

May 6, 2005

Mary Jane Kent  
Solid Waste and Recycling Coordinator  
Greene County  
218 Greene County Office Building  
93 East High Street  
Waynesburg, PA 15370

Subject: **Greene Arc Inc.**

Dear Ms. Kent:

The purpose of this report is to outline recommendations for action by Greene County and Greene Arc, Inc. toward making Greene Arc more financially sustainable and thus better able to meet the County's recycling needs. Greene Arc believes they could improve their financial situation by:

- Increasing quantities of recyclable materials delivered to the facility;
- Improving the quality of materials delivered to the facility (e.g., reducing contamination); and,
- Improving/expanding material end markets, including perhaps finding alternative end markets for crushed glass, as well as potential markets for plastic grocery bags.

R. W. Beck has reviewed and analyzed the above categories and provides the following recommendations outlined in this document for each.

## **Increasing Quantities Delivered to the Facility**

Greene Arc is a non-profit organization that provides job training and jobs for handicapped individuals in Greene County. The County initially established the recycling facility at Green Arc to fulfill this need, with the hope that they would recover their expenses by selling processed materials. While they are able to sell the materials they process, they are not generating adequate revenue to cover facility capital and operating costs.

Greene County has a completely voluntary (no mandated communities) drop-off recycling program. There are 14 full-time sites that accept all paper, cardboard, glass containers, plastic bottles, aluminum cans, and steel cans. No curbside recycling programs operate in the County. Municipal crews collect materials weekly and deliver them to the recycling facility that is owned by Greene County and operated by Greene Arc.

Table 1 shows where and how the materials are collected, and how they are processed for marketing.

Table 1  
 Recyclable Material Flow Analysis

Newspaper	Drop-offs	Combined with cardboard	Manual, pick out contaminants	Baled
Cardboard	Drop-offs	Combined with newspaper	Manual, pick out contaminants	Baled
Office Paper	Drop-offs	Combined with newspaper	Manual, pick out contaminants	Baled
Cardboard	Commercial	Separated	Rebale	Baled
Aluminum cans	Drop-offs	Combined with steel cans	Manual	Densified, strapped into bricks
Steel Cans	Drop-offs	Combined with aluminum cans	Separated with magnet	Densified, strapped into bricks
Green glass	Drop-offs	Combined with other glass	Manual, pick out contaminants	Crushed, roll-offs
Brown glass	Drop-offs	Combined with other glass	Manual, pick out contaminants	Crushed, roll-offs
Clear glass	Drop-offs	Combined with other glass	Manual, pick out contaminants	Crushed, roll-offs
PET plastic bottles	Drop-offs	Combined with HDPE	Manual sort	Mixed PET baled
HDPE plastic bottles	Drop-offs	Combined with PET	Manual sort	Mixed HDPE baled

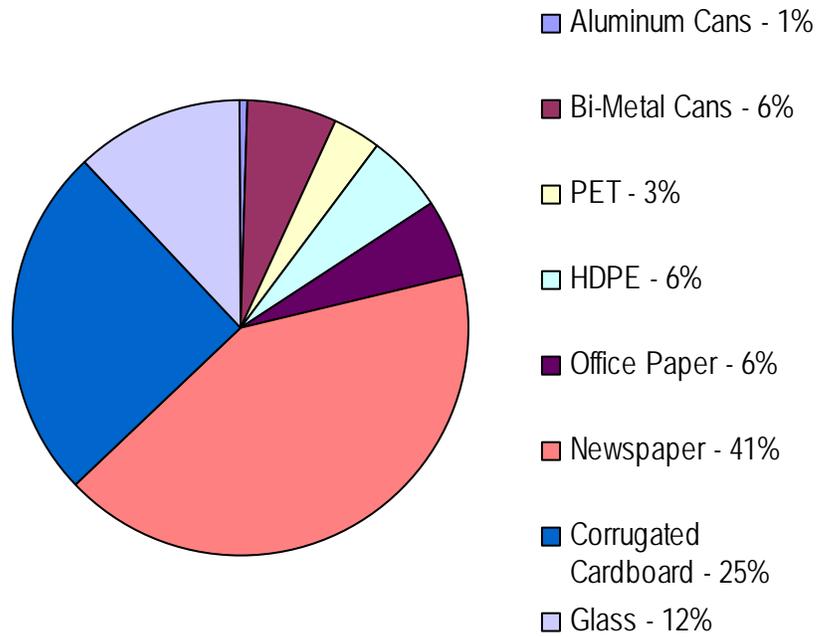
As shown by Table 1, all materials are collected through the residential drop-off system. Additionally, corrugated cardboard is collected from commercial customers. The commercial customers store the corrugated cardboard loose. It is manually collected in a box truck by two Greene Arc employees, then unloaded at the Greene Arc facility. In addition to corrugated cardboard, Greene Arc collects plastic and glass bottles, mixed paper, and mixed recyclables from some commercial accounts. Greene Arc charges approximately \$20.25 per pick-up for this service. Their current commercial customers include:

- Watters
- Central Greene School
- Greene County Administrative Office
- Denovus
- SCI
- Baily's Insurance
- Dr. Toothman
- Eagles
- City of Greensboro

During 2004, approximately 670 tons of recyclables were processed at the Greene Arc facility. For each specific recyclable material collected in the Greene County system, R. W. Beck quantified current recycling quantities, estimated market value and capture rate. This analysis met R. W. Beck's goal of identifying the most viable and cost-effective materials for Greene Arc to target for recovery.

Figure 1 shows, by weight, the percent of each material collected and marketed during 2004. As indicated by this data, newspapers are the most significant material recycled in Greene County, by weight, followed by corrugated cardboard.

Figure 1  
Composition of Recyclables

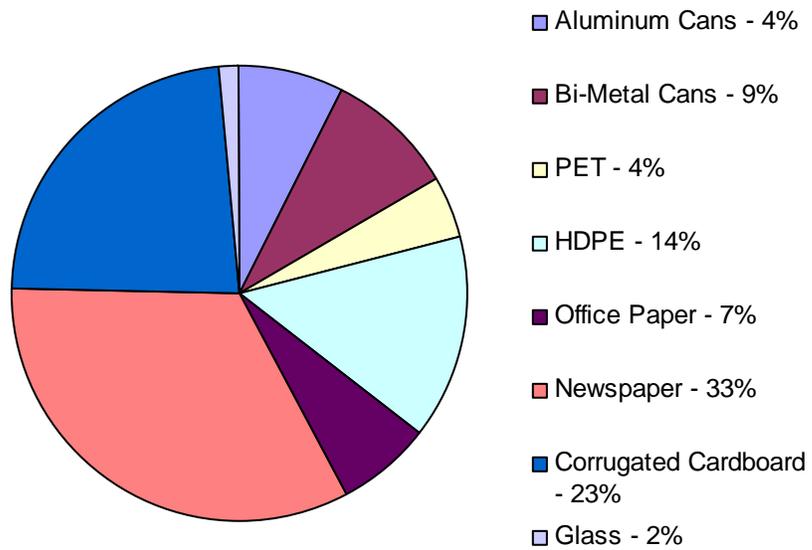


During 2004, Greene County received approximately \$53,266 in revenue from the sale of recyclables. The average market value on a dollar-per-ton basis for 2004 was as follows:

- Aluminum Cans – \$920/ton
- Steel Cans – \$114/ton
- PET – \$120/ton
- HDPE – \$ 200/ton
- Office Paper – \$ 95/ton
- Newspaper – \$ 62/ton
- Corrugated Cardboard – \$ 73/ton
- Glass – \$ 10/ton

Figure 2 indicates the total revenue each material generated for 2004.

**Figure 2**  
**Revenue Analysis**



Finally, Table 2 calculates the capture rate for each of the recyclables processed by Greene Arc.

**Table 2  
 Capture Rates**

Aluminum Cans	0.5%	109	4	113	3.55%
Steel Cans	1.2%	261	42	303	13.87%
PET bottles	1.1%	239	23	262	8.77%
HDPE bottles	0.9%	196	38	234	16.26%
Office Paper	3.1%	674	37	711	5.20%
Newspaper	5.6%	1,217	278	1,495	18.59%
Corrugated Cardboard	7.6%	1,652	168	1,820	9.23%
Glass	3.0%	652	80	732	10.93%
<b>TOTAL</b>	<b>23.0%</b>	<b>5,000</b>	<b>670</b>	<b>5,670</b>	<b>11.82%</b>

<sup>1</sup> Composition derived from data provided in PA DEP Waste Characterization Study, 2002.

<sup>2</sup> Based on a disposal quantity of 21,741 tons. Source: PA DEP Waste Characterization Study, 2002.

<sup>3</sup> Tons disposed plus recycled equals generated

<sup>4</sup> Tons recovered divided by tons generated

Using the data that current recycling quantities, estimated market value and capture rate analysis yielded, R. W. Beck recommends the following strategies for recovering additional materials.

### Target Large Generators of Corrugated Cardboard

Corrugated cardboard has a relatively high market value, but its current capture rate is low. To take advantage of the potentially large revenue stream, R. W. Beck recommends that Greene Arc target generators of large quantities of corrugated cardboard, including:

- Grocery stores, such as Giant Eagle;
- Furniture/appliance retailers, such as Barn's Furniture and Appliances; and
- Home improvement stores, such as Central Plaza Hardware.

To successfully target large generators of corrugated cardboard, R. W. Beck recommends the following implementation tactics:

**Survey large generators of corrugated cardboard:** To determine which generators of corrugated cardboard would be receptive to Greene Arc providing recycling services, R. W. Beck recommends that Greene Arc conduct a survey to gather the following information:

- Whether they currently recycle corrugated cardboard;
- If yes, who provides the service and what they are charged;
- If no, reasons why they don't recycle;
- How much corrugated cardboard they generate (They may need help estimating this);
- How frequently they would require collection;
- What would be the most convenient way to store the corrugated cardboard until collection (i.e. loose or in a container);
- Whether they would have space for a small dumpster for corrugated cardboard on their property;
- How much they current pay for refuse collection; and,
- What they would be willing to pay for separate corrugated cardboard collection.

The survey responses may indicate that the manual collection system currently used by Greene Arc would need to be changed, to match up better with how the generators prefer to store corrugated cardboard on their premises. Offering generators a more convenient way to store their corrugated, along with improving the efficiency of the collection program will most likely increase participation, reduce operating costs and allow Greene Arc to charge a lower collection fee.

**Evaluate the feasibility of a new collection infrastructure:** The current collection method for loose cardboard, involving two staff members and a box truck, may deter some large generators of cardboard from participating in the recycling program because they want to containerize their corrugated cardboard versus storing it loose on their premises. Also the manual loading and unloading process for the corrugated cardboard is inefficient and consequently yields high operating costs. Therefore R. W. Beck recommends that Greene Arc consider replacing the current collection infrastructure with an automated collection system that is comprised of carts, roll-off containers or front-load containers.

In a cart system, the generator stores their cardboard in rolling carts (typically 95-gallons) and the service provider uses an automated truck for collection. Fully automated collection vehicles are equipped with hydraulic crane-like arms that lift, empty, and return the containers to the point of collection automatically. With this type of collection equipment, only one crewmember is usually needed who will not need to leave the vehicle under normal conditions. The generator may need to move the carts from their normal location on collection day to a designated point where the driver can access them without exiting the collection vehicle. Keeping the driver in

the truck optimizes the collection efficiency and reduces the potential for operator injury. The automated truck would also allow collection directly from loading docks.

Carts in this system cost approximately \$40 to \$45 each. A fully-automated collection vehicle costs approximately \$165,000.

Another type of commercial recycling collection system uses a standard frontload container for each type of recyclable material. Containers in this system typically range from 6 to 10 cubic yards and cost about \$650 each. A frontload truck costs approximately \$195,000.

### Target Large Generators of Office Paper

Currently, Greene Arc does not collect office paper from their commercial accounts and only six percent of incoming recyclable material is office paper. As with corrugated cardboard, office paper has a strong market value but the County's capture rate is only 5.20 percent. Therefore, R. W. Beck recommends that Greene Arc target this material for recovery from commercial generators. Using the existing collection infrastructure, Greene Arc could provide commercial customers with blue plastic bags for storing office paper. If a new collection infrastructure for corrugated were established, office paper could be combined in the same containers with corrugated cardboard with out diminishing the market value of either material.

Additional large generators of office paper that Greene Arc should target include:

- Commonwealth of Pennsylvania's Public Administration Offices – 1,103 employees;
- Greene County Memorial Hospital – 350 employees;
- Waynesburg College – 297 employees;
- West Greene School District – 140 employees;
- Jefferson-Morgan School District – 130 employees; and,
- U.S. Postal Service – 105 employees.

As with corrugated cardboard, Greene Arc may want to survey these potential customers to develop an office paper recycling program that best addresses their needs.

### Improve Commercial Recycling Outreach

In order to increase the tonnage of these higher-value materials, Greene Arc needs to improve its outreach and approach to commercial businesses. Currently Greene Arc's primary method for promoting commercial recycling is through the distribution of brochures and periodic newspaper advertisements. R. W. Beck recommends that after Greene Arc decides what type collection infrastructure will be used for commercial recyclables, the brochures be redesigned and include:

- A one page fact sheet about Greene Arc,

- A description of the types of materials recycled, services provided, rates, and contact information;
- Some facts about the economic benefits of recycling; and,
- Several case studies, covering a variety of types of Greene County commercial establishments that have implemented recycling programs with Greene Arc, should emphasize the benefits the establishment experienced.

R. W. Beck recommends that this piece have the appearance of a professionally-designed brochure. Techniques to accomplish this without the expense of professional design services include:

- Use a heavier paper stock (for example, Wausau exact gloss coated and white 80 pound cover) that contains recycled content;
- Use photographs instead of clip art; and,
- Use a Times New Roman font.

The brochure will be a general tool to help market Greene Arc's commercial recycling services to potential customers. R. W. Beck recommends that Greene Arc mail brochures to approximately five of the survey respondents whose answers demonstrate interest in a recycling program. These five businesses should all be similar in the type of service they provide (i.e. grocery stores). Two weeks after mailing the brochure, Greene Arc should follow up with a telephone call to schedule a face-to-face meeting and presentation designed to present more specific information and persuade the business to sign up as a Greene Arc recycling customer.

For this face to face "sales call", R. W. Beck recommends that Greene Arc develop a PowerPoint presentation. PowerPoint is an effective and affordable tool for presenting information in a professional manner, easily modified to address the specifics for each potential customer. The presentation should also address the follow issues that are applicable to all generators:

#### 1. Promoting the Benefits of Waste Reduction and Recycling

The advantages of waste reduction and recycling are numerous. Recycling impacts the economic health of all types of businesses, from corner stores to international corporations, because cutting costs, improving image and lifting employee morale make good business sense. Thus, to encourage commercial establishments to participate in the Greene Arc recycling program, the following messages need to be conveyed in the presentation:

- **Economic gain**: Reducing waste disposal expenses are increasingly important business goals. By examining the financial impacts of operations, purchasing practices and disposal methods, costs can be reduced and waste can be transformed from a liability into a potentially profitable resource.

- **Enhanced product and business image:** The benefits of waste recycling extend beyond the short-term economic advantages. Many organizations have implemented strategies that actually cost slightly more in order to reap these long-term benefits. Positive environmental practices have greatly benefited many manufacturers and retailers in recent years. U.S. consumers are increasingly changing purchasing habits based on the environmental records of products. According to a study published by Cambridge Research International in July 1994, half of the American public actively seeks out recycled content products in the retail store .
- **Improved Employee Morale:** Waste recycling programs have also served as an effective tool for improving employee morale. Starting a recycling program is an ideal opportunity to involve employees in organizational decision making. Employees provide many of the creative and logistical ideas to start waste reduction efforts and the momentum to make these efforts successful.

## 2. Obtaining Support

Greene Arc's presentation to potential commercial recycling customers should also stress that a commitment from company management lends the importance and legitimacy needed to achieve a high level of employee participation in the recycling effort. Endorsement from management is first needed to establish a waste reduction/recycling team and then to support that team by backing program goals and activities. Management will also play a key role in encouraging and rewarding employee commitment and participation in the program.

Greene Arc should encourage their customers, both existing and potential, to distribute or post an announcement from the top management stating their full support of the effort. This statement will impress upon employees that waste reduction and recycling is a high priority for the company. The management announcement should:

- Introduce employees to waste recycling;
- Explain how waste recycling can benefit the employee, the company and the environment;
- Outline the design and implementation stages of the program; and,
- Provide the team leader's name and encourage employee suggestions.

The presentation should also educate management about the range of short-and long-term benefits waste recycling offers including avoided disposal costs, possible revenue from the sale of recyclable material, and improved community relations. Green Arc could also provide guidance on how waste management methods can be re-evaluated on a regular basis to assure continuing cost-effectiveness. As with the brochure, Greene Arc should also provide a list of other businesses that have successfully implemented recycling programs. Contacting these business may help convince management that a recycling program can be successfully implemented.

### 3. Building a Waste Recycling Team

During the presentation, Greene Arc may want to offer to help larger businesses organize a team of individuals responsible for planning, designing, implementing and maintaining the recycling program. The team approach will enable tasks to be distributed among several employees from different departments within the company. A team with varied perspectives is better able to develop creative ideas for waste recycling.

Small businesses may utilize a team of one or two people that are familiar with the overall operations of the company. Team members may be appointed or volunteer but it is important that the team be enthusiastic about the program and has time to commit to the effort. The team or management should also appoint a leader to direct team efforts and administer the planning, implementation and operation of the recycling program.

The waste recycling team is typically responsible for the following tasks:

- Working with company management to set the preliminary and long-term goals of the waste recycling program;
- Gathering and analyzing information;
- Promoting the program and training co-workers;
- Measuring progress of the program and making needed changes; and
- Periodically reporting program status to management.

After the team has been established, its members should meet regularly to develop a plan and begin program implementation. The planning stage can range from two or three weeks to several months based on the size and complexity of the company and its waste streams.

### 4. Educating Employees

The presentation should also outline what role Greene Arc can play in helping to educate employees about participating in the program. For example, memos, updates and announcements should be posted regularly and in a centralized location(s). Instructions on what can be recycled, along with what can't be recycled, must be compiled and distributed to employees in order to make the program work effectively. These instructions can include brochures, electronic mailings, bulletin board posters, and signs on recycling containers. Greene Arc staff may want to work closely with the recycling team at the company to make sure that the educational materials are easy to understand and follow, and that they motivate employees to participate.

Changing employees' habits can be challenging, but creative individuals on the recycling team can usually come up with ideas to make recycling fun and rewarding.

## 5. Monitoring Results

The presentation should also outline how Greene Arc will work with the commercial establishment to monitor the program results in order to minimize problems and to quantify successes. Mechanisms to track a recycling program include:

- Comparing waste hauling records from prior to the program to hauling records after implementation of the program to demonstrate waste reduction and cost savings;
- Checking dumpsters for accidental disposal of materials that should have been sent to Greene Arc; and,
- Tracking of statistics such as decreases in tonnage disposed, avoided hauling costs, recyclable revenue, and employee participation.

Program results should be communicated to employees, both the recycling team responsible for the logistics of the program, and the many employees participating to enable the positive results.

Greene Arc may want to work with Waynesburg College's Digital Media program and find an individual who could assist develop the brochure and PowerPoint presentation.

## Improve Website

A good recycling website or web page can be a successful component of a waste reduction and recycling education campaign. Greene County's current website does not provide drop-off recycling locations or tell the site visitors what materials can be recycled—nor does it provide any information about the commercial recycling program. R. W. Beck recommends that the website provide basic information about the drop-off recycling program, and additionally that it be modified to enable residents to type in their address and be directed to the nearest drop-off site. A separate page should be dedicated to commercial establishments and provide information on how Greene Arc can help them establish recycling programs for cardboard and office paper. Greene County may want to look at other Pennsylvania County websites, such as Mercer County's, for ideas to make their website more useful and user friendly.

## Work with the Greene County Department of Planning and Development

The Greene County Department of Planning and Development (Planning) is currently facilitating the development of the EverGreene Technology Park and a Wal-Mart complex. EverGreene Technology Park is will be built on a 248-acre site adjacent to Greene County Airport owned by GCID Inc., which has donated 20-acres at the site to EverGreene Technology Park Inc. to kick start the development. As a center for entrepreneurial innovation and R&D activities, EverGreene Technology Park hopes to recruit business that specialize in the fields of advanced computing, advanced materials, biotechnology, biomedical, energy, environmental, scientific research, materials science, transportation, telecommunications, robotics, virtual environments, and computer software/hardware development.

The Wal-Mart retail complex will be developed on the property adjacent the Greene County Airport off Route 21. McHolme/Waynesburg LP will be developing the 115-acre site; which is expected to include a Super Wal-Mart, a home-improvement store, several smaller retail shops, and at least one restaurant.

Both of these establishments will employ hundreds of people and will generate substantial quantities of corrugated cardboard and office paper. Thus, they should be targeted by the County and Greene Arc as potentially large and lucrative commercial recycling accounts. In addition, the Wal-Mart complex will be an ideal location for an additional public drop-off recycling facility. It is essential that Greene Arc begin working with the Planning Department while these facilities are still in the development stage so recycling can be incorporated into site plans.

## Improving the Quality of Materials Delivered to the Facility

As shown in Figure 3, plastic grocery bags are the primary residue that is disposed. Based on conversation with Greene Arc employees, the source of the plastic grocery bags is residents who place their recyclables in them and then deposit the bag along with the recyclables into the drop-off container. Beyond disposal concerns, manually de-bagging recyclables reduces the efficiency of the recycling processing facility.

The primary strategy for eliminating this practice is education. All materials and advertisements promoting the drop-off sites should stress that recyclables must be placed loose into the containers and that bags are not acceptable. Additionally, all facility signage should make it clear that only #1 PET and #2 HDPE plastic bottles, jars and jugs are accepted, and other plastic objects, including bags should not be placed in the containers. The signage that R. W. Beck observed during our site visit just indicated that “plastics” were accepted.

Signs that graphically depict what materials are recyclable can help reduce residents’ concerns and misunderstandings about plastics. Signage about plastics should always emphasize the fact that only bottles, jars and jugs are desired for recycling. Wide-mouth containers such as margarine and yogurt containers are considered contamination by plastics markets and at some point they are removed and, most likely, discarded, when the material undergoes final processing for its end use. Keeping those materials out at the source results in greater market satisfaction, although this is not always reflected in the price. It also reduces the time needed to sort material in preparation for baling. With better education and training, over time, the amount of contaminants deposited by the public will decrease, reducing Greene Arc’s sorting costs.

Mary Jane Kent  
May 6, 2005



Figure 3 Solid Waste Disposal Dumpster

Attachment A is an example of the effective signage that Schuylkill County uses with their V-Quip drop-off recycling containers.

R. W. Beck also researched potential markets for plastic grocery bags. While national markets accept baled plastic bags and pay fairly high prices, a market within this region does not appear to exist. However, WalMart does accept plastic grocery bags for recycling. Greene Arc could contact Wal-Mart management to discover how they are processing and marketing their plastic bags, and whether they may be willing to partner with Greene Arc to recycle the plastic bags, possibly by combining bales for shipment.

## Finding Alternative Markets for Glass

As shown in Figures 1 and 2, glass comprises 12 percent of Greene Arc's incoming waste receipts but only 2 percent of the revenues. Given this poor market performance, R. W. Beck researched alternative markets, such as using glass as an aggregate substitute, fiberglass manufacturing, bead manufacturing, decorating applications, frictionators, and fluxes/additives.

### Aggregate Substitute

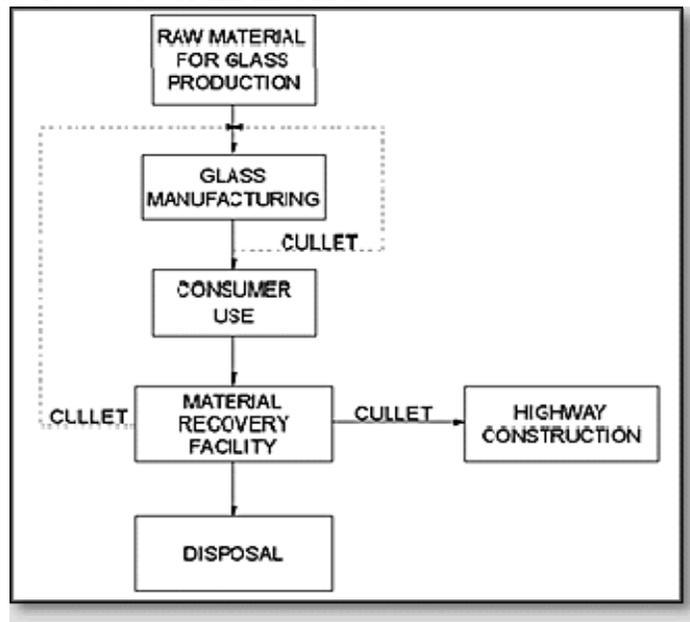
Glass can be used as a aggregate substitute in the following applications:

- Road beds ("Glassphalt");
- Concrete;
- Flexible fill (small amount of concrete only to bind)
- Backfill;
- Landscaping;
- Pipe underlay;
- Jogging/walking trail underlay;
- Septic system filtration; and,
- Mixed with salt for ice control.

Specific examples of using glass as an aggregate substitute in these applications include:

## Glassphalt<sup>1</sup>

Waste glass has been used in highway construction as an aggregate substitute in asphalt paving. Some communities have recently incorporated glass into their roadway specifications, which could help to encourage greater use of the material. Crushed glass or cullet, if properly sized and processed, can exhibit characteristics similar to that of gravel or sand. As a result, it should also be suitable for use as a road base or fill material.



**Figure 4 General Overview of Glass Cycle in the United States**

When used in construction applications, glass must be crushed and screened to produce an appropriate design gradation. Glass crushing equipment normally used to produce a cullet is similar to rock crushing equipment (e.g., hammer mills, rotating breaker bars, rotating drum and breaker plate, impact crushers). Successful production of glass aggregate using recycled asphalt pavement (RAP) processing equipment (crushers and screens) has been reported. Magnetic separation and air classification may also be required to remove any residual ferrous materials or paper still mixed in with the cullet. Because MRF glass crushing equipment has been primarily designed to reduce the size or densify the cullet for transportation purposes and for use as a glass production feedstock material, this equipment is typically smaller and uses less energy than conventional aggregate or rock crushing equipment.

Crushed glass (cullet) particles are generally angular in shape and can contain some flat and elongated particles. The degree of angularity and the quantity of flat and elongated particles depend on the degree of processing (i.e., crushing). Smaller particles, resulting from extra crushing, will exhibit somewhat less angularity and reduced quantities of flat and elongated

<sup>1</sup> [www.tfhr.gov/recycling/waste/wg1.htm](http://www.tfhr.gov/recycling/waste/wg1.htm)

particles. Proper crushing can virtually eliminate sharp edges and the corresponding safety hazards associated with manual handling of the product.

Uncontaminated or clean glass exhibits consistent properties; however, the properties of waste glass from MRFs are much more variable due to the presence of non-glass debris present in the waste stream.

Glass is known for its insulating or heat-retention properties (low thermal conductivity). Aggregates and aggregate mixtures with low thermal conductivity can help to decrease the depth of frost penetration. Studies conducted at the Colorado School of Mines in the early 1970's reported that glass aggregate pavements take a longer time to cool down due in part to the lower thermal conductivity of glass, when compared to natural aggregates.

The high reflective properties of glass can be a desirable property in highway construction if they assist in delineating the roadway surface from the surrounding environs. Excessive reflection could, however, result in glare that could adversely affect roadway visibility. There are no documented studies on the quantities of size fractions of glass in pavements that are likely to produce excessive glare. There is, however, a noticeable glass reflection in pavements with glass fractions exceeding 15 percent by weight.

In order for glass use to be practical in pavement construction applications, stockpiles of sufficient size need to be accumulated to provide a consistent supply of material. Due to the relatively low glass generation rates from small communities, such as Greene County, accumulating these stockpiles may be impractical and limit the use of this alternative market.

#### **Aggregate Substitute in Pennsylvania**

The Pennsylvania Department of Transportation (PENNDOT) has experimented with glass as a substitute for aggregate in various applications. However PENNDOT has not added crushed glass to its list of approved materials, nor specified its use in recent projects.

PENNDOT projects utilizing crushed glass to date include:

- In the summer of 1998 PENNDOT used 100 percent cullet as a pipe underdrain material along SR 2004 in Clarion County.
- In the summer of 2000 cullet was used as an aggregate in base course asphalt along the shoulder of SR4013 in Manheim, Lancaster County;
- In the fall of 2000 PENNDOT installed 2,000 tons of glass cullet between a jersey barrier and sound wall along I-95 in Delaware County.

Because the aggregate industry is strong in the State, particularly in the central portion of Pennsylvania, many recyclers doubt that crushed glass will win favor over aggregate for political as well as economic reasons in that region. There is some hope, however, that mixed cullet could be used for an aggregate substitute in the Eastern portion of the State. In the

Northwestern portion of the state, one recycler hopes to create a market for crushed cullet as fill in drainage ditches. He is uncertain what kind of approval he needs, but crushed glass is being used for this purpose successfully on Ohio farms. Crushed glass has been used as an aggregate substitute (backfill and pipe underlay) in limited applications in county projects in Lackawanna County and Centre County.

### **Septic Filtration**

Pulverized cullet is reported to work at least as well as sand in sand mound septic system filtration systems, and is less expensive than sand (which costs approximately \$10 per ton). Although the PA DEP has crafted a memorandum stating that crushed glass can be utilized to replace sand in septic system filtration systems, the regulation has not been changed, and contractors are skeptical to use this medium, fearing legal ramifications. Septic systems would be a potentially large market for mixed cullet, as each system uses, on average, 100 tons of glass. Another filtration use for glass is as a medium in swimming pool filters. King County Washington uses recycled glass as a filtration medium in their public swimming pool filter.

### **Fiberglass Manufacturing**

According to the Glass Packaging Institute, fiberglass manufacturing constitutes the second most common use of glass cullet. Fiberglass manufacturers have very high standards, however, for quality and consistency of product. They also require that the material be fine-ground. During fiberglass production, raw batch materials and glass cullet are continuously added to the furnace. After melting and “fining,” the molten glass is spun into fibers by a process called fiberizing. To ensure production of consistent fibers, cullet must meet specifications for major and minor oxide chemical composition, color consistency, and contaminant levels. Metal, organic, and ceramic contaminants can degrade the product, and can damage the fiberglass production equipment. In theory, all colors of cullet can be used, however the overall mix has to be consistent, in order to have a consistent oxidization state.

The State of California requires that fiberglass manufacturers use some post consumer content in fiberglass manufacturing. The North American Insulation Manufacturers Association states that in the year 2000 alone, more than 1.2 billion pounds of glass was diverted from the waste stream for this use, which would fill approximately 32 million cubic feet of landfill space. Many fiberglass insulation products contain up to 40 percent recycled materials (including post-industrial and post-consumer). Strategic Materials, which has a plant in Belle Vernon, Pennsylvania, supplies clean, crushed glass to the fiberglass industry. The cullet they supply to this market is derived from plate glass, such as windshields and post-industrial scrap tableware glass, due to its clean and consistent nature. Strategic Materials can process post-consumer cullet, however they charge a tipping fee to accept it. Some post-consumer cullet is received some from Ohio, at a tip fee of approximately \$30 per ton.

### **Bead Manufacturing**

Glass can be manufactured into tiny beads, which are added to paint for reflexivity. These beads can also be used in some cleaning applications. Todd Heller, Inc. in Northampton, PA has the ability to make beads, and company officials have indicated that they have been able to sell some of this product to PENNDOT.

### **Decorative Applications**

Glass cullet is being used in some decorative applications such as glass tiles, coasters, glass brick, etc. Recently some U.S. tile companies began manufacturing tiles with 100 percent recycled glass, however the glass they use is plate glass, due to its more uniform, consistent nature, and also the prohibitive cost involved with cleaning mixed container glass cullet to make it suitable as a feedstock. Some glass blowers are beginning to use post-consumer glass cullet. Decorative applications, at this point, are very low-volume outlets for mixed post-consumer glass cullet.

### **Frictionators**

Glass can be used as frictionators in manufacturing matches and ammunitions.

### **Fluxes/Additives**

Glass cullet can be pulverized into a powder to be used as fluxes, lubricants, and additives in the metal foundry industry. It can also be used as flux and binders in the ceramics industry.

### **Recommendations on Alternative Glass Markets**

Preparing post-consumer glass cullet to the strict specifications of the alternative glass markets described is highly capital intensive and may not be practical due to the low volumes of glass generated in Greene County. Therefore, R. W. Beck recommends that Greene Arc first find the end user, determine their specifications, and research equipment requirements and costs before developing any new crushed glass product.

Mary Jane, I appreciate the opportunity to assist you in improving your recycling system performance and economics. I hope this report provides you with actionable steps you can take to:

- Increase the quantities of higher-value recyclables delivered to the Greene Arc processing facility;
- Improve the quality of materials delivered to the facility by helping to reduce contamination; and
- Improve and expand material end markets for glass - potentially by using alternative end markets for crushed glass - as well as for plastic grocery bags.

Mary Jane Kent  
May 6, 2005  
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Mary Jane, thank you for providing R. W. Beck with the opportunity to assist Greene County and Greene Arc improve your recycling system. If you have any questions, please do not hesitate to call me at 513-936-8955.

Sincerely,

Karen M. Luken  
Senior Director

ATTACHMENT

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**R·W·BECK**

# RECYCLE HERE

Please use containers. Leaving your recyclables on the ground is illegal dumping.  
Violators will be prosecuted.

## CARDBOARD



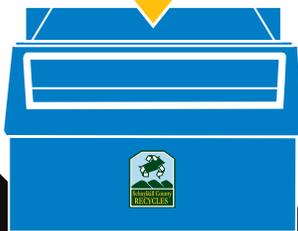
Corrugated Cardboard  
Boxboard  
Brown Paper Bags



Please break down boxes



Pizza boxes



## PLASTICS



#1 PET and #2 HDPE  
Plastic Bottles

Examples:  
Milk Jugs  
Soda Bottles  
Juice/Water Bottles  
Detergent Bottles



Styrofoam  
Plastics Labeled #3,  
#4, #5, #6 or #7



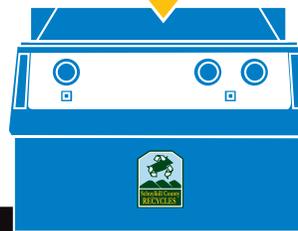
## METALS



Aluminum Cans  
Steel and Bi-Metal  
Food and Beverage  
Cans



Small Appliances  
Electronics



## GLASS

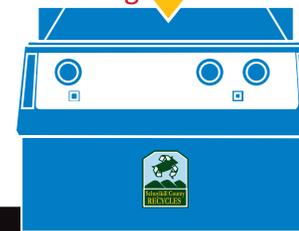


Glass Food and  
Beverage Bottles and  
Jars

Clear, Green and  
Brown Glass



Metal Caps/Lids  
Ceramic  
Light Bulbs



## PAPER



Newsprint  
Phone Books  
Magazines  
Catalogues  
Office Paper  
Junk Mail



Plastic Grocery Bags  
Clothing

