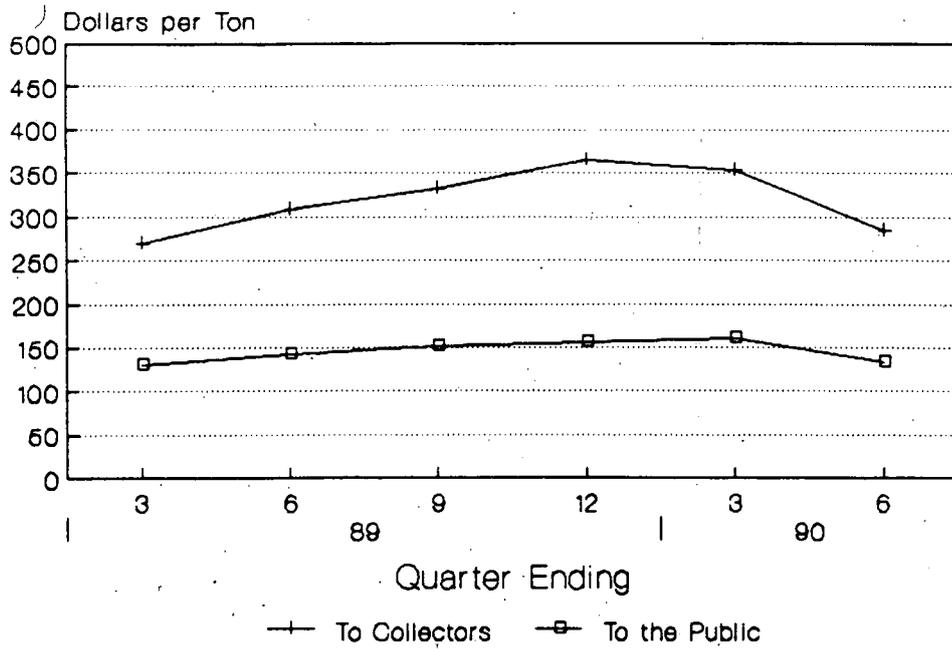
In the United States there are over 600 pulp, paper and paperboard product mills, of which some 200 use paper stock as a majority of their feedstock. Of the 280 mills listed in the Technical Association of the Pulp and Paper Industry (TAPPI) directory of secondary fiber users, only 16 (5.7%) have production capacities of 50 TPD or less, with only 64 (22.8%) producing less than 100 TPD. Typical plant scales are 500-700 TPD and higher. Indeed, paper industry officials consider 200 TPD to be a "small" plant. This is in contrast to typical molded pulp mills of 30 TPD, or cellulose insulation plants of 10 TPD.⁴²

Printing and Writing Paper

Printing and writing paper is some of the highest grade of paper. It represents .2 percent of the City's residential waste stream.⁴³ If properly sorted, the paper has high value. The price for high-grade wastepaper has been dropping recently. The following graphs show the price fluctuations for used computer printout, white ledger and colored ledger given to collectors and to the public.

Used Computer Printout Prices

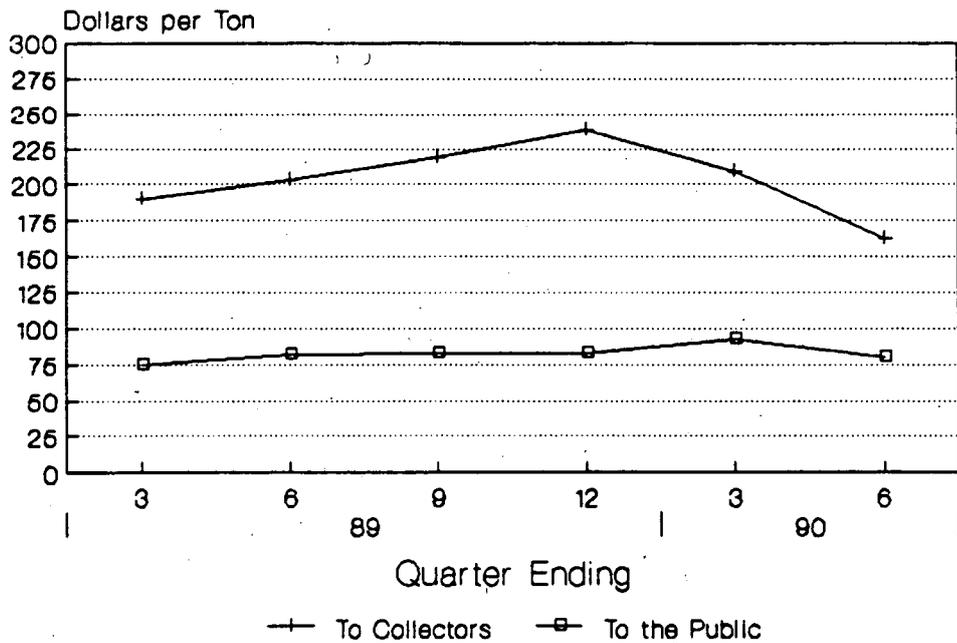
March 1989 - June 1990



Source: CA Integrated Waste Mgmt. Board

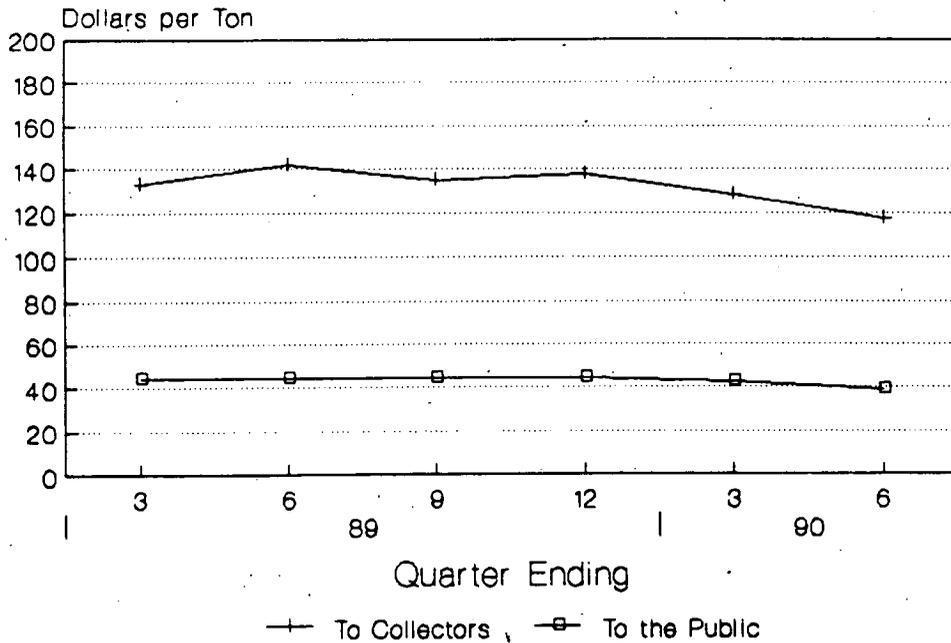
Used White Ledger Prices

March 1989 - June 1990



Source: CA Integrated Waste Mgmt. Board

Used Colored Ledger Prices March 1989 - June 1990



Source: CA Integrated Waste Mgmt. Board

The California Integrated Waste Management Board describes the main reason for price fluctuations in high-grade wastepaper is the changes in the market for pulp. Taiwan, Korea and Japan are the major export markets for west coast wastepaper and also contribute significantly to the market fluctuations. Overseas shipping rates affect the wastepaper market significantly, since wastepaper traditionally receives low priority for shipping space.⁴⁴ The domestic and foreign demand for U.S. wastepaper by 1995 is expected to be 50 percent over 1988 levels. The demand for printing and writing paper stayed strong through the 1980s, even while demand for other grades of paper were weak.⁴⁵ Even though the end-user market is strong, there has been some resistance to recycled paper. It has not been demonstrated that recycled paper is useful for archives. Also, there are problems using recycled paper in high-speed printers.

Because of the wide variety of compositions, printing and writing paper is not usually collected from residential programs. Even though no single action alone, like residential collection, will divert a significant amount of wastepaper from the waste stream, an evolution of steps including the implementation of segregated household paper with an established curbside collection of newsprint, will help.⁴⁶ For best resale value, printing

and writing paper should be separated by color and into at least these three compositions: pulp substitutes, high-grade deinking, and mixed. Collectors of printing and writing paper located in the Sacramento area include A & A Recycling and Waste Systems, Independent Paper Stock Company, Inc., Pacific Coast Wastepaper Company, and Weyerhaeuser Company.

The California Integrated Waste Management Board suggests that any oversupply problem of wastepaper during 1990 is attributed more to a decrease in demand by mills than it is to the increased recovery of printing and writing paper. The apparent economic slowdown in the United States has slowed down paper production.⁴⁷ Mills in California, Oregon and Washington consumed 300,000 tons of printing and writing paper in 1988. Also, 506,000 tons were exported through San Diego, Los Angeles and San Francisco in 1988.⁴⁸ California exports about 90 percent of its recovered printing and writing wastepaper.⁴⁹ The buyers of Sacramento's high-quality paper do not currently have the capacity to purchase additional volumes of printing and writing paper.

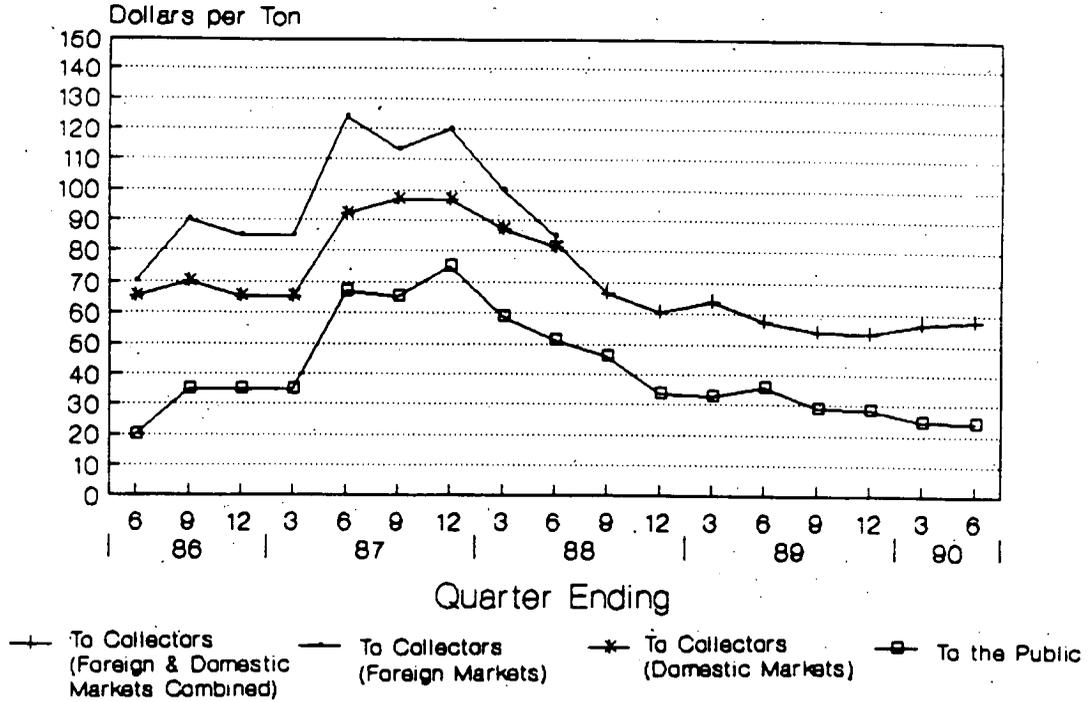
Corrugated Containers

Old corrugated containers (OCC) comprise 3.78 percent of Sacramento's residential waste stream. OCC is the largest volume of material collected in the County. Forty percent of the OCC generated in the county is collected, but it is mostly from commercial and retail stores.⁵⁰

The price for OCC varies depending on the demand for large consumer products, exchange rates, and availability of virgin supplies. The following graph illustrates the prices paid for OCC in California.

Old Corrugated Container Prices

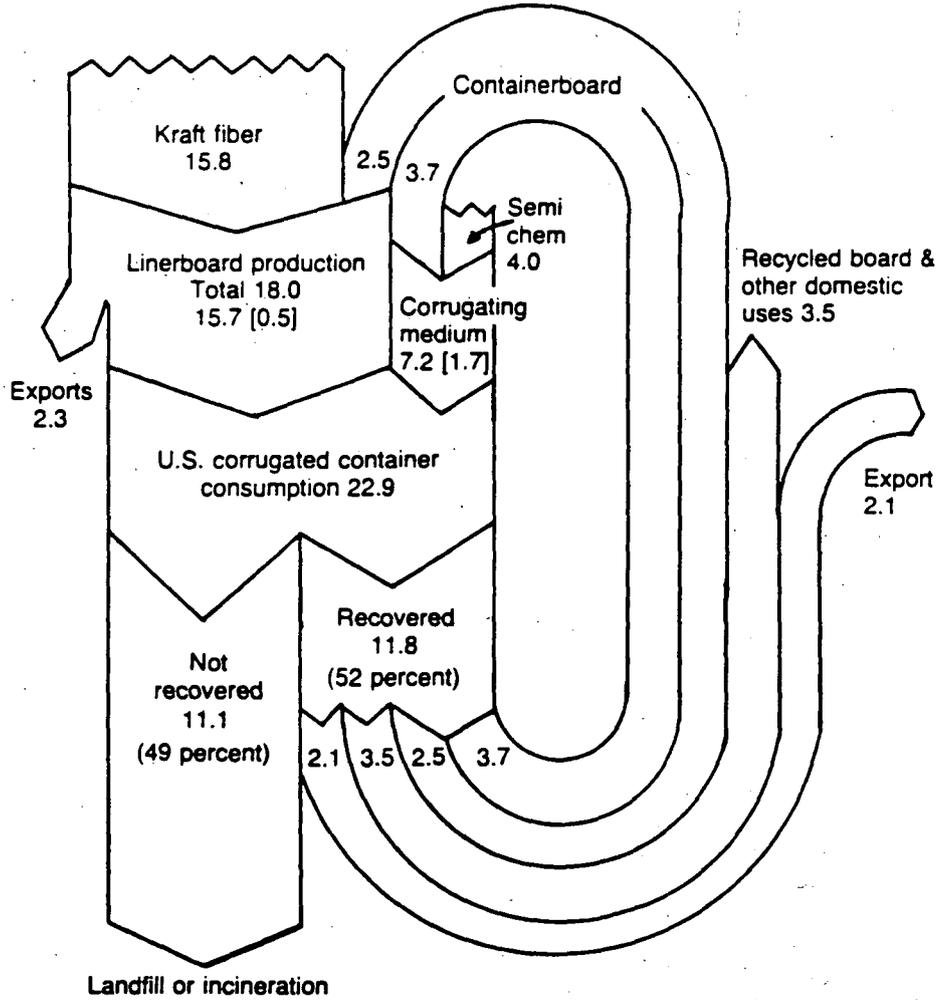
June 1986 - June 1990



Source: CA Integrated Waste Mgmt. Board

Sacramento has a stable and growing market for OCC. The rate of demand for OCC depends on the rate of supply (production) of new cardboard. The following figure, developed by Andover International Associates, illustrates this.

U.S. supply and disposal of corrugated containers, in million short tons (1)



[] Indicates amount made from 100 percent recycled fiber.

(1) Based on 1988 statistics.

Source: Andover International Associates

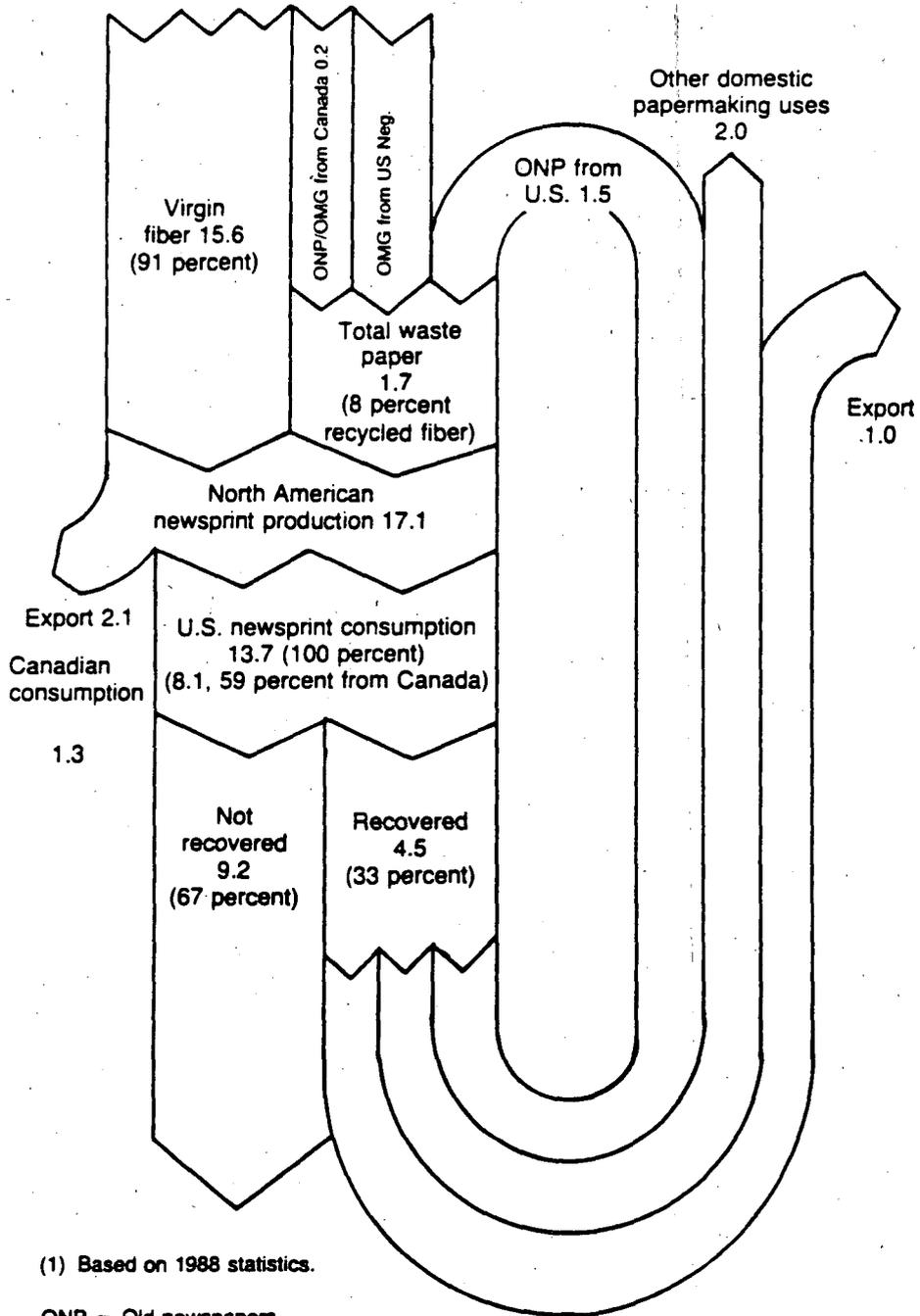
As far as residential curbside collection is concerned, the cost of collection could exceed the value of OCC. Because of its bulk, collected OCC in a source-separated program would lengthen the collection time of recyclables. An automated collection system with 60 to 90 gallon containers would collect the OCC easier, but it risks contamination of the product. Like any other paper product, the revenue generated from the material is directly related to its quality. Other quality concerns the industry has are contaminants such as wax, plastic and chemical treated OCC.

California has a strong in-state market for OCC. Over 50 percent of the recovered OCC from California is consumed in the state.⁵¹ Local recyclers of OCC include A & A Recycling and Waste Systems, Independent Paper Stock Company, Inc., Pacific Coast Wastepaper Company, Recycling Industries, and Weyerhaeuser Company. The local recycling industry has the capacity to consume more OCC. There are also 41 major mills in California, Oregon and Washington which consume OCC. There is a mill planned to be built at the Port of Stockton which will process OCC. The export market for OCC is also very good. In 1988, 630,000 tons of OCC were exported through San Diego, Los Angeles and San Francisco. Because of increasing consumption of OCC and increasing OCC pulping capacity, it is believed legislative incentives are not needed to encourage the recovery of OCC.⁵²

Newspaper

Old newspaper (ONP) represents 6.7 percent of the City's residential waste stream.⁵³ The household ONP is approximately 90 percent of the ONP in the total waste stream of Sacramento. ONP is the most frequently recycled material from the residential waste stream. For more than ten years, the recovery rate of ONP in the United States has stayed at about 30 to 33 percent. The following figure from Andover International Associates illustrates the supply and disposition of newsprint in North America.⁵⁴

North American supply and disposition of newsprint, in million short tons (1)



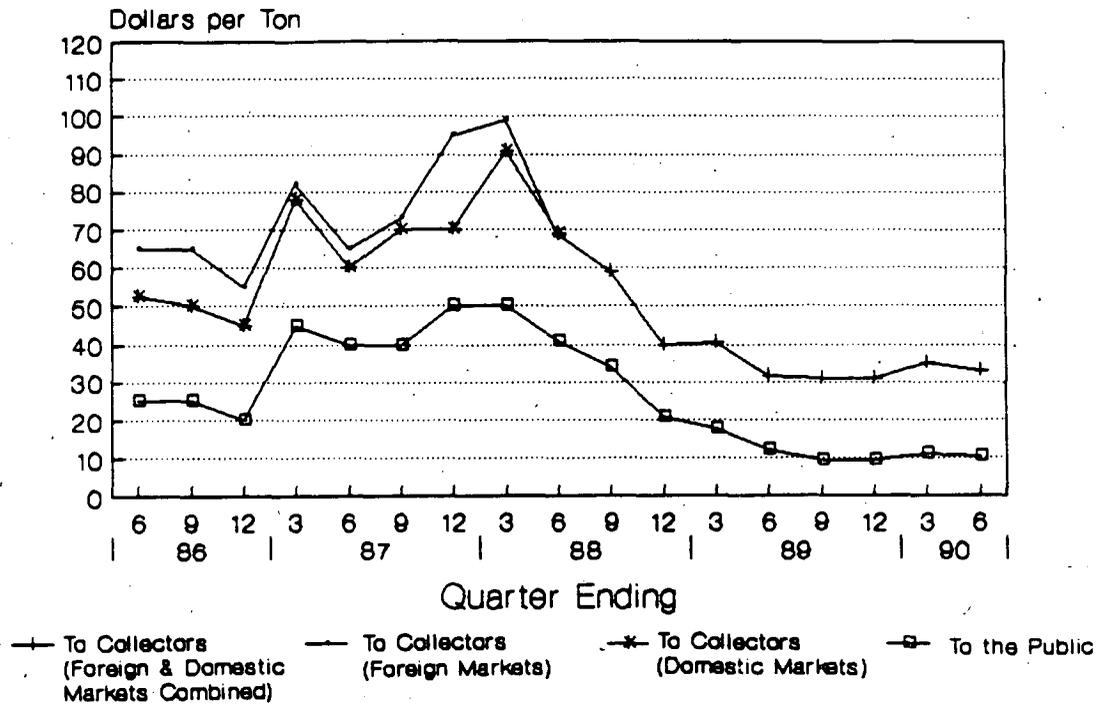
(1) Based on 1988 statistics.

ONP = Old newspapers
 OMG = Old magazines

Source: Andover International Associates

Prices are expected to stay stable for the next two years, even if recycling rates increase. Local buyers are not signing price contracts for periods longer than a year. Price fluctuations for ONP depend on mill capacity, supply from recycling programs, and the strength of the U.S. dollar. Since virgin timber is subsidized, it can be a cheaper source of material than ONP for producing paper products.⁵⁵ Seasonality plays a significant role in the market of ONP which is apparent in the following graph.

Old Newspaper Prices June 1986 - June 1990



Source: CA Integrated Waste Mgmt. Board

The price of wastepaper is directly related to its quality. Expectations of good quality ONP are: dry; not sunburned; free of other papers like magazines, Kraft grocery bags, and office paper; free from plastic bags, tape, metal and glass. As supplies of ONP increase, mills might be more selective of the quality of paper they buy. R.W. Beck reports the mills' main complaint is the presence of glass with the paper.⁵⁶

The paper industry is worried about oversupply of ONP by mandatory recycling on the west coast flooding the market. Mandatory recycling of ONP will be ineffective if a market for the product is not first established. The Northeastern United States has created an oversupply problem. They have adopted many mandatory recycling programs. New Jersey and Rhode Island have statewide mandatory recycling laws. There are currently not enough mills or customers in that part of the country to keep up with the supply of ONP. Many programs across the country have been reconsidering their programs and some have stopped collecting ONP because the market is so bad. The West Coast has not yet reached this situation. Pulping mills are starting to expand their capacities to process wastepaper. There is evidence that the demand for ONP will increase dramatically in the next five years. The U.S. Department of Commerce reports the reduction in wastepaper prices, derived from excess wastepaper, has actually energized producers to explore new ways to use wastepaper as a raw material.⁵⁷

The bottleneck in the demand for ONP is during the deinking process. A new deinking mill costs \$500-600 million and takes five years to become operational. To expand an existing mill to include deinking facilities would cost about \$50 million and takes 18 to 24 months to complete.⁵⁸ The following table shows the targets for recycled fiber content in newsprint, which are achievable in North America, based on the time it will take the industry to expand its production for ONP.⁵⁹

Target Percent Recycled Fiber in Newsprint

<u>Year</u>	<u>Percent Upper Limits</u>	<u>Percent Lower Limits</u>
1989	8	n/a
1992	14	11
1995	25	20
1997	31	25
2000	40	32

Source: Andover International Associates

Due to new content laws and environmental concern, it will become necessary for mills to have deinking capacity in order to be able to sell to all newspaper markets. However, recycled newspaper does have to contain at least 50 percent virgin fiber to produce an acceptable product. Because of this, mills will avoid buying ONP from states with content

legislation of more than 40 to 50 percent.⁶⁰ The California Integrated Waste Management Board observes that within the development of the 'flotation' process of deinking ONP, a demand for old magazines has arisen and will substitute the consumption of ONP somewhat. Old magazines comprise a cheap source of clay which is used to deink wastepaper in the 'flotation' process. The old magazines then supply the fibers for the new paper. Currently, converted mills in Oregon and Southern California are demanding old magazines from California.⁶¹

In 1988, California industries consumed about 45 percent of the State's ONP.⁶² There are 15 pulp and paper mills in California which use ONP. There are four more each in Oregon and Washington. Their combined capacity is 365,000 tons per year for processing newsprint. In Sacramento, Keyes Fibre Company processes ONP into molded pulp products. The demand for molded pulp products depends on changes in agricultural production. Keyes only operates at 70 percent capacity. Other local recyclers of ONP in the Sacramento area include A & A Recycling and Waste Systems, Independent Paper Stock Company, Pacific Coast Wastepaper Company, Recycling Industries and Weyerhaeuser Company. In 1988, 470,000 tons of ONP were exported through San Diego, Los Angeles and San Francisco.⁶³

For a region of agriculture, one type of use for ONP is for animal bedding. Farmers in Pennsylvania are paying \$20 to \$25 a ton for ONP for this purpose.

Newspaper processors have been surveying the Sacramento region. There are plans to construct a mill for ONP and old cardboard at the Port of Stockton. When the Port of Sacramento finishes deepening its channel and the area shows promise in supplying ONP, Sacramento could be a prime location for a mill. Other processors, such as those that produce cellulose insulation, operate much smaller facilities than a pulp mill and could probably be attracted to Sacramento sooner than a mill would.

Mixed Paper

About 5.9 percent of the Sacramento residential waste stream is mixed paper.⁶⁴ R.W. Beck observes mixed paper is a low grade of paper and generates little revenue. In fact, many brokers do not try to solicit mixed paper.⁶⁵ The brokers just collect it from their sorting generations. Residential collection programs rarely include mixed paper.

The prices Sacramento County gets from mixed paper range from \$5 to \$15 a ton and the state average is \$2 to \$10 a ton. Brokers in the Sacramento region which collect paper are Weyerhaeuser and Independent Paper Stock. The mills in California, Oregon and Washington collected 170,000 tons of wastepaper in 1988. The same year 307,300 tons were exported through San Diego, Los Angeles and San Francisco.⁶⁶

Considering that mixed paper comprises a significant percentage of the waste stream, market uses of the material should be focused on. By combining ONP and office paper with the mixed wastepaper, an attractive supply will be created for interested industries. The Cellulose Marketing Council has talked to the City of Sacramento about building a wastepaper recycling plant in the area.

OPTIONS/SUMMARY

PET, HDPE, aluminum cans, steel cans, glass containers, printing and writing paper, old cardboard, mixed paper and old newspapers will be recycled in the residential program. Though some of these markets are in their infancy, the industries are growing quickly. The following paragraphs summarize the markets of these recyclable materials.

Since reprocessors and manufacturers of PET and HDPE are going to be siting in California soon, the California markets for these materials are going to strengthen substantially. Sacramento should begin collecting PET and HDPE from the start of its program and establish ties with reclaimers to buy the materials. The plastics should be separated, washed and granulated to collect the best resale value. The PET and HDPE can also be sold to mixed plastic markets. Once plastic reprocessors are located in California, other reprocessors and end-use manufacturers can be attracted to Sacramento with the right incentives. If the materials are processed correctly, some end users will even be able to buy the plastics directly from the City.

"Aluminum cans have the most developed recycling infrastructure of all common consumer materials."⁶⁷ Aluminum and steel cans can be easily recycled at curbside. Long-term contracts should be established with reclaimers to ensure stable prices due to consistent supplies of recyclables. Reclaimers buy recycled metals in Sacramento at stable prices, but they must transport the materials out of state to be reprocessed. However, there are metal fabricators located in Sacramento and their use of recycled metals should be further developed.

Prices for recycled glass are currently being determined by legislation. Prices will either increase directly from California increasing Redemption Values, or they will increase from a demand for glass caused by mandatory content legislation. An oversupply of glass from recyclers could counteract this. Therefore, long-term contracts must be made with reprocessors located in close proximity to Sacramento. Sacramento's best option for recycling glass is to develop new markets for glass cullet. There must be quality sorting and processing of the glass in order to sell it to the best markets.

High-grade paper, OCC, ONP and mixed paper all have stable markets in Sacramento. Sorting the various grades of wastepaper is the key to successful paper recycling. If given the right incentives, a deinking paper mill could be sited in the Sacramento area. However, other paper processing industries which use the wastepaper for purposes other than pulping can be attracted to Sacramento sooner than a deinking mill. Mixed paper, with lower quality and processing specifications, can then be recycled in greater quantities.

The end uses of these materials are discussed in more detail later in the report.

PROCESSING

Any type of collection program will require some processing to prepare the recyclables for the market. The question arises as to whether the City should process and market the collected materials or whether the City should contract for these services.

In looking at recycling programs in other California cities, many contract the functions of collection, processing, and marketing to a private company. Research staff found that the main reason for contracting is that the cities already have contracts with companies for their garbage collection which can also provide processing and marketing efforts. Some cities like Burbank express the complexity of the recyclables commodity market is too much for them to handle.⁶⁸ Burbank's staff suggests that "the contractor's expertise in brokering the materials collected is the most important feature of the program. Without appropriate brokering, the program will not survive."⁶⁹

MRF'S OPERATIONS AND COST

Considering these factors, a city, county or region can take advantage of economy of scale by initiating the building of a Material Recovery Facility (MRF). A MRF is a facility where separation, processing and marketing of recyclables occurs. MRFs fall into two general categories. Those facilities which process mixed garbage and pull out the recyclable materials are known as "dirty" MRFs. Those which process only recyclable materials collected separately from the rest of the residential waste stream are called "clean" MRFs.

The systems used at MRFs increase the quality of the collected materials for better resale value. Thus, by providing a consistent high-quality supply of materials to its markets, the City can develop stable, long-term ties to the buyers. Whether the facility is publicly owned or privately owned, it will add to the economic base of the area by creating jobs, increasing the property tax base, and diversifying the local economy.⁷⁰ The MRF facility can be used as a catalyst to develop ties with existing manufacturers in the local area which use recycled materials and also will be attractive to industries surveying the region for site.

Research staff investigated the value of a MRF. Some advantages and disadvantages of MRFs follow.⁷¹

Advantages

- High recovery rate
- Collection costs are low
- Mix of mechanical and hand sorting process
- Good potential for plastic recovery
- Works well with curbside and commercial recovery programs
- Provides low-skill jobs
- Potential for removal of household hazardous waste

Disadvantages

- High contamination of commingled materials, especially paper
- Design may require flow control ordinances
- High capital and operating costs
- Difficult to site
- Only limited to U.S. experience

Of the 104 MRFs identified in the United States in the 1990 Materials Recovery and Recycling Yearbook, 51 percent are in stages of planning, 11 percent are under construction, and 34 percent are operational. A majority of the planned facilities are going to be publicly owned, as opposed to the existing facilities of which the majority are privately owned. However, 79 percent of the planned facilities are going to be operated by a private company. More public sources of funding for the projects will be used in the future. Of the planned MRFs, 69 percent will be receiving some form of public financing, bonds, grants or tax revenues.⁷²

To accomplish this task further, it is suggested by the City of Sacramento in the report Issues Related to Accomplishing Recycling Goals that "because of the complexity and scope of our [Sacramento's] marketing needs, the City must seek a qualified marketing specialist to perform those activities necessary to selling recovered materials and compost."⁷³ The experiences of the cities surveyed seem to agree with this suggestion.

The characteristics of the MRF demanded by Sacramento's needs will determine capital and operational costs of the facility. The company Recycle America/Waste Management from Seattle, Washington describes the types of operational costs of such a facility as:⁷⁴

Interest rate costs on bond

Building cost depreciation

Property taxes

Rent (if the building is not owned)

Shipping supply costs

Equipment maintenance and repair

Depreciation on machinery

Utilities

Administration

Labor (for two sort lines, depending on level of automation):

4 people for paper sorting line

4-5 people for bottles and cans sorting line

2-3 people for forklifts and equipment operators

1 baler operator

1 shipping clerk

1 supervisor

Other cities and counties in the country have built comparable-sized facilities which had capital costs ranging from \$0.8 to \$6 million to build. The following table describes these facilities.

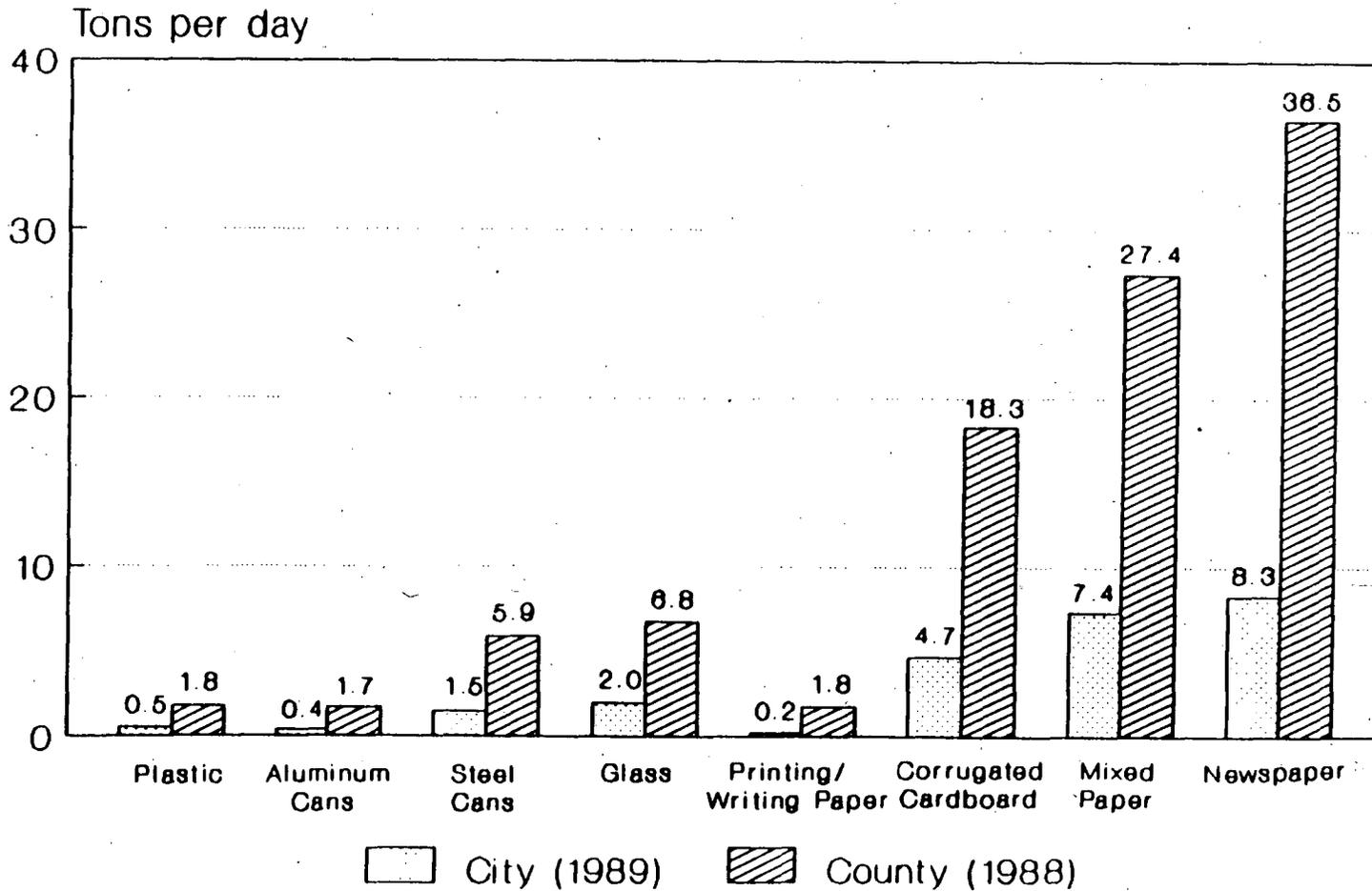
Capital Cost to Build
MRF in the United States

<u>City</u>	<u>Owner/Operator</u>	<u>\$ Capital Costs</u>	<u>Ton/Day Throughput</u>
Bristol, CT	Ogden Martin	N/A	100
Rochester, MA	Materials Recovery and Recycling Corp./Energy Answers Corp.	N/A	100
Somerset County, NJ	Somerset County	3.8 million	10-150
Centre County, PA	Center County Solid Waste Authority	.8-1 million	80-100
Lackawana County, PA	Lackawana County SWM Authority	2 million	100
Philadelphia, PA	National Temple Recycling	1-1.7 million	100
Seattle, WA	Recycle America	500,000 (equipment only)	100
Huntington, NY	Town of Huntington/ Combustion Engineering	6 million	130
Sussex County, NJ		1.5 million	140
Rhode Island	RISWMC/NECRINC	4.15 million	140

Source: Biocycle, Journal of Waste Recycling, May 1989

The key to a successful MRF is in processing the recycling materials into high quality resources. The following graph breaks down the tonnages recovered each day into the various materials. These figures are taken from the residential recyclables estimated to be recovered at a rate of 31 percent from all the residents in the city and county. Take note, however, that the individual materials are not recovered at equal rates. The 31 percent rate is just an average rate for all recyclables. For instance, residents usually recycle more than half the wastepaper in their homes, but only a small percentage of their plastics or metals. These tonnages are based on 1988 and 1989 waste volumes and will be different by the time Sacramento's curbside collection is serving the entire city in approximately five years.

Daily Available Tonnage for Recycling From Sacramento Residential Waste Stream (Assuming 31% Recovery Rate)



Source: City of Sacramento, 1990

There are different methods to process the various recyclable materials. Since the materials will be collected source-separated, two sort lines will be needed, one for the bottles and cans and one for the paper. Recycle America estimates the capital costs of the bottles and cans line to be between \$275,000 and \$300,000. The paper line averages \$200,000.⁷⁵ The metals should be cleaned, sorted and compacted. Such processing requires machinery such as can separators, can flatteners or can densifiers. Contaminants need to be removed from the glass. The glass should be sorted by color and type of glass, separating the whole containers from the cullet. The batches of whole containers can then be sold separately from the batches of cullet. A glass crusher could be useful for processing the cullet. The paper must be separated by grade and all contaminants, including heavily inked materials, removed. A baler is also needed to prepare the paper for market. Recycle America installed a baler costing \$300,000 with an installation fee of \$50,000, into their facility in Seattle.⁷⁶ For highest resale value, the plastics should be separated, washed and granulated. The plastic can be baled instead of granulated, still densifying the materials for easier transportation. But the benefit of granulating as opposed to baling the plastic is that the granulation can be sold directly to end users. Gainer & Associates points out, though, "with granulate, there is no opportunity for processors to exercise their own quality control. To sell granulate to a processor, it will be necessary for the producer to develop a relationship of trust over time The economic feasibility of such an operation would depend heavily on the availability of low-cost labor, public participation, and a consistent, preferably local, market for the granulate."⁷⁷ The following table shows examples of what other processing equipment can cost:

Estimated Equipment Costs
for Processing Post-Consumer Plastics

<u>Equipment</u>	<u>Scale</u>	<u>Cost</u>
High-Density Horizontal Baler	2 Tons per hour	\$50-60,000
Granulator	1 Ton per hour	\$17-30,000
Washing Equipment	2.4 Tons per day	\$100,000
Extrusion of Pellets (extruder, water bath, pelletizer)	2.4 Tons per day	\$150,000

Source: Gainer & Associates and Institute for Local Self Reliance

OPPORTUNITIES FOR NONPROFIT ORGANIZATIONS

Nonprofit organizations which have recycling programs of their own tend to have the same concerns that recycling dealers have. Mainly, they do not want the City duplicating their services. It is difficult to determine exactly how many nonprofit organizations there are involved in recycling located in Sacramento. The organizations are not required to have business licenses and therefore the City has no idea who or how many organizations have recycling programs. However, an idea about the impact on nonprofit organizations can be taken from the experiences of other California cities with established programs.

Other cities have been trying to accommodate self-help organizations. Some of the cities, like El Cerrito, are too small to have such organizations operating recycling programs.⁷⁸ Other cities with old curbside programs, like Davis, no longer have any nonprofit organizations trying to recycle.⁷⁹ Many cities are finding organizations getting out of the recycling business because the market is not good enough for them to keep operating. Even Sacramento has already noticed some of its nonprofit groups leaving the recycling business because of recent declines in recyclables' prices, but this, of course, is not due to a curbside pickup program. San Francisco's new curbside program has found a negative impact on nonprofit organizations that claim to be losing revenue. On the other hand, other cities have residents still donating their recyclables to nonprofit groups.⁸⁰

The City of Menlo Park subcontracts Youth Enterprises Recycling, a nonprofit youth employment and training organization, to process and market its collected materials. Some cities, like Berkeley, use nonprofit organizations to administer and operate the whole recycling program because those organizations were already established curbside collectors before the cities considered operating such programs.⁸¹

The Department of Conservation has found that "a more efficient approach is to develop prescriptions from the existing programs that will allow a combination of curbside programs, nonprofit entities, buy-back centers, redemption centers and exemption to be developed at the local community levels" to reach the recycling goals. The individual programs "appear to serve partially overlapping but different population segments, respond to different citizens' needs, and can complement each other if a comprehensive systems approach is taken."⁸² Gary Van Dorst, from the City's Solid Waste Division, says the reasons people recycle are:

Environmental concern
Economic incentive
Support charitable organizations
Convenience

All these objectives can probably best be met with an integration of community programs.⁸³

In order to involve nonprofit organizations in the City's recycling program, new opportunities need to be opened up for them. As mentioned earlier, some cities have simply contracted organizations with already established recycling programs to operate curbside recycling programs. An organization can also work on just part of the program, like processing and marketing. The California Waste Management Board reports "some communities have chosen, for administrative and legal reasons, to form a nonprofit organization to manage their recycling programs. These tax-exempt organizations can be created by one or more jurisdictions or by a group of concerned private citizens. Their unique tax status gives nonprofit groups one additional funding advantage: local governments can issue tax-exempt bonds to defray operating or capital costs."⁸⁴

Burbank has involved its charitable organizations in a unique manner. A private contractor operates a buy-back center for the city's recycling program. The center allows churches, organizations and schools to establish accounts at the center and the people taking their recyclables to the center credit their materials to the accounts. At the end of the month the checks for accounts are forwarded to each group.⁸⁵

Novato actually shares its revenue from the program with a newspaper collector that was displaced by the program.⁸⁶ On the other hand, nonprofit groups in Ontario are now requesting curbside pickup from the city to collect the materials donated to the groups.⁸⁷

A study for Sacramento County by R.W. Beck suggests other ways cities can assist nonprofit entities: by giving financial and promotional assistance; allowing the use or leasing of nonutilized city property or equipment; and adjust zoning requirements to make it easier to site and operate recycling operations.⁸⁸ Another possibility the Sacramento's Solid Waste Division has found would be to require nonprofit entities to obtain permits and meet regulations in order to operate recycling programs. Negotiations could then

be made with the organizations to assign them certain areas from which to collect materials. The difficulty with this system would be in assuring reliability of the service. An opportunity area charitable organizations could look into is servicing the commercial and multifamily units sectors.⁸⁹

The nonprofit organizations must not be forgotten when the City tries to reach its recycling goals. The groups will be able to fill niches in recycling which the City cannot participate in with its large scale recycling project. The City should take advantage of opportunities to give consideration and assistance to nonprofit organizations in order to promote community involvement. Research staff believes that nonprofit organizations and their donators should have the opportunity to take their recyclables to the MRF, thus crediting the values to their accounts. The City will then be able to record the type of material being recycled, along with its tonnage and location of collection. The operator of the MRF would then forward checks to the organizations for the value of their accounts.

OPTIONS/SUMMARY

Research staff suggests that the City should examine the option of building a MRF which will process a minimum of 100 tons a day. The facility should be built with the potential for expansion. Consideration has been given only to residential recyclables in this report. A follow-up analysis of the commercial waste stream, self-haul waste stream and materials taken to recycling centers is suggested in order to determine the total tonnages which will eventually need processing in Sacramento. Because of the complexity of the field, it is suggested the operations of the facility be contracted as well as the brokering of the materials (which will more than likely be the same company). Again, a successful MRF will lie in its reputation for processing the materials into high-quality resources.

Another option is that the opportunity be open for nonprofit organizations and individual citizens to use the MRF as a drop-off center, or buy-back center, to recycle their materials. This will allow Sacramento to record more accurately the materials being recycled and help reach the State's mandated waste reduction goals.

RECLAMATION AND END USE

Throughout the research of this report city staff pondered the question of how to attract reclaimers. For instance, if Sacramento processed over 100 tons per day of recyclable materials, does this quantity, with the subsequent quality of processed material, create a favorable market for reclaimers?

In setting up the research methodology, staff found that due to the infancy of this industry and the lack of ventures by other local governments, the state legislation has caught local officials off guard with AB939. This, then, has caused many to do primary research in an effort to understand the options available and how to develop opportunities not currently available in the marketplace.

It would certainly seem logical from the economy of scale that Sacramento, since it is one of the largest metropolitan areas on the west coast, would support reclaimers. However, it has been found that in order to attract reclaimers the sales of the recyclable products they produce must reach specific bench marks in the region or state before a manufacturing facility is sited. This chapter illustrates the products made from the recyclable materials and recommends a strategy to attract these types of firms and what it means for the Sacramento economy.

END USES OF PRODUCTS

The products produced from recycled materials are varied. Technology is constantly being developed to find new uses for recycled materials. As materials become more abundant from collections, it is expected entrepreneurs will develop new technology to turn the materials into valuable products.

Plastics

Recycled plastic technology is the latest to be developed. The following table describes the technology of plastics manufacturing which has used recycled plastics.

Plastics Manufacturing Technology Overview

Process	Comments	Suitability to Using Recycled Plastic	Product Example
Extrusion	Plastic is melted as it moves through a "screw." It is continuously molded and cut as it passes through a die.	Most suitable	Pipe
Injection Molding	Molten plastic is extruded into a mold under high pressure	Most suitable	Flower pots, small parts
Compression Molding	Plastic is placed in a mold and then melted under pressure to completely fill mold	Potentially suitable	Pallets, high-strength components
Blow Molding	Plastic is melted and extruded into a mold. The molten plastic is expanded with high-pressure air to completely fill the mold	Less suitable for using low-grade recycled plastic	Bottles

Source: Gainer & Associates

A large industry in Europe, and one that is developing in the United States, is the manufacturing of plastic pallets to replace wood lumber. The pallets have a life span five times longer than wood and can be recycled if they break. The plastic lumber has been used for docks and piers, traffic barriers, curb stops, fencing, park benches, nursery pots and playground equipment. The plastic's life span is also apparent in highway foundations made of mixtures of concrete and plastic waste. Chipboard is made in France from a combination of plastic scraps and wood chips. PET is recycled into polyester fabric, insulating fiberfill for sleeping bags and jackets, rope, carpeting, plastic resin used in the automotive industry, paint brushes, and household cleaner bottles. Detergent bottles, recycling bins, irrigation and drain tubing, and golf bag liners are manufactured from recycled HDPE. The main end uses of recycled PVC are drainage and irrigation pipes. Recycled polystyrene is made into office products, video cassettes, toys, trash cans, flower pots, combs and insulation. The following table lists the estimated end-use markets for recycled PET and HDPE.

Estimated Markets in the United States for
Post-Consumer PET and HDPE Plastics
(millions of pounds)

	<u>1987</u>	<u>1992</u>
PET		
Fiber	90	180
Injection molding	25	160
Extrusion	225	130
Non-food containers	--	30
Structural foam molding	--	30
Paints, polyols, other chemical uses	10	20
Stampable sheet	--	30
Other	<u>--</u>	<u>20</u>
Total	150	600
HDPE		
Bottles (non-food)	--	115
Drums	--	25
Pails	20	65
Toys	--	15
Pipe	30	80
Sheet	--	25
Crates, cases, pallets	--	105
Other	<u>4</u>	<u>130</u>
Total	54	560

Source: Plastics Recycling Foundation, 1988 Annual Report

Metals

Scrap metals have established uses in their industries. Because of their value as nonrenewable resources, metals have a long history of being recycled. Recyclers sell the aluminum cans to smelters, who process the materials into ingots. The ingots are then sold to fabricators. The technology used by fabricators to manufacture products are rolling, pressing, extruding and casting.

Metals are able to be reprocessed into products similar to their former lives because of the composition of the materials. It is estimated that about 65 percent of the recycled aluminum used for casting is consumed by the automotive industry.⁹⁰ Recycled aluminum castings are also produced by the computer, electrical and electronic industries, as well as the building and transportation sectors. As noted earlier, the California Department of Conservation found that 90 percent of all recycled aluminum cans are recycled back into can stock sheet. Other products such as washers and

lettering for signs and parts are pressed from rolled aluminum. Pipes and a wide variety of parts and machinery are extruded from recycled aluminum ingots.

Glass

"Unlike the paper and plastics industries, glass making is a fully-integrated, one-step process in which raw materials are manufactured into finished products at one facility."⁹¹ If glass is able to be remelted, it is made into new containers or other glass products. The following table describes the markets for recycled glass.

Overview of Potential Products Using Recycled Glass

<u>End Product</u>	<u>Suitability to Using Recycled Glass in Production</u>
Pressed Glass Container	Well-suited to using a high percentage Must have highly automated and costly monitoring equipment
Blown Glass Flat Glass	Potential is very low for using large quantities Lowest Potential for using large quantities
Fiberglass	Extremely uncommon

Source: Gainer & Associates

However, because it breaks, recycled glass does not always make it to such manufacturers. The markets that are being developed for broken glass cullet are in ceramics, abrasives, industrial compounds, fillers, bricks, terrazzo tiles and glassphalt.

Paper

Paper products have many recyclable uses. However, for the best quality consumer products the wastepaper needs to be separated into its various grades. Each grade then has end uses suitable to its quality. The technologies used to produce paper products are described as:⁹²

- ▶ Standard paper products: Involves pulping, sheet forming and conversion to final form. These products include all paper and paperboard products in sheet form.
- ▶ Molded pulp products: Involves pressing pulp through a mold.
- ▶ Dry-process paper products: Involves processing the paper without pulping; includes shredded paper products.

As reported by Gainer & Associates, "Standard paper products account for approximately 96 percent of all paper produced in the United States, with molded pulp and dry-process products roughly splitting the remainder."⁹³ The following table and graphs illustrate the end uses of each grade of wastepaper. The table points out what the wastepaper is processed into and then examples of the uses of those products. The pie graphs then show what percentage of each grade of wastepaper is made into the end-use products.

End Uses of Recycled Paper

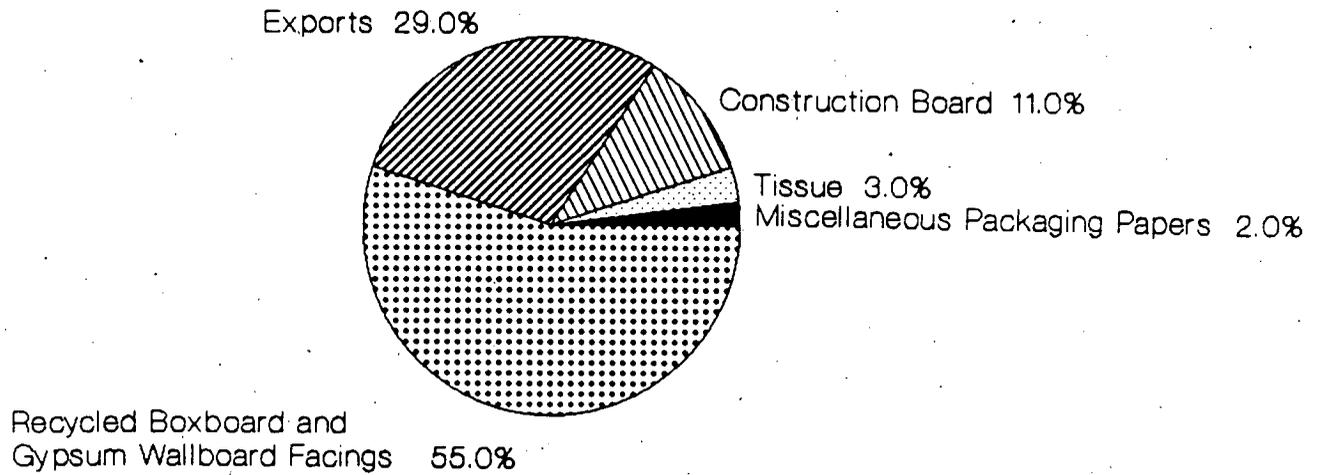
<u>Grade</u>	<u>Recycled</u>	<u>Type of Finished Products</u>
White News Blank	Ground Wood Pulp Substitute	Ground Wood Printing Papers
Publication Blank	Liner for Cylinder Board Grades	Paper Cores for Toilet Paper
Hard White Envelope	White Core Stock - Fine Paper	Tablets, Printing Paper, Bond
No. 1 Book Stock/ No. 1 Flyleaf	Deinking Grade for Book Paper	Printing Papers
Colored Ledger/ White Ledger	Deinking Grades for Book and Bond Paper	Printing Paper, Towel, Toilet,
Colored Envelope	Deinking for Tissue	
Corrugated Containers	Jute Liner Board, .009 Corrugated Medium for strength and drainage in cylinder board grade	New Corrugated Containers (Boxed), Paper cores for toilet paper, etc. and "News" plus suit boxes, beer, solid fiber containers, carry-out cartons for bottles and cans
New Double Kraft Lined Corrugated Cuttings	Same as for corrugated except higher grade uses or requiring less equipment; Direct Kraft pulp substitute	
Mixed Paper	Roofing saturating felt Chip Board	Tar paper for roofs Paper cores for toilet paper, etc.
Newspaper	Deinked Newsprint Insulating Board Back Line for Cylinder Board Grade Building Board Grades Shredded Paper Molded Products	Printing Newspapers Insulating Houses Paper Cores for Toilet Paper, etc. Building Houses and Inside Walls Packing Materials Egg Cartons

Source: Jack Surmani, CSUS Recycling

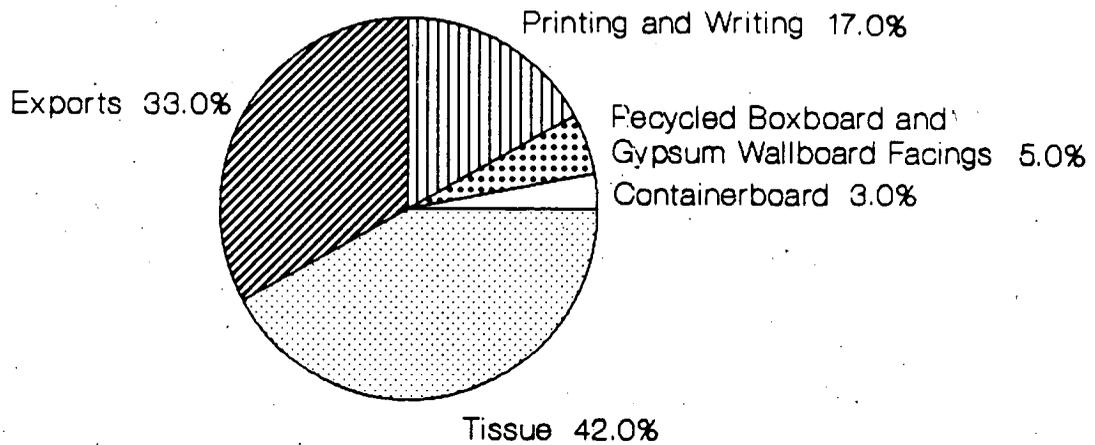
WHERE GRADES OF RECYCLED PAPER GO . . .

. . . and What they Make

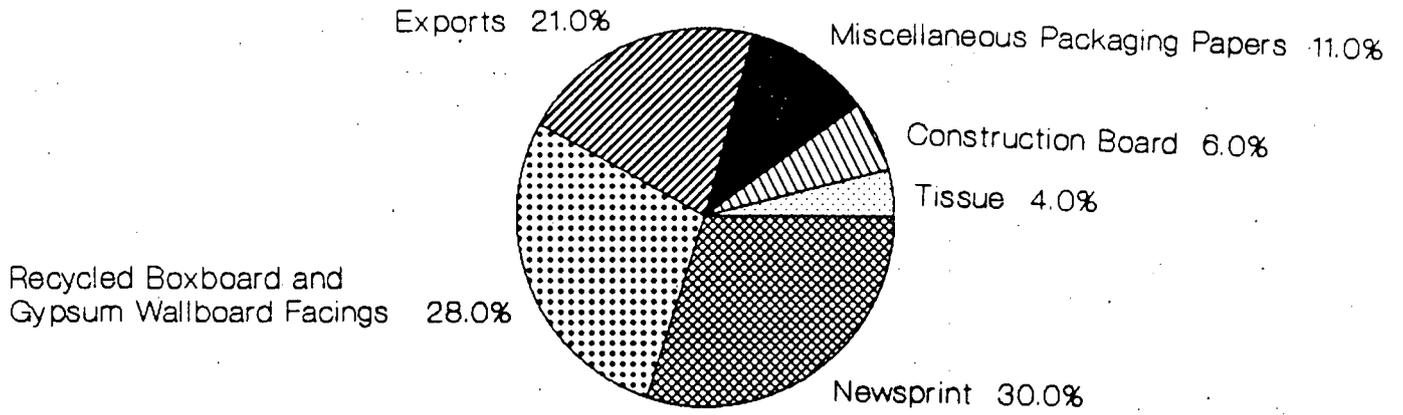
Mixed Paper



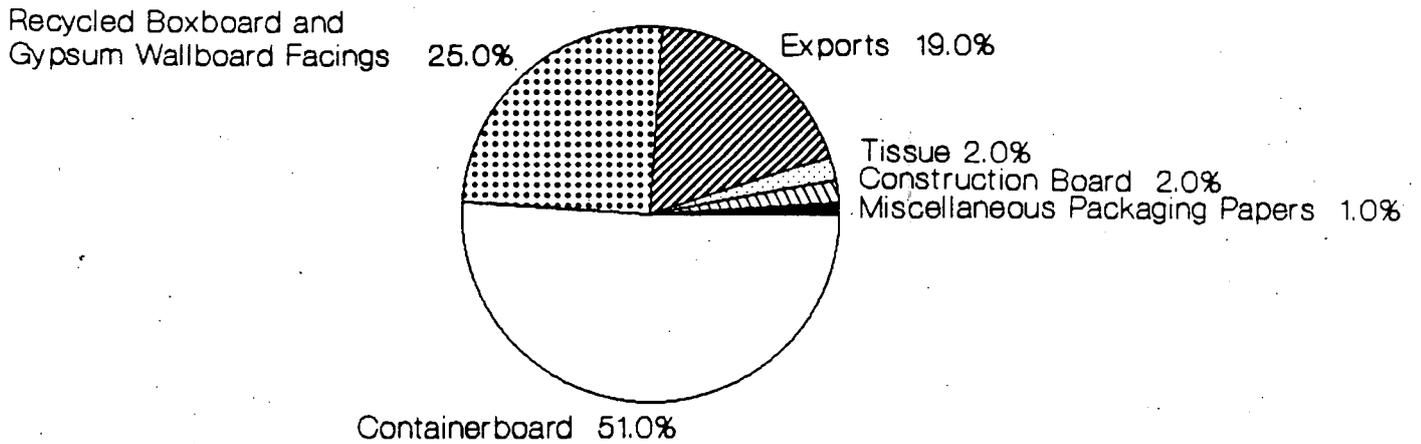
High Grade Paper



Old Newspapers



Old Corrugated Containers



Source: American Paper Institute, 1988

Molded pulp products have other niches in the market besides egg cartons. These products are good for packaging any fragile object, such as electronic components, art objects, and agricultural and food products.

Cellulose insulation is a growing industry for the dry-process paper industry. Shredded wastepaper is also being used for garden mulch, kitty litter, animal bedding, fillers and fireplace logs.

INDUSTRY'S AND CONSUMERS' OPINIONS

In theory, a policy forcing residents to bear the marginal cost of disposal will cause people to recycle more materials. This increase in supply of recycled materials will decrease the price of recycled materials. The lower prices will allow industries to buy more recycled materials and use less virgin materials.⁹⁴ Therefore, the recycling industry has general positive feelings towards mandatory recycling programs. However, the paper industry is concerned about the oversupply of wastepaper on the West Coast, like there is on the East Coast. It is also concerned about the effects on dealers' businesses and about quality problems.⁹⁵ The glass industry supports mandatory recycling as an effective and easy way to generate greater supplies of glass at reasonable prices. However, the industry believes the City should not be doing the processing and marketing of the materials, because it requires specialized knowledge and substantial investments.⁹⁶

The public is also part of the end-use market, the completion of the cycle. It will be important for consumers to "buy recycle" in order to sustain a market for recycled materials. A nationwide Gallop Survey reported that "more than 90 percent of consumers are willing to make a special effort to buy products from companies trying to protect the environment. More than 90 percent say they would sacrifice some convenience, such as disposability, in return for environmentally safer products or packaging. Nearly 90 percent are willing to pay more for them."⁹⁷ According to recent market research by the Council for Solid Waste Solutions, "Americans increasingly look to environmental friendliness of a product before making their purchase. One of the criteria repeatedly leading to a product purchase is recyclability."⁹⁸ Besides the individual consumer, business and government agencies must purchase recycled products in order to complete the recycling process.

However, there is still some resistance to using recycled products from the people who remember the quality of such products as the recycled paper produced in the 1970s. Since then there have been major improvements in the quality of recycled paper, though City employees have found even today's recycled paper may not be able to fill certain needs for high quality paper. Sacramento's Data Management Department has found that using recycled computer paper creates difficulties in processing documents. The Central Services Section, which handles the City's printing, has not yet found a brand of recycled paper that can handle its high-speed copiers. The government has also questioned the use of recycled paper for archives. The State is now conducting research in the area of paper used in archives.⁹⁹

MARKET DEVELOPMENT STRATEGY

As mentioned earlier in the report, one of the most important elements of this research would be the investigation of how to attract recycling manufacturers to Sacramento.

Research staff has outlined a four-point approach, called the "Market Development Strategy." This strategy involves the following categories:

- ▶ Procurement
- ▶ Attraction
- ▶ Contingency Plans
- ▶ Promoting Legislation

These four points were borne out of the interviews and research done by staff in their investigation to find out what efforts have been successful and which are appropriate to enhance the City's chances of locating recycling manufacturers.

Procurement

Procurement practices by the City and other government agencies can instigate the development of markets by stimulating a demand for recycled products. The City of Sacramento's procurement practices can set an example for private sector firms and other public agencies in their efforts to promote recycling-conscious purchasing. The City of Sacramento currently has a procurement policy which gives a five percent preference to vendors using recycled products and targeting the content of recycled materials in the products. The following outlines ideas that are recommended options which can be used to promote the use of recyclables.

From the public sector side:

- ▶ Prepare a guide to purchasing and using recycled products for City departments including a list of available products, how to obtain them, how to minimize costs, and how the departments can adapt their operations and equipment to use recycled paper and other recycled/recyclable products.
- ▶ Continue to identify recyclable items that can replace nonrecyclable materials and products for the City's General Services Department buyers to use potentially in future purchases.
- ▶ Enable City's General Services Department to pay more for materials and products with the highest percentages of recyclable content.
- ▶ Ensure that specifications for bids do not discriminate against recyclable or recycled products.¹⁰⁰
- ▶ Require a graduated increase in the minimum content regarding recycled materials in City contracts, i.e. glassphalt.
- ▶ Investigate the feasibility of using recycled paper for City grants, contracts, and other agreements.
- ▶ Explore the availability of regional buying pools with other local governments and industries and recommend the creation of such elements for cost savings in the purchase of particular recycled materials and products.
- ▶ Prepare standards which require City and Sacramento Housing and Redevelopment Agency construction projects to have a minimum percentage of recycled materials utilized.

The following are options which involve the promotional activities regarding the private sector participation:

- ▶ Promote the City's insight on purchasing recyclable materials and products to local businesses.

- ▶ Prepare a model procurement policy regarding recycling for use by local businesses and promote its use through local chambers of commerce, i.e. Metropolitan, Black, Hispanic, Filipino.
- ▶ Prepare a guide to purchasing and using recycled products for private firms.
- ▶ Provide City Council recognition for those that do recycle.

Examples of legislation promoting procurement of recycled products are AB4, AB1306 and SB2195. These acts encourage the University of California to purchase recycled paper products, the Department of Transportation to use recycled materials in paving roads, and the State of California to purchase compost, recycled plastics and retreaded tires (Appendix A). These efforts should help increase the sales of recyclable products in Sacramento, and illustrate an environment which is looking for business and industry involved in recycling.

Attraction and Expansion Activities

This section entails the retention and attraction of businesses involved in the manufacturing of products from recycled materials. Sacramento, like other California cities, is just beginning to look at attracting this type of industry. The Institute for Local Self Reliance estimates that reuse of recycled materials where they are collected could produce 57 new businesses, 1500 new jobs and add over \$280 million to the local economy in a city of one million¹⁰¹. Given this, the importance of this industry is certainly evident. Secondly, this is a new industry creating new jobs for Sacramentans. Therefore, as part of the effort to retain and attract these types of manufacturers, the Office of Economic Development has outlined the following strategy:

- ▶ Have staff from the Department of Planning and Development earmark appropriate zoning for these industries to locate (M-2 zoning).
- ▶ Formulate a Response Team Program to assist in siting facilities (i.e., Office of Economic Development acts as permit liaison).

- ▶ Target specified companies which do or could utilize high volumes of recycled materials; request SACTO to assist with this effort while on recruiting trips (when and where possible).
- ▶ Site manufacturers in the Florin-Perkins/Power Inn Enterprise Zone (State program, M-2 zoning), allowing companies to take advantage of the tax credits and incentives.
- ▶ Have City staff work to achieve the approval and certification of a State Recycling Development Market Zone in one of the industrial areas, such as the Florin-Perkins/Power Inn area, thus complementing efforts with the Enterprise Zone.

Contingency Plans

Contingency plans "identify alternative markets, uses or processing options for materials whose market demand is weak or unstable."¹⁰²

- ▶ Identify materials where market demand is exceptionally weak, particularly where the loss of one market might compel the landfilling of these materials.
- ▶ Identify alternative uses for materials with weak markets, and identify any procurement policies, legislation, or economic development efforts needed to diversity markets for such materials.
- ▶ Establish trigger mechanisms to direct recycled materials to other uses once the value of materials falls below established standards.
- ▶ Explore potential coordination of the sale of recycled materials with other cities in order to leverage bargaining power with domestic and export mills or industries.
- ▶ Explore possibilities for short-term stockpiling of materials in case of weak markets.
- ▶ Pursue joint marketing agreements with cities and counties in the Sacramento area and set price benchmarks with them at which point the cities and counties may voluntarily withhold materials from buyers until prices increase beyond the benchmark.
- ▶ Seek standby contracts with buyers so that alternative markets can be utilized if the optimal market for a given material weakens.

- ▶ Work with local universities to develop a technology transfer program for new products and new markets for recycled materials, and explore the development of an award program.
- ▶ Create a program to encourage the private sector to develop new products, new markets and new uses for materials recycled in the City.

Promoting Legislation

Another strategy element aimed towards recycling is promoting local, state and federal legislation. Government can take a role which encourages the production of goods and services that increase economic activity yet discourage those that entail external diseconomies. In the case of air and water pollution, when a company or individual dumps waste into the water or air, other firms or individuals often must pay all or part of the cost(s) of putting the water or air back into a usable state. Thus, the disposal of these wastes entail external diseconomies. Unless the government prohibits certain kinds of pollution or enforces specific quality standards or changes polluters in accordance with the amount of waste they dump into the environment, there will be undesirable levels of pollution. Therefore, the City can take an active position in examining the following options in an effort to promote recycling and subsequent market development.

- ▶ Require public agencies which generate "confidential" wastepaper to use shredders so the paper can be recycled. Encourage private businesses to do the same.
- ▶ Support processing fees, deposits or similar items to be placed on recyclable materials which have no redemption values.
- ▶ Examine fees or surtaxes on virgin materials used in production.
- ▶ Examine legislative action which would mitigate environmental damage from production using virgin material.
- ▶ Encourage the establishment of minimum content laws in the state.
- ▶ City policies should be continued to reduce the wastepaper stream from City departments through increased efforts.

THE BOTTOM LINE

Research by the Glass Packaging Institute found that the revenue from a typical city recycling program comes from material redemption. Sacramento's Public Works Department projected the revenues from its source-separated curbside recycling program of 25 percent of the residential households will amount to \$40,000 a year. Avoided landfill costs are projected at \$58,000. The capital expenditures for the collection of the materials will total \$1.01 million. Ongoing expenditures associated with separation will approximate \$510,000 a year. It is obvious the revenues from the collected materials will not cover the costs of the program. However, City Council direction to reduce diseconomies by looking beyond to the social costs, which will eventually realize themselves as clean-up costs or as increased fees for landfills sited outside of the urban area, will more than outweigh these costs. Cities like Austin, San José, and Charlotte have recycling programs that are not expected to be cost effective oriented for ten years. Nevertheless, developing an economic strategy for the city's program will add new businesses, jobs and will have an overall positive impact on the Sacramento economy.

Finally, this report outlines options pertinent to Sacramento's residential curbside recycling program. Further analysis will be needed to examine the commercial aspect. It is hoped by all who worked on this report that it will find its way into the hands and minds of others with similar questions and help them in their recycling efforts.

CONCLUSION

Office of Economic Development staff who were charged with the task to examine the economics of recycling have learned many new facts. For example, the process of recycling a ton of recycled paper saves:¹⁰³

- ▶ 4,102 kwh energy
- ▶ 7,000 gallons of water
- ▶ 60 pounds of air pollution
- ▶ 3 cubic yards of landfill space

Presented in this document are acronyms such as OCC, HDPE, and PET, to mention a few which probably will be known by every man, woman and child in years to come as our society becomes increasingly conscious of the environmental material impacting us.

The process of recycling has been around for decades. But never in the history of mankind has the concern been so great to resolve the issue based upon economics as it is today.

Given this, and an industry in its infancy, counties and municipalities are falling over one another looking to experts for answers, but few to none exist to respond to our list of needs. We must be patient, but also diligent. As illustrated in this research, there are private costs, social costs, and opportunity costs. Sacramento will only know these costs through time.

As the World Watch Institute predicts, "If a sound economy is to be achieved over the next 40 years, it will rely heavily on recycled materials and much less on virgin materials."¹⁰⁴ By balancing the market's ability to allocate resources with government intervention, a recycling system can contribute to a sustainable society.

APPENDICES

APPENDIX A: CURRENT LEGISLATION

STATE LEGISLATION -- SUMMARY OF BILLS

COUNCIL RESOLUTION 89-685

APPENDIX B: INDUSTRY'S ENERGY-COST SAVINGS

APPENDIX C: THE OPTIMAL AMOUNT OF POLLUTION

APPENDIX D: PRICE ELASTICITY

**APPENDIX A
STATE LEGISLATION AND LOCAL ORDINANCES**

- AB939** Assemblymembers Sher, Eastin and Killea, Senators Roberti and Vinich.
This bill generally regulates the disposal of solid waste. The bill imposed a state mandated local program, setting reduction of waste dumped into landfills by 25% in 1995 and 50% in 2000. This bill also calls for the reorganization of the California Integrated Waste Management and Recycling Board.
- AB4** Eastin
This bill requires the University of California and California State University to strengthen procurement of recycled products through purchasing processes.
- AB1306** Killea
This bill requires the Department of Transportation and State Procurement Office to review and modify bid specifications for paving materials to use recyclable materials.
- SB1322** This bill would require the California Waste Management Board to implement specified State programs to promote integrated waste management, including resource recovery, recycling and composting, of specified materials, develop markets for recovered materials, and to provide technical assistance and public information related to waste management. This bill also requires the State Board of Education to include integrated waste management in the science framework in specified study areas.
- SB2195** Bergeson
This bill makes all product specifications that the Department of General Services prepares for goods containing recycled materials for specified contracts for the purchase of goods not subject to specified review and adoption procedures of the Administrative Procedure Act relative to the adoption of administrative regulations.
- AB1305** Killea
This bill requires the State's Department of Conservation to develop and maintain a list of consumers of newsprint and suppliers to those persons because as of January 1, 1991, this bill will require every consumer of newsprint to ensure that at least 25 percent of all newsprint is made of recycled-content newsprint.
- AB2622** Eastin
Existing law does not require glass used for food, drink or beverage containers in California to contain recycled glass. This bill requires that each glass

container manufacturer use a specified minimum percentage of California postfilled glass in the manufacturing of glass, food, drink or beverage containers.

SB2092 Hart

This bill, come Jan. 1, 1993, requires each seller of specified trash bags to certify it has used a certain percentage by weight of recycled postconsumer material.

SB2532 Marks

This bill enacts the Clean Glass Recycling Act of 1990. The bill prohibits the sale, manufacture or distribution of beverage and food containers made of glass which contain ceramic materials on or after January 1, 1991.

AB1308 Killea

This bill would, until 1994, provide a credit under the personal income tax law of California in an amount equal to a specified percentage for each of three specified years, of the purchase price paid or incurred by the taxpayer for property such as machinery or equipment used to manufacture finished products composed of secondary material. The amount credited not to exceed \$250,000.

SB432 Alquist

This bill is the same as AB1308.

SB2894 Alquist

This bill involves tax credits involved with the purchase and acquisition of machinery and equipment for the use of manufacturing goods composed of secondary material.

AB1307 Killea

This bill allows for the inclusion of those activities or uses processing or manufacturing recycled or revised products and materials by allowing the use and subsequent issuance of industrial development revenue bonds.

SB2310 Bergeson

This bill, until July 1, 1997, authorizes California Integrated Waste Management Board to make low-interest loans under specified conditions to local governmental agencies and private business entities within a recycling market development zone from the Recycling Market Development Revolving Loan Account.

SB1322 Market Zones(Brief not included)

SB1200 Oil Recycling Incentives(Brief not included)

AB1490 Bottle Bill/Recycling Centers and Drop-Offs(Brief not included)

Sacramento City Resolution 89-685

This Resolution establishes recycling and waste reduction goals and directs staff to develop recommendations for implementing a curbside recycling program.

APPENDIX B
INDUSTRY'S ENERGY-COST SAVINGS AND IMPACT ON THE ENVIRONMENT

An established recycling program will have the following effects on the environment and manufacturers:

- ▶ Conserve energy during production of new products by using recycled instead of virgin materials
- ▶ Reduce use of virgin resources
- ▶ Reduce toxic pollution of land, water and air

The California Department of Conservation describes, "Energy-cost savings . . . may represent a significant reason why . . . manufacturers will sustain continued interest in recycling."

[Without] the enthusiastic participation of industry . . . there will be no markets for recycling, therefore no place to use the additional secondary materials created by [recycling legislation]. In that context, energy-cost savings represent a key ingredient needed to support and sustain the [recycling] program Because significant energy-cost savings, historically, have been a key reason for the use of recycled products in manufacturing, it is both important to understand their contribution to the overall rationale for recycling and the need to make information about energy savings widely available in support of increased recycling in California.¹⁰⁵

Because of the significant energy cost savings associated with some recyclable materials, it will be advantageous for industries to locate in a region where they can obtain a stable supply of recycled materials (taking into account other optimistic market considerations also).

The following table illustrates the energy saved when using recycled materials for manufacturing instead of virgin materials.

ENERGY SAVED BY USING RECYCLED MATERIALS IN MANUFACTURING RATHER THAN VIRGIN MATERIALS

<u>Recycled Materials</u>	<u>% of Energy Saved</u>
Scrap in general	Up to 97
Aluminum	92
Plastic	85-90
Steel	80
Paper	70
Glass	12

Source: City of Sacramento

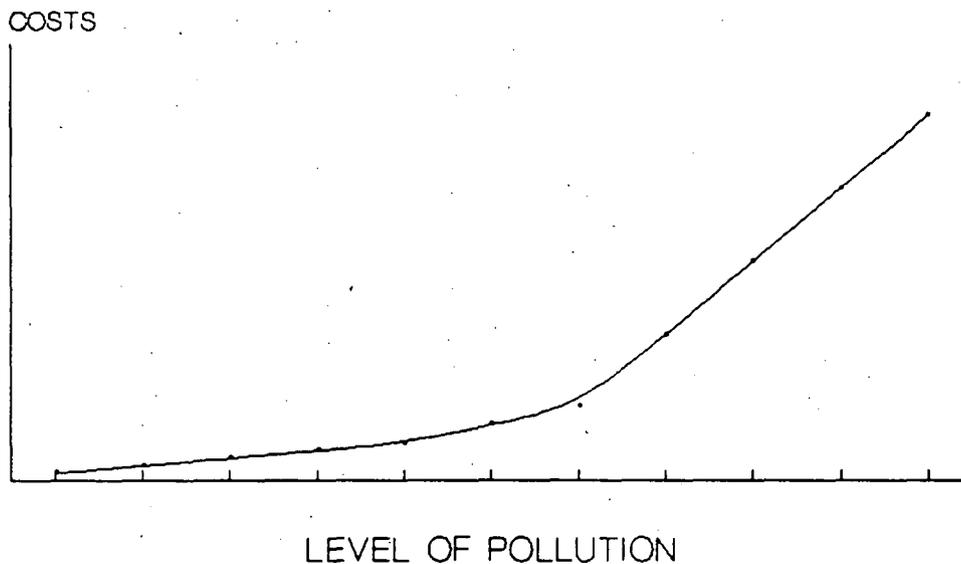
The energy used to produce packaging materials represents 3 percent of the United States' energy use.¹⁰⁶ From a global perspective, energy use leads to such consequences as global warming, acid rain and oil spills. The use of recycled materials instead of virgin materials will reduce environmental damage caused by mining, logging and manufacturing of virgin materials. Gubbels quotes a concerned person, "What I can't understand is why everyone says the problem is a glut of newspaper? Isn't the real problem that we have a glut of trees being made into newsprint?"¹⁰⁷

Neil Seldman from the Institute for Local Self Reliance reports that approximately 50 percent of the solid waste pollution in the United States comes from the manufacturing, distributing and disposal of materials.¹⁰⁸ Processing virgin materials generate 20 to 90 percent more pollution than processing recycled materials.¹⁰⁹ By doubling worldwide aluminum recovery rates, Goldsmith says, "over a million tons of air pollutants -- including toxic fluoride -- would be eliminated."¹¹⁰ Reilly points out that processing scrap glass alone will produce 20 percent less air pollution and 50 percent less water pollution during manufacturing than using virgin materials.¹¹¹ Using wastepaper will reduce the air pollution during production by 75 percent.¹¹² Again, such environmental considerations can make the use of recyclable materials advantageous for processors and manufacturers.

APPENDIX C THE SOCIAL COST OF POLLUTION

When sulphur oxides are spewed out into the atmosphere, individuals may suffer more respiratory diseases, feel worse, and work less efficiently. Society incurs a cost from that pollution. When chemicals are dumped into waterways, the fish population may suffer and swimmers may have to avoid the water, which may be unfit to drink. The costs associated with different types of pollution are the costs that all members of society bear. What are these costs? If you lived in a society with 100 members and if each of you would suffer damages equivalent to 1¢ more per year. If one more unit of pollution occurred, then the marginal social cost of pollution would be $1¢ \times 100 = \$1.00$. An economist would determine the relationship between the amount of these costs and the level of pollution. This, then, would look like the hypothetical curve in Exhibit 1. Here it is, illustrating that the greater level of pollution, the higher these costs will be.

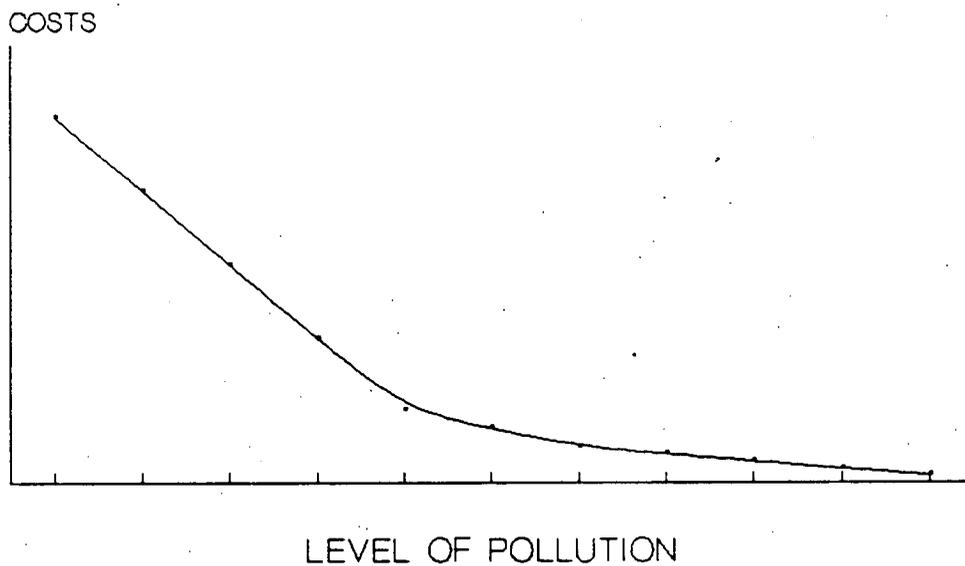
Exhibit 1
Cost to Society of Pollution



THE COSTS TO SOCIETY OF POLLUTION
INCREASE WITH THE LEVEL OF POLLUTION

But these costs are not the only ones that must be considered. We must also take into account the costs of controlling pollution. In other words, society must look at the costs to maintain the levels of environmental quality. However, these costs are not trivial. To maintain a very low level of pollution, it is necessary to invest heavily in pollution control equipment. An economist would graph this based upon the costs of pollution control and the level of relationship between the sum of these two costs and the level of pollution. This, then, would look like the hypothetical curve in Exhibit 2. Here it is illustrated the more pollution is reduced, the higher the costs to society of pollution control.

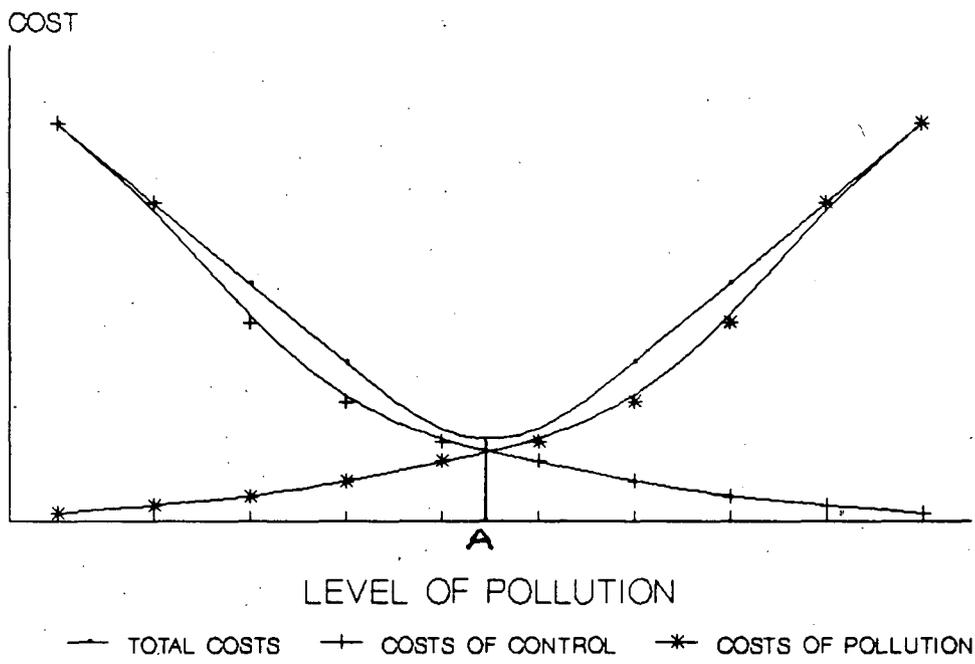
Exhibit 2 Cost to Society of Pollution Control



THE MORE POLLUTION IS REDUCED, THE
MORE THE COSTS OF CONTROL INCREASE

To indicate the relationship between these two types of costs and the level of pollution, an economist would illustrate the level of pollution at which the sum of these two types of costs would be minimal. This, then, would look like the hypothetical curve in Exhibit 3, where it is illustrated that the optimal level of pollution is at Point A, since this is where the total costs are a minimum. Below point A, the cost to society of more pollution is less than the cost of preventing it. It is easy to draw hypothetical curves, but it was not so easy for staff to measure these curves. Unfortunately, no one has a very clear idea of what the curves presented really look like, although through research they look like those illustrated. Thus, no one really knows just what level of pollution our environment is at and how clean the environment should be. Experts differ on the nature and extent of the programs which should be carried out. However, it is evident that through the City's curbside recycling effort, Sacramento is working towards the optimal level of pollution as illustrated.

Exhibit 3
Optimal Level of Pollution



APPENDIX D IMPACTS OF PRICE ELASTICITY

The City of Sacramento, in its efforts to understand its recycling operations, must first understand how the State of California will set statewide redemption values and how this action will impact the revenues received by the City from the redemption of its collected recyclables.

This short presentation examines the consequences associated with the ability to measure the responsiveness of the quantities demanded and supplied of recyclables to changes in relative prices, otherwise known as elasticity.

The State of California is in a real crux. When should it raise redemption values, and how much, if at all? One must know how buyers of recyclable materials will respond to the higher price. If these buyers don't change their buying decisions very much when the price is raised, total revenues may increase. For example, if the State raised redemption values by 10%, the purchasing of recyclable materials in the state may fall, remain constant, or rise. The answer depends on how much the quantity demanded changes due to the price increase.

Returning to the example equation considered by the State, should the price of recyclables be raised and, if so, by how much? Part of the decision rests on what will happen to revenues for the cities and counties as a result of the price change. It is commonly thought that the way to increase receipts is to increase prices, however this is not always the case. It is possible that an increase in the redemption value could lead to a decrease in revenue for the cities and counties, because the redemption price may be too high and buyers of recyclable materials may turn to virgin stock or go out of state to purchase recyclables as a substitute at a lower price.

This causes a delicate balancing act for the State in its efforts. It is readily apparent through this discussion how important it is for the City to be aware of this action, for if a higher value is placed on the recyclables, the market will move elsewhere, thus causing an adverse effect on the City's efforts to be cost-recovery oriented in this process.

GLOSSARY

Broker: Buys and sells recyclable materials; a broker can work for a MRF or processor to find buyers of the processed recyclable material; reclaimer companies have brokers buying specific types of recyclable materials for their own use or for resale.

California Redemption Value: The minimum value that a recycler (collector) certified by the Division of Recycling, Department of Conservation must pay to an individual redeeming beverage containers bearing the California Redemption Value (CARV) label. A processing fee is then paid to collectors by the State. If there are more middlemen in the process, then the last party to sell the materials directly to the manufacturer or reprocessor will collect the processing fee from the State. So the processing fee, or Redemption Value, is actually passed down from the State through every transaction made until that value is given to the public. A market value, or scrap value, is then added onto the Redemption Value at every transaction. Beverage manufacturers or reproducers must pay a processing fee to the State which is deposited into the California Beverage Container Recycling Fund. This Fund is what supplies the fees going to collectors by the State. The Fund also is drawn from for other designated recycling activities.

Collectors: Can be dropoff or buyback centers, curbside collectors or nonprofit groups with recycling programs. They sell the collected materials to either processors or reclaimers.

Deinking: Process of mixing wastepaper with water to separate the paper fibers to form pulp. The pulp is cleaned to remove contaminants.

Economy of Scale: Output increases more than in proportion to the change in inputs.

End users: Can range from the reclaimers to the consumers; reclaimers use recyclable materials such as feedstock to make new products; manufacturers use materials made from recycled materials in their feedstock to make new products; consumers are end users when they buy products made from recycled materials.

Externality: A situation in which a private cost diverges from a social cost, in which the cost or benefits of an action are not fully borne by the two parties engaged in an exchange or by the individual engaging in a scarce resource-using activity.

Flotation process: New deinking process which is improving the quality of recycled paper; results in lower fiber loss and better ink removal than the old wash process; requires clay to facilitate ink removal and old magazines are providing a cheap source for the clay and fibers.

Glass cullet:

Recyclable Glass Cullet: Broken scrap glass that is derived from post-filled food or beverage container glass.

Manufacturer's Glass Cullet: Broken glass used in raw material mixture to produce new glass products; can be made in-house or bought from recyclers.

HDPE: High-density polyethylene; examples: plastic juice and milk containers, hard bases for plastic soft drink bottles, other bottles and containers and some molded products

High-grade paper: Office paper; printing and writing paper; white ledger, colored ledger and computer paper.

LDPE: Low-density polyethylene; examples: grocery bags, thin film plastic used for packaging.

MRF: Material Recovery Facility, Multi-Material Recovery Facility, Municipal Recovery Facility; a processing facility which sorts any range of recyclable materials to prepare them for market.

Normative Economics: Analysis involving value judgments about economic policies.

OCC: Old Corrugated Containers, Old Cardboard Containers.

ONP: Old Newspapers.

Opportunity Costs: The highest valued alternative that must be sacrificed to attain something or satisfy a want.

Organics: Includes food, yardwaste, leaves and grass, and other organics.

PET: Polyethylene terephthalate; examples: plastic soda bottles.

Polystyrene: Commonly known as styrofoam; examples: food and beverage containers.

Positive economics: Analysis that is strictly limited to making either purely descriptive statements or scientific predictions.

Post-consumer waste: Finished material which would normally be disposed of as a solid waste, having completed its life cycle as a consumer item; example: used newspaper, office paper, yard waste, tires, plastic bottles, etc.

Pre-consumer waste: Waste materials or by-products generated after manufacturing of a product is completed, but before the product reaches the end-use consumer; examples: obsolete inventories of finished goods, rejected unused stock, paper wastes generated during printing, cutting and other converting operations; does not

include mill or manufacturing scrap generated at manufacturing site and is commonly reused within the manufacturing process.

Private costs: Those costs incurred by individuals when they engage in using scarce resources. For example, the private cost of running an automobile is equal to the gas, oil, insurance, maintenance and depreciation.

Processing: Reduction, separation, recovery of waste; a recycler processes materials by cleaning, removing contaminants, sorting and densifying them; reclaimers will process materials further. Metals are processed by smelters and sold to end users; Glass is processed by bottlers and other end users; Plastic can be processed in pellets or left as granulation and sold to end users; Paper is processed by pulp mills, paper mold mills or reclaimers who shred the paper; the processed paper then is sold to end users.

PVC: Polyvinyl chloride; a hard plastic most commonly used for tubing, some molded products, and some water bottles.

Reclaimers: Processors or manufacturers who buy the recyclables from the collectors.

Reprocessor: Term used to describe reclaimers who process the recyclables, usually mixing them with virgin materials, to produce a material or product for manufacturers to use. Also referred to as a processor.

Secondary Waste: Recycled materials; fragments of products or finished products of a manufacturing process which has converted a virgin resource into a commodity of real economic value, and includes post-consumer waste.

Social Costs: The full cost that society bears when a resource-using action occurs. For example, the social cost of driving a car is equal to all of the private costs plus any additional cost that society bears, including air pollution and congestion.

Solid Waste: All putrescible and nonputrescible solid, semi-solid and liquid wastes, including garbage, trash, refuse, paper, rubbish, ashes, industrial wastes, demolition and construction wastes, abandoned vehicles and parts thereof, discarded home and industrial appliances, dewatered, treated, or chemically fixed sewage sludge which is not hazardous waste, manure, vegetable or animal solid and semi-solid wastes, and other discarded solid and semi-solid wastes.

Tipping fee: Fee charged for dumping waste in disposal facility.

Waste exchange: Organizations, either private, public or nonprofit, which provide the service of matching buyers and sellers of waste materials; exchanges provide listings of available wastes and other environmental information pertaining to resource recovery.

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