
SINGLE STREAM

An Investigation Into the
Interaction between
Single Stream Recycling Collection Systems
and Recycled Paper Manufacturing

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TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
INTRODUCTION	6
LOCAL GOVERNMENTS	8
Method	8
Results	9
Process	9
Cost	10
Increased Tonnage	10
Participation	10
Contamination	10
Glass	11
Motivation	11
Knowledge of Paper Markets	12
SINGLE STREAM SORTING FACILITIES	13
PAPER BROKERS	14
PAPER MILLS	15
Quality	16
Glass	17
Equipment Damage	17
Worker Safety	17
Customer Safety	17
Public Confidence	17
Plastic	18
Proposed Solutions Do Not Solve the Problems	18
Drum Pulpers	18
Fiber/Glass Sorting System	18
Beneficiation	18
China	19
White Paper	19
Reversion to Virgin Fiber	20
CASE STUDY: SONOMA COUNTY SINGLE STREAM MRFS	21
Empire Waste Management	21
Northbay Disposal Services	21

CONCLUSIONS	22
Observations	23
Recommendations	25
Summary	27
REFERENCES	27

TABLES

Table 1. U.S. Single Stream MRFS, March 2002	6
Table 2. Local Governments Contacted	8
Table 3. Single Stream Sorting Facilities Contacted	13
Table 4. Paper Brokers Contacted	14
Table 5. Paper Manufacturing Mills Contacted	15

EXECUTIVE SUMMARY

Many Sonoma County towns and cities are moving to single stream systems as their recycling and solid waste collection contracts come up for new bids. The County also features two materials recovery facilities (MRFs) that handle the single stream materials. Single stream is gaining favor in the rest of California and other parts of the country, as well.

Local governments report many reasons for single stream collection's appeal:

- Considerably higher volume,
- Possibility for more household participation,
- High public approval because it's so easy and convenient,
- Higher diversion rates, especially for cardboard and paper,
- Reduced risks to workers, especially when the system is automated,
- Wider range of workers qualifying for the automated collection jobs,
- Greater efficiency and productivity, especially with automation,
- Lower costs, including cost savings on worker compensation, and
- Opportunity to add new materials to collection systems, especially green waste.

Most see little or no downside to single stream collection. When pressed for negatives, they name increased contamination, sacrifice of some product quality, and initial capital costs, including new carts and building a MRF (but not all local governments incurred those costs).

Approximately 75-80% of the material that comes into single stream collection systems is paper fiber. Some single stream MRFs report that their fiber is clean enough to be sold as a #7 or #8 news (ONP), although there is wide acknowledgement that the specifications for what constitutes a #7 or #8 news grade are "slipping" and the quality is not as high as the Institute for Scrap Recycling Industries (ISRI) standards actually require.

Yet despite single stream's popularity with local governments in Sonoma County and throughout California, many recycled paper manufacturers object to using materials from these systems. For the most part, single stream collectors have tended to ignore or explain away paper industry criticisms of the system.

Notably, while single stream collectors chart their success by the quality of ONP they produce, newsprint mill representatives described serious problems with using the fiber, even those mills that have added equipment to further sift and sort fibers before use. Not surprisingly, the mills that were most negative about single stream fiber make products such as tissue or high-end food packaging that require high quality fibers, while those that were most positive make low-end packaging and construction products or other types that can more easily incorporate low quality fiber. Even those who buy from single stream programs, however, described problems with using the fiber.

Mill representatives reported that glass is a severe problem for them and that the MRFs are not doing a good enough job of getting it out. The glass causes a number of problems:

- Equipment damage. The glass gets into gears, bearings, and gasket seals; clogs screens; and works like sandpaper to wear down parts. The screens cannot completely keep it out of the finished products.
- Worker safety. While the local governments like single stream because it reduces collection workers' risks, the paper mills feel that the safety problem has not been solved. Rather, it has just been pushed up the line to them.
- Customer safety. The glass sometimes gets picked up in the finished products.
- Public confidence. Finished products contaminated with glass have been pulled and disposed of at the mills. If the public comes to believe that they cannot trust the safety of recycled products and therefore refuses to buy them, community collection programs will be threatened, too. Guaranteeing recovered fiber of sufficient quality to make safe and high-quality products is key to the future of local government collection systems.

The mills are also having trouble with plastic, especially plastic bags and newspaper sleeves. One packaging mill representative told us that there is so much plastic mixed into the fiber coming in from single stream systems that any three bales of paper result in two full gaylord containers of plastic.

Local government and collection system representatives suggested solutions that they believed would solve the paper mills' problems, but these recommendations reflected a lack of understanding about the technology and its ability to solve the problems. For example:

- Paper industry technical representatives make it clear that drum pulpers have limited applicability and are not effective at all with types of paper other than newsprint.
- Several discussions with technical representatives for systems claimed to be able to sort glass from fiber have made clear that, while there are good systems for sorting fiber separately and for sorting glass separately, there is no technology that currently can effectively sort glass from fiber when they have been mixed together.
- Suggestions that the paper industry set up beneficiation plants ignore the reality that a number of newsprint mills have done just that and yet they still have problems with single stream. In addition, what benefit can the MRF claim to have added to the system if it requires an industry to add on the additional expense of intermediate processing for fully 75-80% of the MRF's material in order to make it usable?

A number of respondents told us that China has a large labor pool that can cheaply hand-sort fiber bales for their mills, which they believe are built to take lower grades of wastepaper. Chinese paper brokers told us that neither belief is accurate. Rather, the new, bigger mills coming on-line in China do not have sorting lines and are not built to take low-quality fiber. It is therefore important to consider whether the markets for low-quality fiber will be sufficient as many

more communities all over the country switch to single stream and introduce a much larger quantity into the market, since the mixed materials and low quality limit options for where the fiber can be sold.

There is also some danger that single stream collection is beginning to encroach on office paper collection systems that are necessary for supplying printing and writing paper and tissue mills. More and more offices are being brought into single stream collection routes, with some local governments even requiring it in their contracts. This raises concern about the survival of recycled printing and writing paper, which can only use clean, high grade fiber sources. It also collides with the goals of U.S., Canadian and international environmental organizations that have committed to a Common Vision to increase environmentally sustainable paper production. Many of the groups are focused specifically on driving up market demand for recycled printing and writing papers because they currently incorporate less than 5% recycled content yet offer the greatest opportunities for reducing papermaking's environmental impacts.

Collectors insist that paper mills will just have to adjust. They scoffed at the possibility that some mills would abandon recycling instead. Yet, because of the increasing difficulty in getting competitively priced high quality ONP, one U.S. newsprint mill has closed its recycling line and reverted to using only virgin wood chips, another company has closed their 100% recycled content newsprint mill, and increasingly other companies are saying they are considering closing their recycling and switching to virgin paper production as well. The Canadian Pulp and Paper Products Council announced in October 2002 that its members will tighten their requirements that ONP meet strict grade specifications because the quality they have been receiving over the past two years has been deteriorating.

Still, both the single stream processors in Sonoma County are successfully marketing their material to paper mills in China which find the fiber quality acceptable. The material from Empire Waste Management is used to make newsprint for local use in Asia, and the material from Northbay is made into the type of paperboard used in products such as shoe boxes, as well as into duplex board such as that used to make cigarette boxes.

The juxtaposition of the successful marketing of Sonoma County's single stream materials with the problems cited by paper mills is not contradictory, but actually clearly illustrates both the successes and the challenges to the recycling system posed by the current versions of single stream collection. Ironically, despite the fact that every sector in the recycling cycle is dependent on the success of the other sectors, many of the interviewees did not seem to appreciate this fundamental interconnectedness.

The recycling symbol (Möbius loop chasing arrows) reflects a continuing and interdependent system: collection, manufacturing, use of recycled content products, then return to collection. It is troubling to find in this study that these different sectors seem to be breaking apart. People within each sector seem to be losing sight of the fact that they are in a system *with* each other, that each of them impacts the others, and that the success of each is dependent on the success of the

others. The system seems to have been changed unilaterally by the collectors and many seem to no longer be concerned about the fact that it's not working for many of the manufacturers nor for producing a significant segment of high quality recycled products that purchasers will trust.

Our observations over the past 27 years in recycling suggest that the most effective driver for the entire recycling system is consumer enthusiasm for products made from recycled materials. Collection and manufacturing should both serve that goal. But our interviews suggest a loss of focus on the finished products.

OBSERVATIONS

1. Some form of single stream collection is here to stay.
2. The acceptability of single stream materials depends on the specific products to be made. The fact that some mills are able to accept single stream materials does not mean that all, or even most, are able to.
3. Single stream is beginning to siphon off materials needed by high grade paper product manufacturers.
4. Single stream collection requires us to rethink why we're recycling at all. Recycling is a cycle in which each sector depends upon the others. Therefore, it is critical that that rethinking, and the resulting decision-making, be done in collaboration with all the sectors, and not be determined unilaterally.

Collection system investments are being made now that will set the direction and capabilities of recycling for years, if not decades, to come. If they are short-sighted, they could preclude investments in the paper industry that are necessary for building an environmentally sustainable paper production system.

5. Required by state law (A.B. 939), "diversion" has become the de facto primary - and often only - goal for many communities.

Over and over, local government people told us, "Diversion is the only thing that matters to us." The California legislature and the California Integrated Waste Management Board have created state incentives that are being interpreted by haulers and local governments to prioritize diversion from landfills above, and sometimes to the exclusion of, all other values, including environmental impacts.

RECOMMENDATIONS

1. Base decisions on the health and sustainable functioning of the whole recycling system, not just part of it.

Local government collection systems, as well as MRFs and paper brokers, have an investment in the optimal functioning of the paper mills and, ultimately, in customers' acceptance and incorporation of recycled products.

2. Remove glass from single stream collection.
3. Ensure that good quality high grade paper collection sources remain reliable.

Until the time that sorting systems can reliably and cost-effectively sort high grade kraft paper from the rest of the recycling stream, office paper collection systems should be kept separate from single stream. The current market share of only about 6-7% for recycled printing and writing paper is not enough to motivate and sustain investment and development. It will not be possible to drive that market share up if the clean office paper supply diminishes.

Buy recycled campaigns can help increase demand for recycled content printing and writing papers and create incentives for collectors to maintain a high quality supply from office paper collections. But true market development for these papers will require more infrastructure investments by the paper mills, and they will not do that if a reliable furnish cannot be assured.

4. A Best Practices Manual and more education of each sector into the workings and capabilities of the other recycling sectors would be useful at several points in the system.

SUMMARY

Most people seem to expect that the single stream collection system will get better in the future. But recycling is a just-in-time system, not one that can be put on hold for the future. Products are being made now with the fiber that's being produced now. Investments are being made now that could encourage or preclude needed investments in other parts of the recycling system in the future.

Therefore, it is critical that advocates make sure that the system works well for all manufacturers who may use single stream as their fiber source or whose previous fiber source may now be going into single stream collections. Single stream may well prove to be a wise choice for the future – but only if it works better for all the sectors of the recycling cycle than it does now.

INTRODUCTION

Many Sonoma County towns and cities are moving to single stream systems as their recycling and solid waste collection contracts come up for new bids. Residents who formerly sorted their recyclables into bins for paper, plastic, glass and metals now can mix all their recyclables into one large cart. Trucks that formerly collected recyclables into several different compartments now dump them all into one, to be sorted at a recovery facility.

The county also features two materials recovery facilities (MRFs) that handle the single stream materials. One was built specifically to manage single stream, and the other, formerly a source separated recycling facility, was converted to handle the new single stream material flow.

Sonoma County's investment in single stream collection is not unusual in California. Cities up and down the state have already switched, are in the process of switching, or are studying the potential for switching to single stream collection. Most previously had bin systems that required residents to separate their recyclables before pick-up.

TABLE 1. U.S. SINGLE STREAM MRFs, MARCH 2002

LOCATION	NUMBER
West	41
South	32
Midwest	13
Northeast	2

Source: Speech by Jerry Powell, Resource Recycling, "Trends in Recovered Paper Collections and Processing," AF&PA Paper Week, March 12, 2002

Single stream is gaining favor in other parts of the country, as well. In March 2002, Jerry Powell, editor of *Resource Recycling* magazine, reported that there were currently 88 single stream MRFs in the United States. Although the largest number is in the West, single stream is also fast gaining popularity in the South.

Despite single stream's popularity with local governments in Sonoma County and throughout California, not everyone is happy with it. In particular, many recycled paper manufacturers object to using materials from single stream collection systems. The board of directors of the American Forest & Paper Association approved a policy in June 2002 opposing any collection program that includes glass with paper, and the Canadian Pulp and Paper Products Council announced in October 2002 that its members intend to enforce strict adherence to paper fiber specifications developed by the Institute of Scrap Recycling Industries (ISRI) because the quality of bales of old newspapers (ONP) has seriously deteriorated.

For the most part, single stream collectors have tended to ignore or explain away paper industry criticisms of the system. Conservatree became interested in investigating its impact when, in a study with the Alliance for Environmental Innovation into high grade deinking capacity, we interviewed the managers of all the deinking mills making high grade pulps for printing and writing papers. Most were not at all concerned about the future availability of recovered paper to meet an increase in demand for their unused capacity, but several told us they were concerned about deteriorating collection quality, particularly from single stream systems. Therefore, when the Sonoma County Waste Management Agency (SCWMA) requested that we prepare a report on potential problems created in the paper industry by single stream collection, we were anxious to investigate this as well.

This study has two purposes:

A. Interview representatives of each of the sectors involved in the paper recycling cycle to determine their experience with, and views on, single stream collection. These interviews were conducted from May to July 2002 and were focused on answering the following questions:

- a) Does single stream collection create negative impacts for recycled paper producers?
- b) If so, what are they?
- c) Is there a correlation between single stream processing systems and contamination?
- d) If so, can contamination be minimized within the single stream systems in current use?
- e) If not, how could high quality feedstock be maximized for recycled paper manufacturing?

We also attended the Canadian Paper Week in January 2003 in Montreal, co-hosted by the Pulp and Paper Technical Association of Canada, the Forest Products Association of Canada, and the Pulp and Paper Products Council, as well as the American Forest & Paper Association Paper Week in March 2003 in New York City. Single stream was a significant topic of discussion at both conferences.

B. Trace Sonoma County's collected paper to determine whether there are any problems in the

county system currently in place. These interviews were conducted in September and October 2002.

While this study was charged with being a representative overview of the situation, it is not intended to be a comprehensive or in-depth study. Rather, it is a quick survey to identify any problems that may exist, and to explain to local governments the paper industry issues with the system.

SCWMA requested that Conservatree report this information in two ways:

1. In a speech at the annual conference of the California Resource Recovery Association (CRRA). This covered only the system overview (Purpose A). Conservatree presented the initial findings of this study at the CRRA conference in Oakland, CA on July 15, 2002.

2. In a written report on all findings, including those specific to Sonoma County's existing single stream processes.

Following is the report on Conservatree's interviews with all sectors of the recycling system that are served by single stream collection.

LOCAL GOVERNMENTS

TABLE 2. LOCAL GOVERNMENTS CONTACTED

CITY	COLLECTION TYPE
Burbank	Single Stream since 1989
Glendale	Single Stream since 1999
Sacramento	Collecting Single Stream for 3-4 years
City of San Diego	Switched to Single Stream over 1999 - 2001
San Francisco	Halfway through switching city to Single Stream
San Jose	Switched to Single Stream 7/02, no data yet
Sonoma County	Many jurisdictions are switching to Single Stream over time, unincorporated areas started switching in 2001
Gainesville, FL	Non-automated, switched from one bin back to two in June 2000 because of fiber contamination
<i>City of Fresno</i>	<i>Repeated unsuccessful calls</i>

Method

Conservatree conducted interviews with representatives from eight local governments, seven of them in California, almost all of which are operating single stream collection systems.

We also learned about several other single stream collection systems around the country through various reports, including those listed in the references at the end of this report.

We asked each of the local government representatives the following questions:

- 1) When and why did you switch to single stream?
- 2) Do you see an increase in tonnage of recyclables? How much?
- 3) How do you collect recyclables – packer truck, compacted, with garbage, other configuration?
- 4) Where is it taken for processing?
- 5) How is it processed? Are the materials dropped significant distances, how are they sorted, are they screened in some way, what other processes?
- 6) What is the contamination rate for your system?
- 7) What is the nature of the contamination – are the formerly 100% recyclables reduced to a smaller percentage of recyclables along with new garbage? Or is the “contamination” materials that were collected but are not actually recyclable?
- 8) Is the diversion rate adjusted to reflect the amount of recyclables that end up going back to the landfill?
- 9) Are you happy with the single stream system? Is there any way you would do it differently if you could? What do you find to be the advantages and disadvantages?
- 10) What are your goals in implementing single stream collection – higher diversion rate, ease for citizens, reduction in costs, collecting materials for highest use recycling, other?

- 11) How do your single stream costs compare to your previous system (describe)?
- 12) Does your system produce the same quality paper product as it did before, or is it lower?
- 13) Did you sell to high grade paper markets in the past, and do you now?

Results

Those interviewed reported many reasons for single stream collection's appeal:

- Considerably higher volume,
- Possibility for more household participation,
- High public approval because it's so easy and convenient,
- Higher diversion rates, especially for cardboard and paper,
- Reduced risks to workers, especially when the system is automated,
- Wider range of workers qualifying for the automated collection jobs,
- Greater efficiency and productivity, especially with automation,
- Lower costs, including cost savings on worker compensation, and
- Opportunity to add new materials to collection systems, especially green waste.

San Francisco finds single stream a most efficient collection system for a large and crowded city. Trucks can collect more quickly, thereby reducing street obstructions. Many cities were enthusiastic about the ability to add greenwaste to their collection programs when truck compartments are freed up by combining recyclable materials into one stream rather than different compartments. In Sacramento, greenwaste is one third of the solid waste collection.

Most local government representatives saw little or no downside to single stream collection. Those negatives they did mention, in response to questioning, were:

- Increased contamination,
- Initial capital costs, including new carts and building a MRF (but not all local governments incurred those costs),
- Sacrifice of some product quality.

Individual comments below provide more detail and clarity.

Process

For many governments, single stream allowed automation of recycling collection systems. Some governments use automated top loaders and make three passes through a neighborhood – once for solid waste, another for recyclables, another for green waste. Others collect both solid waste and recyclables in one truck that has two separate compartments, one for garbage and

the other for recycling. San Francisco adds another truck specifically for greenwaste.

Automated systems also switch collection from bins to rolling carts. Some of the perceived advantages of single stream collection, particularly increased volume and worker safety, appear to result from the switch from smaller, manually-collected bins to large-volume automated collection carts rather than specifically from collecting all recyclables in

one stream. In fact, the one representative that tried single stream with a bin system, Gainesville, FL, switched from a one-stream system back to a two-stream system in part because one bin could not hold all the material people recycled. (Gainesville also experienced unacceptable contamination problems with a one-bin system.)

Determining how much of the single stream advantage is created by the ease of throwing everything into one container and how much by changing the collection receptacle is somewhat of a chicken-and-egg question. As Gainesville shows, single stream is not very feasible with traditional manually-collected recycling bins. There is a limit to how large containers can be before becoming too heavy for workers to repeatedly lift and empty them. But moving to the large carts that make the volume more attainable has generally gone hand-in-hand with automating recycling collection, which the large carts are designed for. They are too heavy for the workers to manually lift and dump them, as has been done with recycling bins, but the bins were not adaptable to automation. One respondent commented that if recycling had been automated before garbage collection was, recycling would be far more advanced now than it is.

Cost

The cost savings attributed to single stream are often more accurately attributable to automating previously manual systems.

Some governments have had capital costs for buying new carts and sometimes for building a MRF to sort materials. Most of these have new systems and cannot yet compare their costs, but they expect substantial savings in the long run. San Francisco finds that, because landfill costs are more than twice as high as processing recyclables, its recycling collection program saves money.

Increased Tonnage

All governments reported increased tonnage of recyclables collected, with most estimating it at

double their previous collection. The doubling, though, often appears to result from being able to add more materials to the collection program, especially greenwaste. San Francisco reported that a pilot study in one neighborhood showed a 20% increase in the types of materials previously collected, but adding greenwaste to the program doubled the previous tonnage.

Jerry Powell, editor of *Resource Recycling*, notes that reports of doubled tonnage are often misleading, both because methods for calculating tonnage are not consistent between, or even within, programs and because tonnage often temporarily increases whenever recycling collection programs are publicized, as they are when single stream is rolled out. He estimates that many single stream programs eventually settle into more like a 30% increase after an initial surge. This is consistent with reports from Sonoma County, where some cities and the unincorporated areas are estimating 30-40% increases.

Participation

Interestingly, virtually all the local government representatives interviewed reported that the increased tonnage of recyclables, usually very noticeable, was often not accompanied by an increase in household participation in the program. In other words, the increased tonnage seems to be coming primarily from households already recycling who are now putting even more into their collection carts. Their increase may be attributable to the larger and more convenient carts that often accompany single stream roll-out, publicity that reminds them about the collection program, and new materials that can now be added to the collection.

Most representatives cited the potential for increased participation as one of the advantages of single stream recycling collection, but have found that it does not seem to happen automatically.

Contamination

In our interviews, local governments that have already implemented single stream collection

systems reported contamination rates varying from 5% (two) to 20% (one). Two reported rates around 10%. This is higher, and sometimes considerably higher, than contamination rates common to source separated systems. One government said its previous multi-bin system had a 1-3% contamination rate. Saint Paul, MN reports that their source separated contamination rate is 1.6%. In a study of 70 single stream facilities nationwide, Governmental Advisory Associates found an average “residue percent” of 16.6 for single stream, compared to 4.3 for source separated, 4.2 for systems that exclude glass, and 6.6 for dual-stream collection systems. However, some single stream proponents point out that, even with higher contamination rates, the increased tonnage from the programs results in considerably more recovered and saleable recyclables.

It is important to ask what does “contamination” mean? It could mean that a larger percentage of the recyclables being collected are now being turned into garbage. But it could also mean that materials that would have previously gone into the garbage can are now more often finding their way into the recycling cart. In California, in particular, single stream collection is being introduced at the same time that many programs are also switching to collecting all types of plastic. Recycling programs often do not have markets for all the plastic resin types, but find that they get a larger amount of the marketable plastic types if they do not require the public to sort them.

Interviewees all said that the increased contamination primarily results from more non-recyclable materials being put into the recycling carts, now that they are bigger and the programs are accepting a wider range of materials. With larger-capacity carts, it is easier for households to throw in materials they are not sure are recyclable, trusting that they will be sorted out at the MRF if they are not marketable. San Diego reported no noticeable increase in non-recyclable materials. San Francisco identified mostly non-recyclable plastics. Burbank finds that a continual program of education about prohibitives and, especially, enforcement for

repeated violations, makes a big difference in controlling contamination.

Glass

Both paper mills and plastics recyclers say that glass contamination is one of the most troubling problems in materials produced from single stream programs. Several local government representatives said that they think there is less glass breakage with single stream than with their previous source separated programs because in commingled programs, the paper cushions the glass. Three of the governments that reported low contamination rates also said that their trucks only lightly compact the recyclables. They believe this may account for lower glass breakage in their programs.

There is debate about where the glass breakage occurs. One respondent suspects that much of the glass is already broken when it is put in the collection bin, and then when it is compacted in the truck. In any event, he said, the majority of glass is broken before it gets to the transfer station. He suggested that reducing the compaction rate might reduce breakage, which might also reduce his program’s contamination rate, which is considerably higher than others in this study.

California’s bottle bill and strong glass markets provide an incentive to keep glass whole so that it can be easily color-separated and therefore command a higher price. However much the paper might cushion the glass, though, the challenge for single stream is to get the two materials separated again once they have been mixed.

Motivation

Why does single stream collection have such great appeal? Increased worker safety was an important feature on everyone’s lists, especially as it played out financially in significantly reduced costs for worker compensation programs.

But by far the most important reason cited was diversion. In California, in particular, legislation (A.B. 939) requires local governments to meet specific solid waste diversion rates. Single stream's increased delivery of recyclable tonnage, plus the opportunities it creates for some governments to add more materials (especially greenwaste) to their programs, makes it extremely attractive to governments struggling to meet the goals, or desiring to keep increasing their rates. In some instances, recycling is considerably less expensive than sending solid waste to landfills, such as in San Francisco. Alameda County assesses a fee on all materials landfilled that could have been recycled.

This strong focus on diversion, however, turns out to be frequently at odds with another common recycling value: producing the highest value recyclables possible, both for receiving the best possible sales prices and for marketing the materials for making the highest quality products. In fact, achieving higher diversion rates is a much greater incentive to local government collection systems, at least in California, than getting higher payments for the materials. The reduced value of some of the materials produced in single stream systems does not seem to be a problem to the local government study respondents. One said that volume of diversion is what they care about, and income on selling recyclables is a distant second. Another said they only cared about cost effective diversion and they let the materials processor worry about selling the resulting paper.

We also wondered whether this focus on diversion might make single stream more attractive in a rather unexpected way. If more materials are collected, creating a higher diversion rate, but there is also a higher

contamination rate, do the materials originally collected for recycling but eventually landfilled because of their contamination get deducted from the new, higher diversion rate? Or do governments get to claim the higher, non-adjusted diversion rate because the resulting contaminated recyclables that ultimately go to landfill are no longer "counted" as residential solid waste, now that they have passed through a business facility (the MRF)? In California, at least, all our respondents told us that they follow state law which requires them to adjust the diversion rate for collected recyclables that are ultimately landfilled. Those without their own MRFs, that send their materials to a regional MRF serving many jurisdictions, apparently rely on the MRF to adjust the diversion rate.

A new angle on diversion rate adjustments was raised by several paper mill representatives at both the Canadian and U.S. Paper Weeks who reported that up to 20 percent of single stream materials delivered to paper mills is so contaminated that it can only be landfilled. This should be reflected in the contamination rates of the MRFs and the diversion rates of the local governments, but it is not.

Knowledge of Paper Markets

We asked local government respondents about their paper markets and what products the fibers would be used for. One was very well informed about what types of products his government's materials were going to and another knew most of them. The rest either had no idea or what they told us turned out to be incorrect. They tended to think that their fiber materials are used for higher level types of products, such as tissue and newsprint, when actually much of it is going for chipboard, toilet paper cores, linerboard, wallboard, construction products, or paperboard.

SINGLE STREAM SORTING FACILITIES

TABLE 3. SINGLE STREAM SORTING FACILITIES CONTACTED

FACILITY	LOCATION	CONTACT METHOD
Burbank Recycling Center/BLT Enterprises	California	Phone interview
Empire Waste Management MSS, Inc.	California	Visit
Northbay Disposal Service	Tennessee	Phone interview
Weyerhaeuser	California	Visit
<i>California Waste Solutions</i>	Colorado	Phone interview
	<i>California</i>	<i>Repeated unsuccessful calls</i>

After the recyclables are collected by local governments, they must be sorted into different types of materials, and often different grades within those material types. Some MRFs have been built specifically to sort materials collected in single stream programs, some have been adapted from facilities that previously sorted source separated collection lines, and some have not been adapted but are trying to handle commingled materials anyway.

We interviewed several people from five single stream sorting facilities and visited two. The California facilities are sorting all kinds of materials that are commingled. MSS and Weyerhaeuser have developed equipment for sorting mixed paper fibers. MSS has also developed equipment for sorting glass, as well as a system for sorting paper commingled with other materials that do not include glass, but these systems are not possible to combine (see page 18). We also learned about a number of other sorting facilities from the reports listed in the references on page 27 and from informal notes and discussions with respondents to our surveys.

From our visits and interviews, it appears that 75-80% of the material that comes in from single stream collection systems is paper fiber. In their study of 70 single stream facilities nationwide, Governmental Advisory Associates found an average of 79.3% fiber. Most of that is newsprint, although we also observed quite a bit of white ledger mixed in with the newsprint. The

significance of this commingled fiber is discussed more fully on page 19.

All but one of the local government representatives we interviewed said that their fiber was sold as a #7 or #8 news. The MRFs that handle single stream materials also told us that they were able to do quite clean sorts, to at least a #7 news. However, everyone from local governments to MRFs to packers acknowledged that the specifications for what constitutes a #7 or #8 news grade are “slipping” and the quality is not as high as the standards actually require. One local government said that their MRF cleans their newsprint so well that they are paid #8 prices for #7 quality ONP. Another, though, said that their newsprint had downgraded to #6 and may even be moving down to #5 quality.

MRFs built for sorting single stream materials have “star screens” or similar types of sorting equipment to separate fibers from other materials. The relatively recent development of this type of equipment has allowed single stream recycling to quickly become more popular. Before its development, sorting such a wide variety of commingled materials was not feasible on a large scale.

The single stream MRFs acknowledged that there are many complaints about glass in their bales, but they said they were doing a very good job of getting it out and their paper was still selling. Some criticized the paper mill buyers, describing them as complainers and increasingly outdated in global paper markets.

PAPER BROKERS

PAPER BROKER	LOCATION	CONTACT METHOD
America Chung Nam	California	Phone interview
Bayside International	California	Phone interview
Cell Mark	California	Phone interview
Paper Tigers	California	Phone interview
Smurfit	California	Phone interview
Tidewater Fiber Co.	Virginia	Phone interview
Western Pacific Pulp & Paper	California	Visit
Weyerhaeuser	California	Phone interview

Once the paper fibers are sorted at the MRF, they are marketed by paper brokers. Sometimes the brokers further sort the paper, if it is cost effective in bringing a higher price for the resulting grade. We interviewed representatives from eight paper brokers and visited one.

It is among the packers and brokers who buy and sell fiber that we heard the most divergent views about single stream materials. Some said, "Single stream is the wave of the future and we can find markets for anything." Some also said that the quality from single stream MRFs is getting quite good, especially for newsprint. Others referred to materials from single stream collection systems as "dirty mix" and "questionably objectionable." Of course, the sorting abilities of the specific MRF supplying the paper fiber makes a difference in brokers' evaluations.

Some of the difference in opinion also depends on what type of product the broker usually markets. Those that concentrate on high end paper markets were most derisive of single stream paper quality. Two told us that they would not buy materials from the Empire Waste Management single stream facility in Sonoma County because its quality is not high enough for their markets. Other brokers focus on supplying paper mills that can use lower-quality fiber bales, and therefore find the single stream quality acceptable. That same Empire Waste Manage-

ment facility is successfully marketing its material through a contracted broker.

To a large extent, the difference in quality requirements depends on the types of end products a mill is making. One broker said he never has a problem moving material, no matter how low the quality, but there is always a risk with low quality material of losing a customer who expected better.

On the positive side, paper brokers see that single stream increases the amount of material they have available to sell. On the negative side, the lower quality of the material limits their options for where they can sell it. Right now, one broker said, there is demand for low grade mixed paper to make products such as shoe boxes and toilet paper cores. Some of it is also made into duplex board, chipboard, linerboard, construction grades, construction paper, and laminated cover for low-end packaging. Much of the single stream materials in California are sent to China, where some are made into newsprint but many are made into the low-end products previously listed.

Almost all the brokers interviewed said that glass was a problem in the fiber bales, but some considered the problem to be much more severe than others. One described single stream operations run by companies that specialize in waste hauling as still operating on the mentality of "bury it and send someone a bill." One broker pointed

out that MRFs that have traditionally specialized in top-quality sorting from source separated systems cannot risk taking in single stream materials because the resulting lower quality would threaten the trust they have built up with buyers of high quality recovered paper.

A nearly unanimous belief of everyone in this collection sector of the recycling system is that the problems in the single stream system are all coming from the paper manufacturing mills. They see most of the mills' complaints coming

from a refusal to modernize, or as part of their negotiating strategy, or as just plain complaining. One broker sympathetic to the mills' quality complaints also believes that single stream fiber materials will be more acceptable as technology improves to better sort the recovered paper and as mills are built to better utilize the material. Another recommends that mills embrace single stream because it increases their supply of recovered fiber and therefore should lower their costs over time.

PAPER MILLS

Most of the respondents on the collection side of the system blame the paper mills for creating problems with single stream fiber collection by not modernizing to accept it. We wanted to find out what is behind complaints from people in the paper industry. Are they simply complaints, or are there real problems that have not been sufficiently addressed? And, if there are real problems, who needs to address them?

To find out, we talked to representatives at 3 deinking mills and 13 paper manufacturing mills, which included those making newsprint, paperboard, tissue products, printing and writing paper, and other types of paper products. We made calls to nine other paper mills, as well, but were unable to reach them.

TABLE 5. PAPERMANUFACTURING MILLS CONTACTED

PAPER MILL	PRODUCT TYPE
Abitibi-Consolidated	Newsprint
Bowater	Newsprint
Inland Empire	Newsprint
Newstech	Newsprint
SP Newsprint .	Newsprint
Norpac (Weyerhaeuser/Nippon)	Newsprint
Smurfit	Board (packaging)
Visy	Board (packaging)
Georgia-Pacific	Tissue
Marcac Paper Mills	Tissue
Oconta Falls	Tissue
International Paper	Printing/writing
Boise Paper	Printing/writing
Fox River Fiber	Deinking
Burrows Paper	Deinking
Mississippi River Corporation	Deinking

In our interviews, we asked paper mill representatives:

- 1) What type of pulp are you producing?
- 2) What grades of wastepaper are you using?
- 3) Are you getting recovered paper from single stream recycling systems, where all the recyclable materials are dumped into one household collection bin and sorted later at a facility? (We needed to differentiate single stream systems from those that commingle all the grades of paper but don't add bottles, cans, and other non-fiber materials.)
- 4) How do you know you are getting single stream material, if you are?
- 5) What is your experience with it?
- 6) If you report problems, what exactly are they, and how do you think they are created?
- 7) What do those problems lead to in your operation?
- 8) If you report problems, how do you think those problems could be resolved? In particular, if you report glass problems, do you think the fiber quality would be acceptable if only the glass were eliminated?
- 9) For high grade pulp mills for either tissue or printing and writing, how much do you rely on recovered paper from residential collection systems, or how much do you want to (i.e., is your mill built to use that low level of fiber quality)?
- 10) Do you think the problems you encounter are problems for *all* paper mills, or just for your mill or grade?

It is at the paper mills that the negative impacts of single stream collection seem to be playing out. Paper mills need different types of fiber, depending on the types of products that they make. Some mills can use single stream materials more easily than others, and many can't use them at all. Some products are more amenable to single stream materials than others.

Deinking technology sales have been one of the few bright spots in the current mostly dismal paper industry financial picture, with mills all over the world building new recycling capacity, especially in Asia where paper production is growing 14% a year in China alone. Even in North America, one mill representative told us, the industry has invested \$10 billion in deinking technology in the last six years.

Increased investments in recycling mean increased demand for recovered paper. Prices for the recyclable fiber increase if quantities lag

behind demand and also if the necessary quality of fiber becomes harder to source. Mill respondents recognized that increased tonnage collected could be an advantage and bring prices down, but many worry about the quality.

Quality

One newsprint mill paper buyer was quite graphic in describing the noticeable change he has seen in recovered fiber quality in the past few years. "Some of it might as well be backing a garbage truck up to the baler," he told us. He said he now can identify bales by region, with California noticeably dirtier than others. Another mill representative was even more blunt, calling single stream fibers "puke" produced by garbage companies.

But their view was not universal. Some mill representatives said they buy materials from single stream collection programs, although they have had to develop and enforce stronger

standards for what they will take. One mill, though, said they could work with even low quality fiber. Notably, while single stream collectors chart their success by the quality of ONP they produce, newsprint mill representatives described serious problems with using the fiber, even those mills that have added equipment to further sift and sort fibers before use. Not surprisingly, the mills that were most negative about single stream fiber make products such as tissue or high-end food packaging that require high quality fibers, while those that were most positive make low-end packaging and construction products or other types that can more easily incorporate low quality fiber. Even those who buy from single stream programs, however, described problems with using the fiber.

Glass

The big concern to paper mills is glass. Everyone said that glass is a terrible problem for them and that the sorting facilities are not doing a good enough job of getting it out. The glass causes a number of different problems:

Equipment Damage. First, it damages the machinery. By the time single stream recovered fiber gets to a paper mill, most of the glass is ground down into very small pieces, much of it almost like sand. Deinking pulp mills cost \$200 million or more. Papermaking machines can cost up to half a billion dollars. Mill equipment is full of fast-moving fluids and precision gears. Yet the glass gets into the gears, the bearings, and the gasket seals. It clogs screens. It works like sandpaper and wears down parts. Even the screens cannot completely keep it out of the finished products. That's why the board of directors of the American Forest & Paper Association approved a policy in June 2002 opposing any collection program that includes glass with paper.

Worker Safety. Second, mill representatives say glass puts their workers at risk. While the local governments like single stream because it reduces collection workers' risks, the paper mills feel that the safety problem has not been solved,

it has just been pushed up the line to them. Now paper mill workers are getting injured by glass shards when they unload bales of paper to recycle.

Customer Safety. Glass is a problem not only when the bales are delivered to the mill, but also when the mill sends its finished products out. The trucks that deliver recovered paper bales to the mills do not go away empty. They turn around and backhaul the mill's finished products to market. Yet even sweeping and blowing out the trucks does not get all the glass out. It not only continues to injure mill workers, it also gets picked up in the finished products.

Most paper is shipped not as cut paper in boxes, but as giant rolls that are either stacked on end, or they are rolled "on bilge," on their side. Which way they are stacked is specified by the customer and depends on the type of unloading equipment at the customer end.

If there is glass in the truck, the finished products get embedded with glass that then causes safety risks to the customer's employees and problems in their machinery.

Public Confidence. Some of the people at the mills said that there have already been occasions when glass got into the finished products, either through contamination from the trucks or from going through the pulping system. This has resulted in their having to pull and dispose of some of the product run.

A real potential for glass getting into finished products could severely threaten recycled paper production, not only at one mill but overall. At a minimum, customers such as major newspapers would be likely to discontinue contracts with mills that could not guarantee that their products would not have glass contamination that could grind up the newspapers' printing presses.

But the risks are far greater. If the public comes to believe that there might be glass in their newspaper, or in their cereal boxes, or - worse - in their tissue products, the resulting loss of confidence in recycled products could

undermine the whole recycling system. After all, mills will only buy recovered materials from local government collection systems if customers will buy the products they make from those fibers. If customers do not trust the safety of the products and therefore refuse to buy them, the local governments will lose their markets, too. Guaranteeing recovered fiber of sufficient quality to make safe and high-quality products is key to the future of local government collection systems.

Plastic

The mills are also having trouble with plastic, especially plastic bags and newspaper sleeves. In this, the newspaper publishers themselves help create the problem by wrapping their papers in plastic sleeves no matter what the weather. Some of that plastic inevitably gets through the system and then produces “ghosting” on newspaper pages, which looks like the ink is missing in splotches all over.

One packaging mill representative told us that there is so much plastic mixed into the fiber coming in from single stream systems that any three bales of paper result in two full gaylord containers of plastic.

Proposed Solutions Do Not Solve the Problems

Local government representatives and many of those at the single stream MRFs believe that there are several ways that mills can get rid of the glass and plastic if they really want to.

Drum Pulpers. First, they say, the mills just need to put in drum pulpers, and then they can easily get rid of glass and other contaminants. But paper industry technical representatives make it clear that drum pulpers can only be used in newsprint mills, not in packaging mills, tissue mills, or others. It is a gentle type of process that is only effective on newsprint, which is not a tightly bonded type of paper. It is not effective with papers like magazines, packaging and office papers which have much more robust surfaces and have been coated in sizing or clay

to keep the fibers together. Those can only be separated in hydropulpers.

Even in newsprint mills, respondents told us, drum pulpers are not always a good choice. One representative from a newsprint mill that does have a drum pulper told us they take days to clean the fibers, and if the mill has to invest in another to handle the volume, the increased capital cost (approximately \$100 million) will force them to pay less for the lower grade newsprint that requires the drum pulper.

A tissue mill respondent told us, “Drum pulpers work well for sorting trash. But a pulp mill needs a pulper to make fiber, not sort trash.” Another mill representative said, “Single stream just pushes costs onto someone else.”

Fiber/Glass Sorting System. Another option that people on the collection side say will solve the problems for the mills is the type of fiber sorting system that has been developed by MSS, Inc. and Weyerhaeuser. There are two systems currently installed in the United States, one in Baltimore and another in Denver. So far, these are only running sorted white ledger (SWL) and sorted office paper (SOP), which are very clean recovered paper streams compared to the much more diverse and mixed residential fiber sources for single stream. There is a third system working in Sweden, sorting curbside material, but MSS confirmed to us that the fiber stream in the Swedish system has no glass mixed in with it and that their system cannot sort glass mixed with fiber. MSS has a separate glass sorting system, but it does not combine with their fiber sorting system, and they do not believe that it will be able to be combined technologically.

We have heard references to other systems that are claimed to sort glass from fiber, as well, but each time we have investigated, we have learned the claims are unfounded.

Beneficiation. Some have suggested that the paper industry should set up beneficiation plants to produce the quality of fiber that they want. The glass industry was forced to do this in California many years ago, taking the glass from

MRFs and further cleaning and sorting it at intermediate processing plants before it reached the manufacturers. Glass, however, is considerably less than 5% of the collection volume, while paper is 75 to 80%. A number of newsprint manufacturers already have set up a sort of beneficiation system by installing drum pulpers and other sorting systems. But what benefit can the MRF claim to have added to the system if it requires an industry to add on the additional expense of intermediate processing for fully 75-80% of the MRF's material in order to make it usable?

China

If the U.S. and Canadian mills do not want their fiber, many of the local government representatives and paper brokers say it does not matter. Especially in California, facilities are shipping their fiber over to China. There is a large labor pool there, many say, who will cheaply sort the bales for their mills, which they believe are made to take lower grades of wastepaper. Chinese paper brokers say that neither belief is accurate.

We talked to paper brokers shipping to China who told us that the Chinese are increasingly disturbed by the glass and decreasing quality of recovered paper bales coming from single stream collection systems. So much so that, even while they import 5 million tons of wastepaper from the U.S., they also are starting to use more virgin fiber, and they have increased their imports from Japan by 500%. Although they consider the Japanese fiber to be weaker quality, the fact that it is so much cleaner than U.S. fiber makes it worthwhile.

We were told that some of the smaller, older mills in China can handle #6 news and do have some hand-sort lines to clean up materials coming into the mill. However, the new, bigger mills coming on-line there do not have sorting lines and are not built to take low-quality fiber. They require #8 news. They are also expected to be upgrading the quality of their production quickly in order to meet specifications for exporting to countries such as the U.S.

It is, therefore, important to consider whether the markets for low-quality fiber will be sufficient when many more communities all over the country switch to single stream and introduce a much larger quantity into the market, since the low quality limits options for where it can be sold.

White Paper

Our visits to single stream sorting facilities revealed a significant amount of white ledger paper mixed in with the newsprint that was being baled. We first heard about single stream fiber problems when we interviewed high grade deinking mill managers for a capacity study. However, people from local governments considered the high grade mill managers' concerns irrelevant because they were not collecting high grade papers such as white ledger and their paper has never gone to mills making fine papers. Rather, they insisted, the recycled fiber for tissue and fine papers comes from commercial office collection systems. Some of the high grade deinking mills, however, were built with the expectation of using low grades of paper such as those recovered from residences, although they have not been able to perfect the technology required to actually use it.

However, it appears that single stream is now beginning to encroach on the commercial systems. The Weyerhaeuser/MSS sorting system in Denver sorted a trial load of recyclables from a California single stream system and found 15% white ledger in the mix. One of the single stream sorting facilities we toured said that they had started offering their pick-up services to offices on their routes, which had jumped at the chance. In fact, some local governments are now requiring in their contracts that offices be included in the collection mix. The collectors told us, "If you want white ledger sorted out, we could do it, but you'd have to pay for it."

But recycled printing and writing paper already often costs more than virgin paper. A dozen mills making recycled printing and writing paper have closed in the past two years. Less than 5% of recovered paper goes back into printing and

writing paper now as it is. There is real cause for concern that the U.S. could lose the infrastructure it needs for making recycled content printing and writing paper.

That concern brought 56 environmental groups together in November 2002 to agree to work cooperatively on converting paper production to environmentally sustainable processes. The Environmental Paper Summit's consensus Common Vision document has already been signed by more than 75 environmental organizations all over the world, along with an increasing number of companies and academic experts. Most of the campaigns are focused particularly on printing and office paper because it currently has such low recycled content, compared to other paper grades.

To increase that recycled content, mills will have to acquire significantly expanded and very reliable sources of high quality office paper. If, instead, that fiber goes into single stream, that will not be possible. If cost-effective and high quality fiber is not available, the mills will not develop more recycled papers, increase the recycled content in the papers they already produce, nor integrate more deinking plants into their production systems to make the papers more cost-efficient. If fiber costs are increased because office paper was mixed in with low quality materials and then had to be re-sorted out, and if clean fiber is hard to source, there is a serious possibility that recycled printing and writing paper might not survive, let alone thrive and expand its markets.

Some are unconcerned about this possibility because they question the value of recycled content in printing and writing papers to begin with, suggesting that all recycled fiber should be downcycled into packaging and lower-end products anyhow. However, doing so would eliminate paper recycling's greatest opportunities for environmental responsibility. Because they can be recycled multiple times, printing and writing papers offer 8 to 12 times greater savings in trees, solid waste, energy, water, pollution and greenhouse gases than virgin paper production or than most low-end recycled products and then they still can be

downcycled into low-end packaging and construction products. Why would recyclers want to throw that all away?

Reversion to Virgin Fiber

In response to problems reported from the paper mills, many people on the collection side insist that paper mills will just have to adjust. But it is not assured that the mills will, or even can, adjust to lower quality feedstocks. There is the possibility that, instead, inadequate quality might drive some mills to abandon recycling and return to virgin fiber wood chips. All the collectors scoffed at that concern and said it would never happen. But on July 3, 2002, Bowater's newsprint mill in Calhoun, Tennessee, which had been producing 150,000 TPY recycled newsprint, shut down its recycling line and stopped taking recovered newsprint. It announced that finding high-quality ONP at a competitive price had become too difficult so it switched back to using wood chips and will run only virgin fiber for the foreseeable future.

Bowater is not alone. A second newsprint mill (making 100% recycled newsprint) has since closed, another that buys from California single stream markets told us they were seriously considering switching back to virgin fiber, and more mill representatives at the Paper Weeks reported their companies were considering similar decisions, as well. As one respondent said, when comparing using virgin vs. recycled fiber, "A tree is a tree, but a bale is not a bale."

Some paper mill representatives are increasingly vocal about poor quality recovered fiber but are proposing less extreme solutions. The Paper Recycling Association of the Canadian Pulp and Paper Products Council announced in October 2002 that their members will tighten up on specification requirements for recovered ONP bought by their mills because the quality they receive has been deteriorating. McEntee Media's *Recycled Paper News* quotes the Council's managing director as saying, "In the last couple of years it has gotten worse. Despite the mills investing in new equipment, it just isn't working anymore."

CASE STUDY: SONOMA COUNTY SINGLE STREAM MRFS

This study reports on interviews with representatives from each sector in the recycling cycle. Most are in California, but some are in other parts of the U.S. The interviews give an overview of the benefits and problems created by single stream collection. Because Sonoma County has increasingly embraced single stream collection, the Sonoma County Waste Management Agency wanted to determine the fate of paper specifically from its own programs.

We interviewed each link in the chain of commerce from Sonoma County's two single stream facilities to the paper brokers that supply the mills that use the county's paper. Both facilities appear to have built solid markets through brokers that sell recovered paper to China, and to sort material to a level of quality that meets the needs of these markets. Both reported contamination levels of "below 5%." We were not able to determine whether some was landfilled in China.

Empire Waste Management

Almost all the paper processed by this Santa Rosa facility is handled by a paper broker that sells and ships it directly to a paper mill in China. The recovered paper is graded as ONP #7 and used to make newsprint for local use in Asia. The Chinese mill does not re-sort the paper, although it inspects it. Any unacceptable paper is rejected or downgraded and sometimes used by other mills. A small amount of fiber from Empire Waste Management has also been bought by a U.S. mill to make newsprint.

The broker told us that, while single stream is a bit more difficult to process because of the potential for commingled contamination, mills only need to be careful in the recovered paper they buy. He emphasized that the processor (MRF) must be responsible for sorting well the first time because mills and paper brokers cannot afford to do it. He believes that single stream is the future for recycling collection and that mills

have to tolerate a slight increase in the level of contamination. At the same time, he makes sure to only buy good paper from MRFs with good equipment such as star screens.

Not only do MRFs need to invest in the right technology, he told us, but they also must operate it at rates of speed that can ensure high quality materials. He thinks it is the MRFs that try to run too much tonnage too fast that end up with unacceptable materials.

Clearly, he found the materials produced by the Empire Waste Management facility to meet the quality needs of the mill he supplies.

Northbay Disposal Services

This Santa Rosa facility ships both OCC (old corrugated containers) and Mixed Paper (including coated groundwood, coated specialty paper and newsprint) through a broker to a paper mill in southern China. This mill does do a second hand sort, but the broker said he does not see a real increase in contamination nor dangers from glass.

The materials from Northbay are made primarily into two kinds of products: 100% recycled clay coated news back (CCNB), which is a type of paperboard used in products such as shoe boxes, and duplex board, which mixes recycled fiber with virgin to make paperboard such as that used in cigarette boxes.

The broker's representative said he has noticed an increase in available tonnage from Northbay since the facility installed star screens, and that the paper is of good, usable quality. He felt that one factor that makes the recovered material more easily used is that the mill it is shipped to operates older, slower paper machines than the newer mills. The slower operation allows the workers to more carefully watch for and prevent any problems that could be presented by the recovered paper as it comes in to be pulped.

CONCLUSIONS

If Sonoma County's two single stream MRFs are successfully marketing their recovered fiber materials and meeting the needs of the brokers and mills that buy from them, is there any need to be concerned about the complaints from many of the paper mill representatives we interviewed? The juxtaposition of these two different outcomes actually clearly illustrates both the successes and the challenges to the recycling system posed by single stream collection.

On one hand, there are enough paper manufacturers making types of products that can use single stream fibers that Sonoma County's MRFs have been able to establish solid markets. However, because even paper brokers that gladly handle single stream told us that the quality limits the markets they can sell it to, single stream's current market success does not necessarily mean that it would be beneficial for all collection to go this direction. Clearly, there are many paper manufacturers that have been making recycled products who are now having serious difficulties with the quality of the fiber from single stream. The recycling system cannot afford to lose them, nor to discourage new recycling mills from opening.

Single stream's current concentration on low-end product markets also potentially threatens recycling's significant contributions to reducing environmental impacts. Recycled materials are fine feedstocks for construction products, but they are unlikely to be recycled again afterwards. Similarly, recycled fiber in cereal and shoe boxes, toilet paper cores, linerboard and molded pulp products are fine feedstocks, too. But, while these products are more likely to be recycled again, the mixed fibers cannot be sorted out for higher-level types of products that would be recycled many more times.

Talking with people from the different sectors of the recycling cycle was often similar to talking to members of a dysfunctional family. Each person we interviewed was very generous with their time and explanations, and yet many did not seem to be able to value nor often even hear the

experiences of other sectors. They often blamed any problems on other sectors rather than considering ways they themselves might be contributing to them. And they did not seem to comprehend the problems as opportunities for creative problem-solving that could benefit everyone, including their own recycling sector. Instead, we frequently heard denials that there were any "real" problems and accusations that others were exaggerating or deliberately refusing to cooperate.

Ironically, despite the fact that every sector in the recycling cycle is dependent on the success of the other sectors, many of the interviewees, particularly on the collection side, did not seem to appreciate this fundamental interconnection. Rather than working for the success of all, it was striking how often the respondents seemed to see themselves as separate, unconnected points rather than as parts of a continuous circle.

The recycling system has been plagued over the past two decades with weak commitment to buying recycled products. The public proudly gathers materials for collection programs but has not made an equally strong commitment to buying products made with those materials. Yet, as Conservatree first pointed out in the 1980s, *"If you're not buying recycled products, you're not recycling."*

Our observations over the past 27 years in recycling suggest that the most effective driver for the entire recycling system is producing recycled products that purchasers will enthusiastically buy. Collection and manufacturing are only successful if recycled products are selling. But our interviews in this study suggest that the lack of collaboration between many in the collection and manufacturing sectors of recycling reflect a disconnect similar to the public disconnect between collection and buying recycled products, resulting, again, in loss of focus on the critical finished products.

Our discussions led us to a number of observations and recommendations.

OBSERVATIONS

1. Some form of single stream collection is here to stay.

Virtually everyone, including those at the paper mills, acknowledged that single stream is the wave of the future and there's no stopping it. They also recognize the advantage of the increased tonnage, as long as it is usable.

2. The acceptability of single stream materials depends on the specific products to be made.

The materials coming from single stream are very acceptable to some manufacturers, particularly some making low-end packaging and construction products. Single stream materials need to meet much narrower quality variations when manufacturing products such as newsprint, and currently are not usable for higher-level products such as high-end packaging, tissue products, and printing and office papers. It is important to keep in mind that the fact that some paper mills are able to accept single stream materials does not mean that all, or even most, are able to.

3. Single stream is beginning to siphon off materials needed by high grade product manufacturers.

Some of the fibers formerly going to high-end products are now going into single stream collection programs, depriving the high-end product manufacturers of some of the materials they will need for a build-up in demand. While this may currently have minimal impact because most single stream systems are still collecting only residential materials, it has the potential to seriously undermine future development for recycled printing and writing papers, as well as environmental sustainability goals.

4. Single stream collection requires us to rethink why we're recycling at all. Recycling is a cycle in which each sector depends upon the others. Therefore, it is critical that that rethinking, and the resulting decision-making, be done in collaboration with all the sectors, and not be determined unilaterally.

Whether consciously considered or not, the pragmatics of any collection system's organization results in making a choice, expressing values, and choosing a path that will enhance some recycling opportunities and close off others. Communities, society, and recycling organizers should know what we are choosing and agree that it is our best choice, or figure out how to adapt it to fulfilling our priority values. Collection system investments are being made now that will set the direction and capabilities of recycling for years, if not decades, to come. If they are short-sighted, they could preclude investments in the paper industry that are necessary for building an environmentally sustainable paper production system.

Originally, when local community collection programs were developed in the 1980s, most recyclers and legislators said it was to reduce demand on resources, energy, and water. Saving landfill space was not the purpose for recycling but, rather, a strategy for achieving the environmental goals. Now it seems that keeping materials out of landfills has become an end in itself, and the larger picture of resource use and environmental impacts is considered by many to be irrelevant or naive.

Have the reasons behind recycling really changed? Are “diversion” and preserving landfill space truly more important than conserving natural resources? Are they alone enough to justify the huge investments in equipment, labor, organization, education, and innovation?

It is also important to decide whether shipping our recovered paper to other countries because U.S. paper mills find the quality problematic is the best solution. Are markets in other countries assured into the far future? If U.S. mills close or do not expand their recycling capacity, will we lose our ability to use our own recyclable materials here? The U.S. steel industry was devastated 40 years ago when Asian countries created unbeatable competition by using the scrap materials U.S. producers thought were throwaways.

Is it responsible to produce such huge amounts of discarded materials in the U.S. because of our consumption patterns, but then ship them off to some other country to take care of them? As the generator and template for many of the world’s highest quality manufacturing systems, does not the U.S. have a responsibility to set the model for environmentally sustainable production? How can we expect other countries to design the environmentally sustainable production systems the world needs if we do not do so ourselves? Such a system, though, requires optimizing all levels and aspects of the system, not just part of it.

The recycling symbol (Möbius loop chasing arrows) reflect a continuing and interdependent system: collection, manufacturing, use of recycled content products, then return to collection. It is troubling to find in this study that these different sectors seem to be breaking apart. People within each sector seem to be losing sight of the fact that they are in a system *with* each other, that each of them impacts the others, and that the success of each is dependent on the success of the others. The system seems to have been changed unilaterally by the collectors and many seem to no longer be concerned about the fact that it is not working for many of the manufacturers nor for producing a significant segment of high quality recycled products that purchasers will trust.

5. Required by state law (A.B. 939), “diversion” has become the de facto primary - and often only - goal for many communities.

Over and over, local government people told us, “Diversion is the only thing that matters to us.” The California legislature and the California Integrated Waste Management Board (CIWMB) have created state incentives that are

being interpreted by haulers and local governments to prioritize diversion from landfills above, and sometimes to the exclusion of, all other values, including environmental impacts.

A major original impetus for recycling when many community collection systems were set up back in the 1980s was the recognition of the folly in “throwing it all away” into landfills and incinerators. People recognized that there is no true “away” to throw things. How is “diversion” alone more than one step removed from “throwing it all away,” if the materials collected are increasingly made into products that are not recycled again because the quality was too poor for higher end, multi-recyclable products?

A.B. 939 was intended to drive recycling by keeping recyclable materials out of landfills and incinerators so they could be made into new products. It was intended to be a tool, not an end-point goal in itself. Instead, while local governments are achieving higher diversion rates through single stream collection, the quality of materials is deteriorating, yet most local government representatives told us that all they care about is hitting the mandated diversion rates.

Does a healthy recycling system accept recycling a large percentage of our materials only once, when many could have been recycled repeatedly? Some argue that that is the most economically feasible course. They also may add that recycled fiber is a better manufacturing source for some products that do not get recycled, such as tissue, than using natural resources. Other recycled content products unlikely to be recycled again, such as wallboard and shingles, are at least relatively durable.

Others argue that conserving resources requires the best effort possible, and that recycled fibers should be used for their “highest and best use,” then cascade down into lower-end products as the fibers are re-used over and over. The system should not preclude providing fiber for the “highest and best use” without a clear public decision.

Is it necessary for these viewpoints to be opposed? Single stream collection is designed to maximize quantity. Source separated collection is designed to maximize quality. Is there a way to maximize both to supply *all* the different types of recycled paper products?

RECOMMENDATIONS

1. Base decisions on the health and sustainable functioning of the whole recycling system, not just part of it.

Clearly, there are many valid reasons why single stream collection is so attractive to local governments. However, cities and collectors cannot unilaterally change the inputs to the system and expect the other sectors, such as manufacturers and product purchasers, to take it or leave it. Ultimately, if

their needs are not met, many manufacturers and purchasers will leave it. Then the community collection systems will break down, too.

In fact, local government collection systems, as well as MRFs and paper brokers, have an investment in the optimal functioning of the paper mills and, ultimately, in customers' acceptance and incorporation of recycled products. If customers find they cannot trust the safety and quality of recycled products, they will reject them, jeopardizing the functioning of the whole recycling system.

It could be very productive for local government representatives, collectors, sorters, packers, paper manufacturers and major purchasers such as newsprint publishers to get together to figure out how to optimize the recycling system they all are part of to best serve and balance the needs of each of the recycling sectors. Calling together a conference to look at the functioning of the whole system might be a good role for the Sonoma County Waste Management Agency or the CIWMB to play.

2. Remove glass from single stream collection.

Sorters, packers and mills have all invested millions of dollars to keep glass out of the furnish, and they have not been successful. Some mills, producing some types of products, can deal with the amount and form of glass residue that remains, but most cannot. There currently appears to be no technology that can remove glass from fibers effectively enough for mills that cannot accept glass in their furnish. It should be kept out of the fiber from the start.

Glass could be collected separately, as some cities already do. It can be directed to separate collection centers, which will reduce its quantity but should improve its quality. In bottle bill states such as California, the buy-back value for bottles could be raised high enough that people will take them to buy-back centers or donate them to organizations that will.

3. Ensure that good quality high grade paper collection sources remain reliable.

Until the time that sorting systems can reliably and cost-effectively sort high grade kraft paper from the rest of the recycling stream, office paper collection systems should be kept separate from single stream. The current market share of only about 6-7% for recycled printing and writing paper is not enough to motivate and sustain investment and development. It will not be possible to drive that market share up if the clean office paper supply diminishes.

Buy recycled campaigns can help increase demand for recycled content printing and writing papers and create incentives for collectors to maintain a high quality supply from office paper collections. But true market development for these papers will require more infrastructure investments by the paper mills, and they will not do that if a reliable furnish cannot be assured.

4. A Best Practices Manual and more education of each sector into the workings and capabilities of the other recycling sectors would be useful at several points in the system.

Single stream sorting facilities vary greatly, and some are more successful at meeting paper mills' needs than others. Some respondents suggested that lighter compaction reduced problems, and others theorized that minimal handling or reduced distances for dropping materials would help. Some suggested that high processing speeds and too many tons processed per day decreased single stream quality. Analysis of the differences and development of a best practices manual could help improve the quality of single stream fiber overall.

It would also be helpful for more local government and collection system representatives to tour the paper mills their product goes to – and also the ones it doesn't go to – to better understand how their decisions affect what the paper brokers and the mills are able to do with their materials. Positive communication between single stream collectors and paper mill representatives could better sensitize both to the constraints of each others' technology and systems.

SUMMARY

Most people seem to expect that the single stream collection system will get better in the future. But recycling is a just-in-time system, not one that can be put on hold for the future. Products are being made now with the fiber that is being produced now. Investments are being made now that could encourage or preclude needed investments in other parts of the recycling system in the future.

Therefore, it is critical that advocates make sure that the system works well for all manufacturers who may use single stream as their fiber source or whose previous fiber source may now be going into single stream collections. Single stream may well prove to be a wise choice for the future – but only if it works better for all the sectors of the recycling cycle than it does now.

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