Single-Stream Recycling as a means for Reducing Solid Waste in Portage County, Wisconsin

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Executive Summary

What is Single Stream Recycling

Single stream recycling refers to a system in which all paper fibers and containers are mixed together by the generator, both the collection and processing systems must be designed to handle this fully commingled mixture of recyclables.

Objective of Study

The purpose of this project was to compare current recycling collection and processing practices within Portage County, Wisconsin, to the possibilities of single stream collection and processing.

Findings of the Study

Single stream recycling can offer significant savings to collectors, due to collecting more homes in a given period of time, reduction of labor, efficient use of trucks, less fuel, an increase in collected recyclables and an associated reduction in garbage collected.

Single stream processing can be expensive. Significant capital can be required for new sorting equipment. Typically processors will also find an increased residual rate that further increases their operating expenses. Contamination of recyclables can also be an issue.

Currently the Portage County MRF’s dual stream processing system has a net operating revenue of $13.59 per ton of recyclables. With a proposed single stream processing system, a net revenue of $6.90 per ton could be generated. A detailed engineering study needs to be conducted to verify these numbers.

It appears as if the current dual stream system is the most cost effective process.
Introduction

What is Single Stream Recycling?

Conventional recycling systems require generators to separate their recyclables into their individual components. The recyclables are divided into two or more categories, such as paper and containers, which are collected separately and remain separate throughout the collection and sorting process, easing sorting for the processor.

Single stream (also known as “fully commingled”) recycling refers to a system in which all paper fibers and containers are mixed together by the generator (i.e. not sorted into separate commodities such as newspaper, cardboard, plastic, glass, etc.). In single stream recycling, both the collection and processing systems must be designed to handle this fully commingled mixture of recyclables. (Bureau of Waste Management, Wisconsin Department of Natural Resources) As simple as it sounds, the issue of single stream recycling is complex. Across the country there are collectors and processors, in both the public and private sector, which have switched to single stream, touting its benefits. It is true that single stream can offer advantages to homeowners, waste collectors, and waste processors.

Benefits to Homeowners

Homeowners benefit from the use of single stream recycling in several ways. Participating in a single stream recycling system is easier for residents. Instead of separating their recyclables into different categories, all they have to do is separate waste from recyclables. Materials can be placed on the curb in bags or regular trash cans. Some single stream collection systems will give residents a single tote to place all their
commingled recyclables. Residents find a single tote takes up less floor space than multiple containers needed for conventional recycling. Totes can be designed with convenient features for the homeowner. These features include: size of the tote, a handle and wheels to roll the container to the curbside, a lid to keep animals/rain out and wind from taking the paper and plastics. Totes are also more aesthetically pleasing than bagged materials. A single tote should be large enough to hold all the recyclables generated by a typical resident between collection periods. The size of the tote determines the initial cost to the recycling program ($40 to $50 per household). Usually the initial cost is offset by the long term savings in collection and processing costs. There are typically two options. Either the collector pays for the totes or residents will be forced to pay. Being forced to pay for a tote can upset residents. No matter what any additional charges are for, they will typically meet with resistance. On top of the potential costs, residents who generate a lot of waste and/or recyclables may not be able to fit all their materials into their totes. This can lead to recyclables being put into the garbage tote, or garbage being put into the recycling tote. Johns Disposal found that almost all of their customers using a single tote found them to be a boon, simply because of the ease of movement and use (Johns Disposal Service, Inc., Whitewater, WI). This ease of use encourages residents to recycle more.

**Benefits to Collectors**

Waste haulers interviewed in this study find it easier to collect single stream recyclables than sorted materials. Haulers find significant savings in not needing expensive multi-compartment collection trucks as well as savings in fuel and labor.
Haulers can then pass on the savings to homeowners. City government owned collection systems expect to save between two and five dollars per household in monthly collection costs for recyclables. Homeowners in the city of Madison, Wisconsin, saw a savings of about $2.30 per month after the city switched to single stream collection. (City of Madison Streets and Recycling). The city of Stevens Point, Wisconsin, will be switching to single stream collection in the summer of 2008. It is estimated that homeowners will save between $4 and $5 a month with the new collection system (City of Stevens Point Streets Department). With 7,600 homes, that is a savings of around $364,800 (City of Stevens Point Streets Department). Of course, homeowners will only see these savings if the hauler recognizes the reduced costs for the collector and in turn lowers the fee for residents, as the City of Madison has done and as the City of Stevens Point is planning to do.

The conversion from a conventional recycling system to a single stream collection system often requires waste collectors to modify their process. In a single stream system collectors only need to pickup recyclables once. The largest savings comes from using a single truck route (as long as on pass/route) as opposed to multiple passes per route of a conventional system (garbage, paper, cardboard, and commingled containers – i.e three trucks for three different materials or three pickups on a single truck). Collection can be as simple as having a container emptied manually into either a single compartment or a split compartment truck, if the collection service picks up both garbage and recycling. The use of totes can make collection more efficient. Trucks can have a single operator that can collect more homes than a multiple stream system since they only have to empty a single container into their truck without having to sort into
multiple compartments. Additionally, trucks with single compartments avoid the mechanical maintenance or capacity related complications faced by dual or more compartment trucks when one compartment fills before the rest, forcing them to go and offload their collected materials. Wittenberg Disposal has found that their manual single stream collection process, a single operator with a single compartment truck, can collect between 700 and 800 homes in a 7 to 8 hour shift (Wittenberg Disposal, Wittenberg, WI).

Single stream recycling also offers the option for collectors to automate their process. Due to the use of totes, trucks with mechanical arms can be used to collect waste and recyclables. This can further increase collection efficiencies. Wittenberg Disposal is planning on converting part of their single stream collection system to an automated process. It is projected that this system will be able to collect 1,200 to 1,300 homes in a seven to eight hour shift (Wittenberg Disposal, Wittenberg, WI).

Automated systems can also save collectors money on worker’s compensation. Johns Disposal found that when they began to use their automated collection system, their workers experienced fewer injuries. In 2007 they had a worker’s comp. mod. of .67, much lower than they use to have (Johns Disposal, Whitewater, WI).

In either single stream collection method, collectors benefit from collecting more homes in a given period of time, reduction of labor, efficient use of trucks, less fuel, an increase in collected recyclables and an associated reduction in garbage collected. An increase in the number of homes collected per hour means savings. A reduction in necessary labor can also save money. Stevens Point is projected to be able to halve the number of trucks and operators it uses for collection when it switches to single stream (Joe Euclid, Director of Public Works).
The increase in recyclables means reduced tonnage of garbage, which means less money that the collector has to spend on tipping fees at landfills. Additionally, the recyclable increase means collectors may make more money if a processor is paying them per ton of recyclables they bring in.

Simply operating single compartment trucks versus dual compartment trucks can also create significant savings. Wittenberg Disposal found around a 40% savings running manual single compartment trucks versus their dual compartment trucks (Wittenberg Disposal, Wittenberg, WI). This savings is attributed to reduced maintenance, reduced fuel use, and reduced labor. (Wittenberg Disposal, Wittenberg, WI).

Challenges for Collectors

Though single stream offers many benefits for collectors, there can be challenges. Switching to a single stream collection system, either manual or automated, can require a fair amount of capital for a collector or processor, along with expenses to educate the generator. They may need to purchase new trucks as well as totes. For the switch to automated single stream collection, the city of Stevens Point, Wisconsin, will purchase four trucks and two totes per home, at an estimated cost of $1.9 million (Euclid). The introduction of totes can also cause problems with generators. Some homes may still try to put their garbage and recyclables at the curb the way they had done previously. Materials that are not in the totes must be picked up by the operator or ignored, which could create further conflict with the resident. Eventually people usually adapt and no longer resist the new collection system (Johns Disposal, Whitewater, WI). Still this remains a potential problem during the startup of the program. Automated systems also
have their own set of challenges. In rural areas automated systems still work, but they are not the most cost effective as the length of the route and the distance between homes can make savings negligible (Johns Disposal, Whitewater, WI; Wittenberg Disposal, Wittenberg, WI; Conservatree and Environmental Planning Consultants). The increased investment in equipment must be recouped and therefore depends on what the collector charges. It has been found that for some operations, communities need around 700 homes for the collector to break even (Wittenberg Disposal, Wittenberg, WI). Urban areas with high numbers of cars parked on streets also present a problem. Automated collection systems can lose their heightened efficiency in these areas as drivers need to exit the vehicle and position the totes for collection. Similar problems may be encountered in areas that experience build up of snow obstructions in winter months.

Benefits to Processors

Processors can benefit from single stream recycling because the process generates more recyclables. Since recycling is easier for residents, they recycle more. Some processors are also willing to accept a wider variety of materials when using single stream, further increasing the recyclables generated. Though the results of single stream programs vary it has been found that in most systems there has been an increase in the tonnage of recyclables collected (Conservatree and Environmental Planning Consultants).

Johns Disposal found a 10% increase in recyclables when they switched to single stream collection. Initially there was a larger increase but it settled at about a 10% increase (Johns Disposal, Whitewater, WI).
Wittenberg Disposal saw an increase of 30% in collected recyclables from the communities that switched to single stream collection (Wittenberg Disposal, Wittenberg, WI).

The Waukesha County Recycling System and Capacity Study estimated that there would be a 25% increase in recyclables generated (GBB, Inc., RTT Design and Construction).

The city of Madison found a 25% increase in recyclables collected during their first year of single stream operation, though of this increase is due to the acceptance of a wider variety of paper materials. (University of Wisconsin Extension Solid and Hazardous Waste Education Center).

In 2002 the city of Chula Vista, California, found that their tonnage collected curbside doubled after they switched to single stream collection (University of Wisconsin Extension Solid and Hazardous Waste Education Center). This is a rare occurrence. It is likely that they have had such a high increase because the community also uses a pay-as-you-throw garbage system as well as fining residents who have had garbage in their recyclables.

These numbers are relative to the communities’ base numbers and depend on participation and recycling rates prior to conversion to single stream. Additionally, percentages of increase in recyclables can be deceptive since they include the additional material that will eventually become residual waste that needs to be landfilled and may also include items that were not allowed before the single stream collection.

If a processor can handle the increased tonnage, the increase in recyclables can possibly mean an increase in revenue.
Challenges for Processor

Single stream recycling presents several challenges for processors. The nature of fully commingled recyclables means that there may be higher levels of contamination as unwashed containers or broken glass comes in contact with paper. Upon moving to single stream some processing facilities may attempt to compensate for higher contamination levels by allowing more types of paper to be collected. This way they hope a higher volume of mixed paper will compensate for its higher contamination by allowing them to sell more material, even though the market value may be lower when compared to the less contaminated paper. There is the possibility that the paper quality will not be significantly different and the materials can be sold for regular market prices. So, not only does higher contamination mean potential lower quality recyclables, there could also be an increase in residuals. A study conducted by Government Advisory Associates looked at 36 single stream processing systems and found an average residue rate of 16.6%, not including glass (University of Wisconsin Extension Solid and Hazardous Waste Education Center). Not all programs have had residuals as high as this, but it can be a possibility. Johns Disposal has an average residual rate of 7.5% (Johns Disposal, Whitewater, WI). Besides materials left over from sorting that need to be landfilled, there is also a possibility for market residue. Market residue is any material that the end user cannot utilize and has to landfill. This could be whole or partial bails of unacceptable material. This could occur if contamination reduces the quality of materials to below the standards of the manufacturer. Where collectors see savings on landfill fees, the processor will see an increase in them. The burden merely changes hands. Sorting the
materials requires more work. For the commingled recyclables to be manually sorted, more workers would be required to sort single stream than dual stream. Machines can be used to sort the materials. This may require a processor to purchase new equipment, which they may not have the capital to afford.

All of these factors need to be considered when determining whether single stream recycling will work for a community.

**Objective of Project**

The purpose of this project was to compare current recycling collection and processing practices within Portage County, Wisconsin, to the possibilities of single stream collection and processing. Single stream recycling has seen successful across the country, including Wisconsin. These successful programs have shown that there can be significant benefits to making the change to single stream. Still, not all communities have switched to single stream recycling. This is because single stream practices are not suitable for all areas. To evaluate the potential of residential single stream recycling in Portage County the current collection and processing of recyclables was evaluated. To gather information existing operators were interviewed and research reports from various communities were evaluated. Based on this information the potential of residential single stream recycling within Portage County was assessed.

To evaluate the potential of single stream recycling in Portage County it is important to have an overview of the current environment: the current collection
processes for serviced municipalities, the existing Portage County MRF, the current dual stream processing system, and current MRF expenses.

**Recycling in Portage County**

*Current Collection Processes for Serviced Municipalities*

State law gives local governments recycling responsibilities. Local governments with these responsibilities are called responsible units or RUs. Each RU must develop and implement a recycling program to manage the banned materials residents generated within its jurisdiction and is responsible for establishing local ordinances to ensure all residents, businesses, government agencies and institutions recycle (Recycling Quick Reference). Initially, all local governments (townships, tribes, villages and cities) were responsible for recycling unless they merged with other units of government to form larger RUs (Recycling Quick Reference). Portage County is a RU. Many communities in Portage County are part of this RU. The main collectors in the area are; Wittenberg Disposal, Veolia Environmental Services, City of Stevens Point (municipal collector), and IROW. Wittenberg Disposal is contracted for collection within fifteen of the twenty one municipalities serviced by the Portage County Material Recycling Facility. The method of collection that Wittenberg uses is currently decided by their contracts with municipalities. In some places they use dual stream collection, while in others they use manual single stream. For single stream communities they run a single compartment manual truck with a capacity of 30 cubic yards. Though it varies from community to community they find that they can collect between 700 and 800 homes per eight hour work day. Wittenberg is also test running an automated single stream collection process.
It is expected that they will be able to collect between 1,200 and 1,300 houses per day (Wittenberg Disposal, Wittenberg, WI).

Veolia Environmental Services collects for the town of Dewey as well as the villages of Rosholt and Park Ridge.

The village and Town of Almond use a shared drop off site, where the residents bring their own garbage and recyclables. Residents are expected to completely separate their recyclables into the appropriate categories and deposit them at the drop off site in the properly labeled bin.

The city of Stevens Point does its own collection. Garbage is collected once a week, recycling is collected two times per month. Stevens Point uses a manual dual stream collection system for recycling, but that will change soon as they already have planned to move to an automated single stream collection system. Currently they use six trucks, with no compaction capabilities, that have about 33 cubic yard capacity. In a single day about 475 houses can be serviced per truck with a one person crew. The new system will use three automated trucks that will require one person per truck. It is projected that around 950 homes can be collected per day using the new automated system (City of Stevens Point).

**Portage County Material Recovery Facility (MRF)**

The Portage County MRF is located at 600 Moore Road, Plover, Wisconsin. The facility is made up of three areas: the tipping area, the processing floor, and the storage area. The tipping area is approximately 6,800 square ft, the processing floor is 9,800 square feet, and the storage area is 6,200 square feet. It is publicly owned by the county,
but is privately operated under contract by Veolia Environmental Services. The MRF is contracted with Veolia until 2010 to process up to 900 tons a month (Portage County Solid Waste Department). It is also contracted to process the recyclables of 21 Portage County municipalities until 2012. Veolia brings in approximately 4,500 tons a year; with this tonnage the MRF received around 9,160 tons in 2006 (Portage County Solid Waste Department). Residue rates are around 4%. Currently glass is processed into aggregate for sub-road base. If this material were not removed, residue would be around 8%. With the current system around 367 tons of residuals are generated per year. To offset processing cost the county receives the majority of the revenue, while the operator receives a small portion of the revenue for quality sorting and marketing (Portage County Solid Waste Department).

MRF Dual Stream Processing

Two nine hour shifts are run five days a week, nine employees on first shift (includes a scale attendant and floor manager), then seven employees on second shift. Shifts are nine hours long, including a half-hour and two ten minute breaks. Shifts typically spend half the time sorting paper, the other half handling plastics, glass, and metals. Ideally each shift sorts a minimum of 30 tons a day, an average day should see 65 tons sorted. Typically one week per year is needed for maintenance of the processing area. It is estimated that the maximum capacity of the facility is currently 15,000 ton a year (Portage County Solid Waste Department). It could be possible to add a third shift to increase capacity to 20,000 tons (Portage County Solid Waste Department). Line workers
are provided through an operating contract with Veolia Environmental Services Inc. (Portage County Solid Waste Department).

Recyclables are piled on tipping floor in two piles, paper and commingled containers. From there a front loader moves the materials to their respective lines.

The paper line starts where the materials are loaded onto a conveyor, and then materials move along past sorters. Newsprint, sorted office white, and mix of glossy materials and cardboard are separated.

Materials from either line fall out down from the sorting line into appropriate bunkers. The material remains there until it is moved by a front end loader onto a conveyor that feeds to a bailer. The bails are stored in the North end of the building.
The commingled line also begins at a conveyor belt where material is moved up, through a shaker that removes small broken pieces of glass and other fragment materials. From there the materials move down the line where sorters pull out plastic bottles. Undesired materials are also removed from the line, paper, non-recyclable plastics, and garbage. Down the line there is a magnetic sorter for removing ferrous metals, and a blower for not ferrous materials. Glass is not sorted and is allowed to fall of the end of the conveyor line.

Current MRF Expenses and Revenue

In 2006, the expenses of the MRF came to $820,057 (Portage County Solid Waste Department). This includes processing/operation, staffing, maintenance, and utilities expenses. This figure does not include debt service on the land, building, and equipment depreciation as these costs are fixed. In 2006 the MRF generated $944,496.00 from sales of recyclables (Portage County Solid Waste Department). The MRF processed about
9,160 tons in 2006 (Portage County Solid Waste Department). Without factoring in responsible unit basic grant money or the costs of land, the building, and equipment depreciation the MRF generated a net operating revenue of $13.59 per ton of recyclables.

**Single Stream Recycling in Portage County**

For the collection end, a switch would be relatively easy. Stevens Point is already planning to switch to single stream collection. Wittenberg Disposal, which services 15 out of the 21 contracted municipalities, would be willing to convert its collection of Portage County municipalities to single stream if given the opportunity (Wittenberg Disposal, Wittenberg, WI). If some municipalities remained dual stream it is unclear if this willingness would require a modification of the terms of the existing contract, though it would not have a negative impact on a single stream processing operation. Collectors would have a great opportunity to save money.

With proper education, it would be expected that residents would respond positively to a single stream system. The convenience is typically enough for residents to accept the system, especially if totes are provided. There would also be the potential for savings to be passed on to them.

Educational programs would of course have to be implemented to inform residents of the change. That project could be handled through existing County educational staff as well as through the collector. Fliers could be mailed out, as well as information posted online. If totes would be used, a flier that would explain the new system could be attached to them upon delivery.
The most difficult part of converting Portage County to single stream would be adjusting the processing to fully commingled recyclables. It is unlikely that the overall tonnage (individually increased tonnage due to single stream) would exceed the facilities capacity. To accept single stream recyclables the MRF would have to modify its current process. A potential issue is the single stream collection could contaminate paper products beyond acceptable levels for manufactures. Depending on markets, it is unlikely that single stream recycling would jeopardize the MRF’s revenue. According to data from 2006 the MRF made around $599,237 from containers and $358,253 from paper recyclables, showing that a larger portion of revenue comes from containers. Currently, the Portage County MRF’s buyers accept up to 5% contamination within the paper they buy. Originally when single stream recycling began, paper mills said they would not accept the “highly-contaminated” paper from single stream facilities, but soon it was found that there were markets for the single stream paper and domestic mills adapted (Portage County Solid Waste Department). Today, single stream recycled paper has very similar market value to paper sorted by a Dual Stream process (Portage County Solid Waste Department). It is likely that the Portage County MRF would be able to sell single stream processed paper as they would for Dual Stream processed paper.

**Sorting Equipment**

Processing single stream recyclables requires different sorting techniques to be strategically placed to maximize efficiency and quality. Machinex Recycling Technologies, headquartered in Pickering, Ontario; Canada, offers some equipment specifically designed for single stream processing. They have a series of three machines
capable of processing commingled recyclables. First is an old corrugated cardboard (OCC) screen. Next is the Mach One Single Stream Separator, a disk screen that removes newspaper and allows containers to fall through. Finally, the Mach One Finishing Screen sorts round from flat, further separating out containers from mixed paper. There are also other options to further increase sorting efficiency and mechanical durability. The system can be tailored to specific capacities. For a capacity of 60-70 tons in one shift, the machines would cost about $295,000. Installation costs will be extra.

Sequencing of the sorting line is essential to efficient and effective sorting. Typically in single stream processing large materials will be removed first in a presorting area either, manually or mechanically, this way oversized materials will not interfere with machinery (Conservatree and Environmental Planning Consultants). Typically containers will then be separated from paper mechanically, allowing the two materials to further be separated, either manually or mechanically. Combining mechanical sorting and manual sorting requires them to be properly ordered, but can efficiently sort recyclables. Johns Disposal in Whitewater, WI, is an excellent example of a well sequenced single stream processing facility. At their facility they process around 15,600 tons a year that they collect themselves, occasionally taking additional tonnage from outside sources. When they made the switch to single stream they built much of their own sorting equipment to create their sorting line. Their sorting line is laid out as follows:

First there is the outdoor dumping pit. It has a conveyor in the bottom of it that moves the commingled materials onto the sorting line. Trucks dump their loads into a pile where an end loader pushes it into the pit at a controlled rate. Inside the large pole barn structure the material first is sorted by hand for large cardboard pieces, non-
recyclable materials, and other large items. Next the material passes over a disk screen that sorts out paper from the other materials. Then there is an angle disk screen that removes even more paper. That material is then sent back up past a couple hand sorters for a final removal. The next step is to sort the material for glass, plastic, and cans. Glass is separated out manually, while there is an eddy current separator to remove non-ferrous cans. Plastic is either launched off of the belt or pulled by hand.

The separated materials are then placed in large cages, with each cage having a one bale capacity. They operate on one bailer with no backup. In the future they want to convert to a bunker system. All glass is transferred outside to a glass crusher and is stored in large piles.

John’s is allowed to have 3% undesirable material per bale according to their contracts. Of this undesirable material, plastic bags make up a large majority, wet material is also a problem. On average they have a residual rate of 7.5%.

**Possibilities for Portage County MRF**

**Switch to Single Stream Processing**

For Portage County to switch to single stream processing, the facility would have to be retrofitted with new equipment. With the use of the three Mach series machines from Machinex, repositioning of magnetic separator, and the modification of existing conveyors, commingled recyclables could be processed. The line could be laid out like this: first the OCC screen would remove large pieces of cardboard, then the material would pass to the Mach One separator where newspaper would be removed and containers allowed to fall to the shaker. Next, the material would continue to the Mach
One Finishing screen where mixed paper is separated from the remaining containers. The containers would move over the shaker to remove broken glass and other small pieces. Moving along a conveyor belt the materials will pass under a magnet, from the existing system, removing the ferrous materials. The remaining containers can then be hand sorted with glass being allowed to roll of the end of the conveyor belt, unsorted. It is estimated that the entire length of the sorting system would be around 200 feet, likely to be able to fit within the current facility (Machinex Recycling Technologies). This would require some considerable reconstruction but it could allow for the reuse of most existing equipment. Conveyors could be modified to maximize use of space, being turned around at places instead of continuing in a straight line. Land is available if the facility would need to expand to accommodate a new processing line.

If paper would be sold as mixed, the Mach series equipment would allow 60-70 tons to be sorted in one shift. This would require around 15 manual sorters, a conservative estimate that is only a fraction less than the current staff (Machinex Recycling Technologies). It is possible that more or less material would be required, depending on how well the machinery handles the local incoming waste. Fewer employees could also be used if optical sorting equipment was installed, but this is prohibitively expensive and typically only viable for large operations (Machinex Recycling Technologies). The system employs eight 5 horsepower motors (Machinex Recycling Technologies). The estimated electrical cost of running this equipment, using rates from Wisconsin Public Services would be around $17,628 a year. This could of course vary as rates change.
It is a reasonable estimate that the recyclable tonnage will increase by 25%. Based off of the 9,160 tons processed in 2006, it is likely that 11,450 tons would brought in if a single stream system was used. That would mean around 2,290 additional tons would be sent to the MRF instead of the landfill. The estimated revenue generated from single stream processing, based on 2006 market value, would be $1,142,840. This assumes that there will be no significant increase in any one type of recyclable, just an overall volume increase. Additional actual revenue will vary with market value of recyclables. A single stream system would also include an increased residual rate. A reasonable estimate would be a residual rate of 8%. Overall, around 916 tons of residual would have to be sent from the MRF to the landfill. This means an overall 10,534 tons would be diverted from the landfill, and of the 2290 additional tonnage generated and processed at a single stream MRF, only a net 2106 tons is actually being recycled. Assuming an estimated tipping and transportation cost to the land fill of $45 per ton, the cost to dispose of the residue would be $41,220.

Overall estimated costs of running a single stream processing system would be $1,063,858 per year. The MRF would potentially generate $6.90 per ton. This cost is based off of some fixed costs of the current operation as well as estimated costs, including: residual disposal, maintenance, utilities, administrative/educational/clerical staff, 15 sorting laborers, glass transport, computers, payment for new equipment, phone service, and water. It is estimated that with installation, the Machinex equipment would cost around $500,000. Assuming that it could be paid for over a ten year period, with 8% interest, the cost would be $54,000 a year for ten years. Costs for converting the current equipment and facility could not be determined without detailed engineering estimates.
Pros:

- The MRF could process commingled recyclables.
- Municipalities could benefit from lower collection costs as long as the contract with the collector passes on some of the savings
- Would require less labor for sorting
- Increased recyclable tonnage

Cons:

- Residual rate would increase
- Costs for new machinery and facility modification
- Downtime for modification
- Potentially lower quality recycled materials

Transport Single Stream Recyclables to a Processor outside Portage County

If Portage County’s collection switched to single stream, the MRF could be converted to a transfer station and transport commingled recyclables to another processing facility. A conveyor belt system could be set up that would feed the recyclables onto semis for transportation. This could be a viable option if the recyclables would be sent to a facility that would be in the direction of the final user. If the materials had to be sent in a different direction than the final user for processing, fuel costs could be prohibitive.

Tucks could likely hold about 17 tons of compacted recyclables. Assuming that the trucks could travel around 55 miles per hour, and that they would get about 4 miles per gallon, it would cost around $462.85 to send the 17 tons 150 miles. This estimated cost includes:
the drivers pay, fuel costs, truck operation, and loading expenses. The building would still need to be maintained, but only two employees at a time would be required to run the facility, one to load the semi-trucks and one to run the tipping floor. If around 11,450 tons were to be transported, and the semi-trucks could transport 17 tons of compacted recyclables per trip, then 674 trips would be required. 674 trips would cost around $311,961. Including the building, utilities, maintenance, clerical/administrative/educational staff, and the operations labor, overall expenses for a transfer station could be conservatively estimated around $556,406 per year. This could vary depending on changing fuel and labor costs. Again, the costs of converting the facility could not be determined without a detailed engineering study.

It is estimated that a receiving MRF would be willing to pay around $35 a ton. With 11,450 tons that would be $400,750. The cost to operate a recycling transfer station would be estimated to be $7.78 per ton.

Pros:

- No substantial capital costs
- Could contract the work out
- Collectors and communities could decide what method of collection they would use, dual or single stream.

Cons:

- Would loose control of recyclable sales and associated revenue
- High costs, subject to changing fuel prices
- Reliance on what the receiving MRF is willing to pay
• Jobs would be lost

**Manually Sort with Increased Labor**

Single stream recyclables could still be processed manually using the current Dual Stream facility, with minor modifications. To process the estimated 11,453 tons of commingled recyclables additional sorters would be required, as the fully commingled recyclables would require extensive sorting. The current facility would also require some modification to accommodate this additional presorting. A possibility would be to add an additional four sorters to each shift. These four would separate the paper from containers so they could be processed by the existing sorting lines. Costs would remain similar, but with the addition of 8 employees. This would likely increase expenses by around $364,694, bringing total costs to around $1,220,272. Assuming that the revenue would be the same as the proposed single stream sorting system, $1,142,840, the net processing cost per ton would be around $6.76 per ton.

**Pros:**

• The current facility would require little modification

• Could accept both fully commingled and Dual Stream recyclables

**Cons:**

• High labor costs

• Potential for lower quality recycled materials
Comparison of Proposed Systems

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</thead>
<tbody>
<tr>
<td><strong>Tonnage</strong></td>
<td>9160</td>
<td>11450</td>
<td>11450</td>
<td>11450</td>
</tr>
<tr>
<td><strong>Processing/costs</strong></td>
<td><strong>$653,059</strong></td>
<td><strong>$861,339</strong></td>
<td><strong>$137,223</strong></td>
<td><strong>$1,017,753</strong></td>
</tr>
<tr>
<td><strong>Transport Costs</strong></td>
<td><strong>$43,261</strong></td>
<td><strong>$54,077</strong></td>
<td><strong>$311,961</strong></td>
<td><strong>$54,077</strong></td>
</tr>
<tr>
<td><strong>Disposal costs</strong></td>
<td><strong>$16,515</strong></td>
<td><strong>$41,220</strong></td>
<td><strong>$0</strong></td>
<td><strong>$41,220</strong></td>
</tr>
<tr>
<td><strong>Total Estimated Cost</strong></td>
<td><strong>$712,835</strong></td>
<td><strong>$956,636</strong></td>
<td><strong>$449,184</strong></td>
<td><strong>$1,113,050</strong></td>
</tr>
<tr>
<td><strong>Revenue</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sale of Recyclables</strong></td>
<td><strong>$944,496</strong></td>
<td><strong>$1,142,840</strong></td>
<td><strong>$400,750</strong></td>
<td><strong>$1,142,840</strong></td>
</tr>
<tr>
<td><strong>Net Revenue</strong></td>
<td><strong>$231,661</strong></td>
<td><strong>$186,204</strong></td>
<td><strong>-$48,434</strong></td>
<td><strong>$29,790</strong></td>
</tr>
</tbody>
</table>

*This cost includes maintenance, utilities, investments in equipment, and labor. It does not include Administrative, educational, and clerical staff as well as other fixed expenses.

Looking at the net revenue of each proposed system, the current process appears to be the most cost effective.

**Conclusion**

It appears as if single stream recycling would certainly benefit collectors within Portage County. Collectors could experience significant savings, of which a portion could be passed to residents if contracts are written to include a discount to residents due to collector savings. The residual rate also increases significantly for the MRF, meaning that landfilling costs would be transferred from the collector to the MRF. For the Portage County MRF it would appear that single stream processing would initially be more expensive. For a facility the size of the Portage County MRF, the capital required for a switch to a single stream system may be too expensive and would require the entire collection system converting to single stream to provide the additional tonnage. This
reliance on a complete switch to provide additional tonnage would make single stream less viable. Comparing the current revenue generated, $13.59 per ton, to the estimated revenue from the proposed single stream facility, $6.90, it would appear as if the current system is more cost effective. After ten years when the machinery is paid off the revenue could be around $11.62 per ton. In the long run, single stream processing could become more cost effective after the new machines are paid off, as well as the potential for an additional reduction in labor. Of course these numbers are subject to the change in market value for recyclables as well as utility costs. An in depth engineering study will be required to fully assess the benefits versus the costs of Portage County converting to a single stream processing system.

The City of Stevens Point will be using single stream collection soon. Currently no other collectors have plans to switch to single stream collection within Portage County, though enthusiasm has been expressed by Wittenberg Disposal. The Portage County MRF will have to face the challenge of sorting Stevens Point’s commingled recyclables, but as long as no other communities use single stream collection and the equipment at the MRF is functioning, the existing system should be sufficient, and the most cost effective option, to continue processing the recyclables of Portage County.
Sources


City of Madison Streets and Recycling. Personal Interview 25 April 2008


City of Stevens Point Streets Department. Personal Interview. 9 April 2008


Machinex Recycling Technologies. Personal Interview. 25 April 2008

Portage County Solid Waste Department. Personal Interview. September 2007


Wittenberg Disposal , Wittenberg, WI. Personal Interview. 20 March 2008
Acknowledgements

Without Dr. Aga Razvi, I never would have been able to do this project. He told me about this opportunity and helped me write my proposal. Throughout the project he continued to offer me guidance and help.

I would also like to thank Meleesa Johnson for her help and cooperation with this study. She made it possible for me to conduct this study by providing access to the Portage County MRF’s operating data. I also appreciate the rest of the Portage County Solid Waste Department’s staff for aiding me in my research.

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Jim Hartleben at Wittenberg Disposal provided me with a lot of solid information, for which I am grateful.

I should also thank Joe Euclid for the data on the City of Stevens Point’s collection process and the planned conversion to single stream recycling.

Overall, without the help and cooperation of these people, and many others, I could not have conducted this research. I really appreciate all of the time and effort they gave to help me.