

Phase I Report

Hamilton County

August 30, 2002



HAMILTON COUNTY PHASE I REPORT

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This report has been prepared for the use of the client for the specific purposes identified in the report. The conclusions, observations and recommendations contained herein attributed to R. W. Beck, Inc. (R. W. Beck) constitute the opinions of R. W. Beck. To the extent that statements, information and opinions provided by the client or others have been used in the preparation of this report, R. W. Beck has relied upon the same to be accurate, and for which no assurances are intended and no representations or warranties are made. R. W. Beck makes no certification and gives no assurances except as explicitly set forth in this report.

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EXECUTIVE SUMMARY

Introduction

Hamilton County Solid Waste Management District desires to promote the recovery of additional materials from the landfill, and at the same time, stimulate Hamilton County's economy. Toward this end, the District contracted with R. W. Beck to perform a market study of selected secondary materials that have a potential for industrial/commercial use in feedstock by local or regional business operations. The three materials chosen for further examination in Phase I of this project are: food waste, yard waste, and untreated wood and wooden shipping pallets. Provided in Appendix A is the letter report documenting the research and rationale supporting this selection process.

Objective

The objective of this report is to document the flow of each of the materials studied. In particular, R.W. Beck focused on identifying:

- Who generates the material;
- The infrastructure in place for recovery and processing of the material;
- The adequacy of the recovery infrastructure;
- End users of recovered/processed materials;
- Barriers that inhibit generators, processors, and/or end users from recycling the material; and
- Whether potential opportunities exist to expand markets for the material in the future.

Methodology

R.W. Beck used existing databases (such as the Department of Environmental Services' Database of recyclers) to identify processors in the County. In addition, investigations utilizing the Internet yielded other contacts. R.W. Beck developed a questionnaire to ascertain the desired information from interviewees. Next, R.W. Beck conducted telephone interviews with an array of stakeholders in the County, including:

- Generators, processors, and end users of the targeted materials;
- Program managers; and
- Other public officials.

R.W. Beck utilized information obtained during these telephone interviews, as well as existing experience and knowledge of organics recovery programs, to ascertain the flow of materials for each selected material. This report is the culmination of those efforts.

R.W. Beck notes that the study methodology has inherent limitations. While personal interviews with key stakeholders in the County and in the region provide valuable information, the District has not conducted a waste composition study in recent years. Consequently, R. W. Beck was not able to develop estimates on the quantities of each target material being disposed in the local municipal solid waste landfill or one of the C&D landfills in the District. Therefore, the relative magnitude to which the study materials are generated and landfilled is based on opinions provided by those interviewed for the project, as well as from knowledge pertaining to other communities' waste composition and materials markets.

Report Organization

This report is divided into three material-specific sections containing a description of:

- Primary material sources;
- Current management and recycling practices;
- Existing collection, handling, and processing infrastructure;
- Key players;
- Existing end users;
- Recycling market barriers; and
- Potential recycling market development opportunities.

The report concludes with a summary of findings and recommendations for Phase II of the markets assessment project. The objective of Phase II is to further explore and prioritize potential market development opportunities and strategies, whereas this report's purpose is to describe the current flow of materials, and introduce some potential opportunities that could be explored further in Phase II. Market development opportunities to be explored in Phase II include:

- New business development in Hamilton County, including the attraction of existing firms and the start-up of new ones;
- The development of new recycled products by existing firms in the Tri-State area;
- Increases in output by existing recycling firms (thereby using greater amounts of secondary material); and
- Conversion from virgin to secondary feedstocks by existing local manufacturing firms.

Section 1

FOOD WASTE

Food waste is consistently one of the largest categories of waste being landfilled in most parts of the country. In California, according to the California Integrated Waste Management Board, food waste comprises approximately 16 percent of the disposed waste stream (from residential, institutional, and commercial sources). R.W. Beck's Montgomery County, Maryland Waste Composition Study indicated that food waste comprises an estimated 15.3 percent of the materials landfilled in that County. Because of the challenges inherent in the separation, collection and processing of food waste, effective composting or other food waste recycling programs have been slow to develop.

Food waste is often characterized in the waste industry as being either “pre-consumer” or “post-consumer”. Pre-consumer food waste is typically generated as a result of food production or preparation for consumption, and in some cases may include food that is still edible for use in food bank programs. Post-consumer food waste, as the term implies, has been served to consumers and is generally not recoverable except for composting or animal feed operations. The primary concern with recovery of post-consumer food waste pertains to sanitation and health issues in handling these materials.

Another important consideration within the realm of food waste recovery is the presence or absence of meat in the waste stream. This concern stems from the potential for foodborne pathogens to proliferate under certain conditions during storage, transport and processing of the food waste. Proper handling effectively controls pathogen growth but the tendency of public health agencies is to err on the side of caution. Because of this, most food and food waste handling regulations, including composting regulations, are considerably more restrictive where meat is present.

1.1 Generators of Food Waste

Generators of food waste can be classified as: residential, industrial, and commercial/institutional. The residential and commercial/institutional sectors are capable of generating both pre-consumer and post-consumer food waste. Whatever food waste is generated by the industrial sector is primarily pre-consumer.

1.1.1 Residential Generation

Households generate a significant amount of food waste, both pre-consumer and post-consumer – an average of 474 pounds per year, according to recent research from the University of Arizona. Unless a household actively composts their food waste, the pre-consumer and post-consumer materials are commingled with other household garbage. The food waste coming from each household is unique according to individual diets and lifestyles. In general, this is the most difficult sector from which to recover food waste economically.

1.1.2 Industrial Generation

Some industrial entities, such as food product manufacturers, are potential generators of pre-consumer food waste. Industrial generators have a built-in economic incentive to minimize the amount of food waste they generate because, unlike residential generators, their disposal costs are almost always directly tied to the amount they generate. Furthermore, manufacturers of food products have an economic incentive to streamline operations.

Food waste generated from industrial sources is generally more homogeneous than the other sectors, which could make it more appealing as feedstock for large-scale composting operations. Another characteristic of industrial generators is a higher degree of predictability of quantities generated.

The Harris Directory lists several possible generators of food waste in Hamilton County, including six sausage and meat product businesses, a poultry slaughtering facility, fourteen bakeries, six food preparation facilities, three dairies, an ice cream manufacturer, a canned fruit facility, and three soft drink and/or syrup manufacturers.

1.1.3 Commercial and Institutional Generation

Commercial entities consist of establishments such as restaurants, produce wholesalers, grocery stores and grocery store warehouses. Institutions that generate food waste include hospitals, schools, correctional facilities, etc. Commercial and institutional generators can potentially generate both pre-consumer and post-consumer food wastes.

Commercial and institutional pre-consumer food waste is most commonly targeted for food recovery programs or composting operations, because they tend to generate a larger quantity of source-separated food waste than residential and industrial generators. Grocery stores also fall into this category. Commercial and industrial generators of food waste in Hamilton County are described in Table 1-1. Food wholesalers and distributors are not listed, because they tend to generate little food waste.

Table 1-1

Commercial and Institutional Generators of Food Waste in Hamilton County

Type of Facility	Number of Facilities in County
Grocery Stores	57
Meat and Seafood Retailer	1
Produce Retailers	3
Retail Bakeries	4
Eating Establishments	139
Nursing Facilities	89
Hospitals (All types)	13
Schools (Excluding Universities)	28
Universities	6
Prisons/Juvenile Detention Facilities	3
Total	343

Source: *The Harris Directory*

1.2 Recovery of Food Waste

Recovery of food waste is currently very limited within Hamilton County. There is no comprehensive collection or transportation infrastructure in place for any category of generator, nor are there any large-scale composting facilities in Hamilton County that accept food waste.

1.2.1 Recovery from Residential Generators

There is no collection or transportation infrastructure in place to recover food waste from residential generators. Residential generators may recover some food waste for at-home composting; however, this quantity is not known and is not expected to amount to a significant portion of that which is generated.

1.2.2 Recovery from Industrial Generators

Although the scope of this project did not allow for all food waste generators to be contacted, R.W. Beck contacted a number of industrial generators in order to assess to the fullest extent possible what is being done with their food waste. By and large, most industrial generators appear to be minimizing the amount of food waste they landfill by implementing waste minimization strategies and/or selling their products at secondary retail outlets at reduced prices.

Industrial generators of food waste often donate what cannot be sold, but is still consumable (overstock, for example, or product nearing the end of its shelf life) to

food banks. Large-scale food manufacturers, for example, often distribute substantial quantities of consumable food products (at least three truckloads) to Second Harvest's headquarters in Chicago where it is distributed to food banks nationwide that can use the products. Second Harvest indicates that most large-scale food manufacturers participate in this program.

No industrial generators in Hamilton County are known to send food waste to a composting operation, an animal feed manufacturing facility, or alternative potential market for food waste. A manufacturer of snack foods noted, however, that a farmer collects food waste on a regular basis from their plant to use directly as cattle feed.

1.2.3 Recovery from Commercial and Institutional Generators

Some wholesale producers, grocery stores, restaurants, and community events (like food festivals) donate food waste or excess food for human consumption. Kroger, for example, donates food to Second Harvest food banks. The FoodBank, Inc., in Cincinnati also has a food reclamation program with Kroger, whereby damaged food products from all of the Cincinnati area (approximately 100 stores) are delivered to Kroger's warehouse, and then delivered to The FoodBank, Inc., in Cincinnati. There, employees scan the food for Kroger. Information is downloaded, so that Kroger can claim the damaged merchandise against the manufacturer. The food is then either: 1) Destroyed (landfilled) because it is not consumable (about 15 percent); 2) Shipped back to the manufacturer (about 5 percent) or donated to the food bank, for human consumption (approximately 85 percent). Approximately 2 million pounds of food per year are donated to the food bank through this program.

Most supermarkets have similar programs for non-perishable food items. Winn Dixie Supermarkets, which operate as Thriftway Stores in the Cincinnati area, send their unsalable non-perishable food products to their district warehouse in Louisville, Kentucky. In Louisville, a private company performs the food reclamation service.

None of the supermarkets in Hamilton County are known to donate or dispose of food at composting operations, nor does FoodBank, Inc.

Excess prepared foods are not donated on a large scale. Some restaurants and institutions, as described below, donate prepared food items to FoodBank, Inc.; however, prepared foods are a very small portion of what they receive. Generally, when such donations are made, FoodBank, Inc. picks up the donation and delivers it to the point of consumption – a food pantry or shelter, for example.

Several bakery thrift stores sell outdated product to hog farmers, who arrange for transport of the product.

1.3 Uses and Markets for Recovered Food

Food waste can be used for a wide variety of products that fall into four categories: recovery for human consumption, animal feeds, compost products, and other products. Table 1-2 lists various products and their applications. Each of these uses and the

extent to which food is used for each purpose in Hamilton County, is discussed in more detail below.

Table 1-2

Products and Applications of Food Waste

Surplus Food Recovery for Human Consumption

- Perishable and prepared food recovered for distribution to the needy
- Canned foods and dry goods recovered for distribution to the needy

Animal/Fish Feed

- Direct feeding of food waste to swine, dairy cattle and other livestock
- Conversion of food waste into animal/fish feed or ingredients therein

Compost

- Soil amendment for various horticultural and landscaping applications
- Mulch products for various applications
- Ingredient in manufactured soil products for sale as topsoil or loam
- Ingredient in plant growing media

Other Products

- Fertilizer
- Tallow (rendered animal or vegetable fat used to make soap or candles)
- Industrial chemicals

1.3.1 Surplus Food Recovery for Human Consumption

Surplus food recovery for human consumption is accepted primarily by two types of entities: food banks and food rescues. A food bank is a warehouse for excess non-perishable food supplies – grocery store or manufacturing overstock, for example. These items are warehoused until they are needed, and distributed to hungry people for consumption. Food rescues, on the other hand, provide an outlet for prepared or perishable foods. Food is collected by the rescue, and generally is delivered immediately to a church, soup kitchen, or shelter, where the food can be served that day.

In Hamilton County, there is a food bank known as FreeStore/FoodBank, Inc, which is a Second Harvest affiliate. This facility is located on Tennessee Avenue in Cincinnati. It serves as both a food bank and a food rescue. They also have a second location that serves food directly to families. FoodBank Inc. distributes approximately 12 million pounds of food per year to hungry people in 22 counties. They estimate that

approximately 65 to 70 percent of the food is distributed within Hamilton County. They also have a food preparation training program, which teaches individuals kitchen job skills, while preparing foods for distribution. FoodBank, Inc. receives mostly non-perishable food products, and about 1.3 million pounds of prepared and perishable foods per year. They purchase approximately 30 percent of the products they receive, at discounted prices. This is the only food bank/food rescue known to be operating in Hamilton County. They distribute food to approximately 40 food pantries, where families and individuals are fed.

1.3.2 Animal Feed

Food recovery for animal feed can be direct: e.g., saving food scraps and feeding them directly to animals, or can involve manufacturing animal food from food waste.

The Department of Agriculture has jurisdiction over animal feed that involves animal products, or is post-consumer, and therefore may have come into contact with animal products. The State of Ohio still allows “garbage feeders” – such as pigs, that can eat post-consumer scrap food. However, the practice has become highly regulated due to concern about the spread of disease, particularly foot-to-mouth disease. In Ohio, post-consumer or mixed food waste must be cooked before it can be turned into animal feed. There is a large processor in northern Ohio that processes post-industrial food scrap and sells it to four animal feed manufacturers, none of which are located in Hamilton County.

In Hamilton County, there are a few known food recovery programs that involve reuse of food to feed animals directly. These are explained below.

- **Panera Bread** recovers day-old bread from their Cincinnati stores, and donates it to the Cincinnati Zoo for animal feed. Zoo staff indicate that they receive several 55-gallon bags of bread products every few days. There are no other food donations being made to the zoo, although the zoo receives many offers for donated food. Their experience has been that the perishable foods offered by other organizations are generally not of high enough quality to feed to the animals, and then the zoo has to dispose of the material.
- **Hostess/Wonder Bread thrift stores** sell their outdated product as animal feed to Kalbach Farm in Columbus, Ohio, who pays for the product and its transportation. The company states that they dispose of very little product – mostly product with compromised packaging that is therefore not edible.
- **Nickles Bakery Inc.** also uses thrift stores to sell their products that are nearing expiration. What is not sold is slit open (to ensure that it won't be consumed by humans), bagged, and sold to local hog farmers for animal feed. They do not donate to food banks, because they need to make what they can on the product, and do this by selling through thrift stores.
- **Husman Snack Foods** allows a cattle farmer to collect industrial food waste (potato peelings, primarily, as well as other food waste) from their manufacturing facility, which he uses to directly feed to his cattle. No money is exchanged,

however the company saves on their disposal costs by allowing the farmer to collect these peelings.

- **Caruso Foods**, a wholesale food distributor, pays a silage company called Superior Feed in Sidney, Ohio, 40 miles north of Dayton, to take its food waste (primarily corn husks and other vegetable waste). Superior Feed manufactures animal feed or animal feed additives. David Caruso of Caruso Foods reports that he saves about 40 percent in disposal costs by paying Superior Food to haul the food waste, rather than landfilling it. The owner of Superior Feed, Tom Kloppel, was not forthcoming about his final product and processing. However, he indicated a capacity of up to 2,000 more tons per week of feedstock, including animal products, post-consumer food wastes and sawdust. Kloppel already hauls from several generators in and near Hamilton County, which is about 75 miles away from his facility, and increasing collection of food waste and sawdust from that area would be advantageous to him.

1.3.3 Composting

Composting of food waste offers perhaps the greatest unrealized opportunity for diversion of food waste. The characteristics of food waste are suitable for composting with a variety of other feedstocks, including yard waste and untreated wood waste.

Ohio law (Chapter 3734 of the Ohio Revised Code) considers solid waste composting a form of solid waste disposal utilizing controlled biological decomposition. Therefore, composting is regulated by the Ohio EPA-DSIWM (Composting Unit). In the State of Ohio there are four classifications for composters. A Class I facility is the only facility that can accept post-consumer food waste. Class II facilities can accept source-separated (pre-consumer) vegetative and non-vegetative food waste with Director approval.

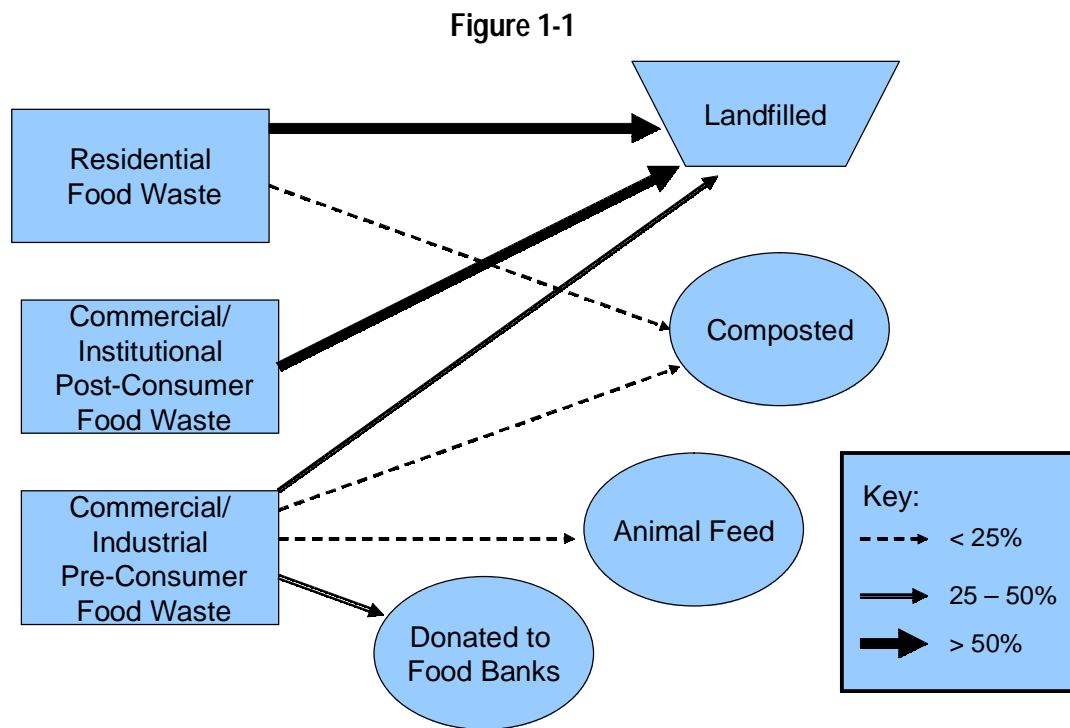
There are currently no Class I or Class II facilities with Director approval to accept pre-consumer vegetative food waste located in Hamilton County, with the exception of an educational farm that does have Director approval to compost source-separated vegetative food waste from a local produce market on-site. The farm, called Gorman Heritage Farm, composts discarded produce from Pipkins' Produce Market. The facility obtained a grant to undertake this pilot project, and was exempt from certain operational requirements because they take in a relatively small amount of material from just one supplier, and because they use the material on-site. The composted material is not sold; rather it is used on-site as a soil amendment for the crops grown on the farm.

The closest large-scale composting operation to Hamilton County that accepts food waste is Garick (owned by Pay Gro), in Clark County. This facility is a Class II facility, which has approval by the Director to compost source-separated vegetative waste. They accept Dole's salad waste, for example, from a nearby salad bagging facility. They did not want to discuss the amount of material received from the food waste generator(s), but said what they receive is all pre-consumer vegetative waste. They said the situation works for their suppliers because they save money on tip fees.

Section 1

If the economies worked out, they could accept a lot more pre-consumer vegetative waste from other sources.

Figure 1-1 below shows the flow of food waste in Hamilton County.



* Percent represents portion of each waste generator category– e.g. Residential Food Waste

1.4 Barriers to Recovery/Utilization of Food Waste

There are numerous reasons why more food waste is not currently being recovered in Hamilton County. Many of these reasons exist in other parts of the country, as food waste is one of the more difficult waste streams to recover economically. Barriers to food waste recovery are mostly related to storage and collection issues rather than processing or market limitations.

1.4.1 Barriers Common to All Markets

- **Separation and recovery challenges at point of generation** - Recovery of pre- and post-consumer food waste requires educational efforts and significant changes in behavior. Restaurants and institutions often indicate that with the high turnover they have with kitchen staff, it is difficult to train and re-train kitchen staff to separate pre-consumer food waste. Training residents and patrons to separate post-consumer food waste is even more challenging, as many see this practice not only as a change, but distasteful.

- **Lack of storage space at generation site** – Suitable storage at the point of generation is important regardless of the market for food waste. For example: many food banks will accept prepared foods but cannot always collect the food immediately, so they ask that the food be frozen. Most restaurants and institutions have limited freezer space. Similarly, food waste generators that might consider separating their food waste to be utilized as feedstock in compost operations may lack space for two sets of containers for waste (one for waste to be landfilled, one for waste to be composted).
- **High moisture content** – The high moisture content of some food waste causes problems with both storage and handling. Some haulers prefer to compress the liquid out of the material before transporting, in order to make transportation more economical. This practice, as well as unintentional spillage, can cause odor problems at the generator’s site.
- **Collection economics** - Even a small amount of putrescible waste can generate odors or attract vectors in a short period of time. For this reason, generators with large quantities of food waste require more frequent collection than if food waste were not present in their waste stream. Most food waste generators in Hamilton County commingle their food waste with other waste materials. If a generator were to begin separating food waste for a recovery program, it would require an additional refuse container to accommodate all waste materials. The cost of additional refuse containers and service are likely to be greater than the original cost of one container of commingled materials.
- **Transportation is expensive relative to tipping fees** - Often the resources required to collect perishable foods could be more efficiently used for other purposes. For a while, FoodBank, Inc., Cincinnati, was having linen delivery drivers deliver prepared foods to the food bank; however they became “tired of donating their time.” Transporting food waste to composting operations is relatively expensive, considering the relatively low tip fees for municipal solid waste in the area.

1.4.2 Barriers Specific to Composting of Food Waste

- **Lack of composting infrastructure** - Currently there are no composting operations within Hamilton County that accept food waste. (One exception is Gorman Heritage Farm, which only accepts vegetative waste from a single wholesale produce market.) There are no Class I or Class II composting facilities in the County. Class I facilities are allowed to accept post-consumer food waste, and would not need Director approval to accept source-separated vegetative waste.
- **Regulatory restrictions** -- A Class II composting facility must receive Director Approval to be allowed to accept food waste containing meat products for use as feedstock -- Some composting facilities have indicated that this can be a regulatory barrier, as it can take six to eight months to receive this special approval.

- **High level of contamination in post-consumer food waste** – For post-consumer food waste in particular, contaminants or concern regarding contaminants may limit the resultant product applications and end markets. Food waste from industrial generators is usually more consistent and of higher quality (from a contamination standpoint).
- **Lack of developed markets for food waste compost** – Compost markets in general are relatively undeveloped in Hamilton County. Further, customers may not want to use compost made of animal products or post-consumer food waste. Some users of compost may perceive that pathogens are not killed in the composting process, and therefore may not wish to use compost made of animal or post-consumer food waste.

1.4.3 Barriers Specific to Animal Feed Markets

- **Lack of animal feed producers within the County** - Only one animal feed manufacturer that accepts food waste as feedstock is known to exist in the Tri-state area, however further research may identify additional manufacturers. Land O'Lakes, reported to be a large-scale manufacturer of animal feed in Fayette County, Ohio, does not use food waste to manufacture animal feed. Instead, they use corn and soy to manufacture cattle and horse feed.
- **Strict regulations for feeding of animals directly** - Food containing animal product, or that has potentially come into contact with animal product, must be approved through the Department of Agriculture. The State of Ohio still allows what is often called “garbage feeders” – however it must be processed (cooked under certain conditions) before it can be fed to animals, or used in the production of animal feed. The State has these guidelines in place to protect animals from diseases – particularly foot-and-mouth disease. This is an important regulation for health and safety reasons, however it food waste must be recovered and utilized within these regulations.

1.5 Potential Opportunities to Enhance Recovery/Utilization of Food Waste

Beneficial use of recovered food waste could be enhanced in Hamilton County by improving economical recovery of food waste, and supply of food waste to existing potential processors – such as animal feed manufacturers and compost manufacturers, to use recovered food waste as a feedstock in their production process. Opportunities to attract new processors that could utilize food waste as feedstock could also be pursued.

Interest on the part of large generators of food waste is essential to develop successful recovery strategies. These generators have an inherent economic incentive to find less expensive alternatives to landfill disposal. Jim Caruso of Caruso Foods, for example, said that if it were less expensive for him to dispose of the waste in another way, such as composting, then he would do so. He says that he is considering getting into the

composting business himself, in part to save on disposal costs. He currently pays to have his food waste processed by an animal feed producer. Preliminary opportunities to enhance food recovery for the various end uses are listed below.

Food Banks

- **Stimulate additional recovery for food donations.** The demand for food donations has doubled in the past 18 months, according to FoodBank Inc., Cincinnati's Executive Director. In general, the need for perishable and prepared foods is greater than the need for non-perishable foods.

Animal Feed

- **Explore opportunities to expand use of food waste in feeding farm animals directly.** Farming is not a large industry in Hamilton County, however the potential exists for food waste to be utilized directly on other farms in Ohio and northern Kentucky. There are several hog farms in northern Ohio.
- **Explore opportunities for use of food waste in manufacturing animal feed within Hamilton County.** Currently, there are no known animal feed manufacturers in Hamilton County that utilize food waste in their production.

Composting

- **Explore on-site composting opportunities.** In-vessel composting systems are available in the marketplace that target large-scale generators of food and similar wastes. On-site composting eliminates the cost to haul food waste and yields a marketable product. Ag-Renu, a company located in northern Ohio, uses in-vessel technology to manufacture compost at the site of generation.
- **Encourage existing or new compost facilities to incorporate food waste into their operations.** There are no large-scale compost facilities in Hamilton County that are permitted to accept food waste at the present time. The regulatory process to obtain the appropriate permit to accept food waste for composting is reported to be quite onerous. Rumpke's NPK facility in Colerain reportedly intends to pursue this in the future.

Section 2

YARD WASTE

Yard waste includes tree trimmings, brush, grass clippings, leaves, and small stumps. The amount and relative composition of these materials in municipal waste streams varies across the country. No comprehensive studies were found to accurately characterize this waste stream in Hamilton County or Ohio since the enactment of the source-separated yard waste disposal ban in Ohio. In Oregon, a recent statewide waste composition study indicates that leaves, small prunings (under two inches in diameter) and grass trimmings comprise approximately 5.3 percent of the disposed waste stream. Most yard waste generated by Oregon residents within metropolitan boundaries and by commercial entities are source-separated and hauled to a composting facility. Before this infrastructure was in place, yard waste comprised approximately 10 percent of the disposed waste stream. In Montgomery County, Maryland, yard waste comprises approximately 2.4 percent of waste disposed. There, source-separated yard waste is not allowed to be disposed with solid waste and is either chipped or composted. Exceptions to this are loads contaminated with poison ivy, oak, or sumac.

2.1 Generators of Yard Waste

In general, yard waste generators can be considered in two categories: residential and commercial.

2.1.1 Residential Generation

Residential yard waste consists of tree trimmings, leaves, and grass clippings from single-family households.

2.1.2 Commercial Generation

Commercial yard waste refers to grass clippings, leaves, and tree trimmings generated by professional landscapers and municipalities in the course of maintaining yards, grounds and parks. The State of Ohio bans source-separated yard waste from landfills - which is what commercial generators tend to produce. In essence, the commercial generators are expected to find alternatives to landfilling the yard waste they generate. They also have an economic incentive to do so, as tip fees at municipal solid waste landfills are more expensive than tip fees at facilities that accept yard waste for composting and mulching operations.

2.2 Recovery of Yard Waste

2.2.1 Recovery of Residential Yard Waste

County Programs

Hamilton County encourages on-site yard waste composting followed by recovery and composting of yard waste that cannot be managed on site. The County produced a Yardwaste at Home Handbook, which encourages residents to participate in the following activities to avoid landfilling yard waste:

- “Just mow it” – leave grass clippings on lawn;
- Composting yard waste; and
- Vermi-composting food waste.

The handbook includes the benefits of organic gardening, as well as projects for children and other resources for those who want to “dig deeper.” The County also has a composting display at Delhi Township Park, where residents can learn more about composting.

There are three drop-off locations that all residents of Hamilton County may utilize at no cost to them. These sites are:

- Evans Landscaping, 3700 Roundbottom Road in Newtown (East)
- Kuliga Park, 6717 Bridgetown Road in Green Township (West)
- Rumpke Sanitary Landfill, Struble Rd. & Colerain Ave, Colerain Twp. (North)

In 2001 1,113 tons of materials were brought to these three drop-off sites. The materials were delivered via 35,000 car trips. The majority of the material collected is brush; however in the fall, a significant amount of leaves is also delivered to the sites. Reportedly, most residents in the area do not bag their grass clippings. The sites are all staffed, so material collected is assumed to be relatively contaminant-free.

The materials collected at the Evans Landscaping site are processed into compost by Evans Landscaping. Materials delivered to the Kuliga Park and Rumpke sites are delivered to the NPK Composting facility, which is owned by Rumpke. Processing of the Kuliga Park materials is contracted each year to the lowest bidder.

Municipal/Township Collection Programs

There are 48 jurisdictions in Hamilton County: 36 municipalities and 12 townships. In the municipalities, separate yard waste collection is generally offered to residents at no extra cost. Leaf collection is provided in most municipalities as well. In the townships, residents subscribe to private haulers for waste collection. The haulers no longer provide separate collection of yard waste in the townships, however some of the townships provide for separate collection of leaves only. Township residents, for the most part, either manage their yard waste on-site, haul their yard waste to one of the drop-off locations, or dispose of it with their regular refuse.

Table 2-1 lists the programs for curbside collection of yard waste in the County's municipalities and townships with a population of greater than 15,000 (2000 Census). These jurisdictions comprise approximately 73 percent of the County's total population.

Table 2-1

Yard Waste Programs in Most Populated Municipalities and Townships in Hamilton County

Community Population	Yard Waste Separate?	Materials Collected at Curb	Collection Arrangement	Notes
Cincinnati 331,285	Yes	Grass Leaves Tree Limbs Brush Residents put yard waste in own containers marked Yard Waste, bags (no plastic), or 90-gallon yard waste carts. Branches bundled no larger than 4'X2'.	Weekly collection on same day as refuse. Service provided April through December. January through March, residents can call Cincinnati Public Services to schedule a pickup for yard waste.	Collection provided by City Crews. C&D Disposal has contract with City, but sub-contracts out to Evans Landscaping. In general, City crews deliver yard waste directly to Evans Landscaping. At times, yard waste is accumulated at Cincinnati facility, and transferred by Evans.
Colerain Township 60,144	No	Not applicable		Township hosts a clean-up day in October when residents can drop off brush and limbs. Leaves and grass clippings not accepted. Township grinds brush and limbs to make mulch – free to residents.
Green Township 55,660	No	Not applicable		Township encourages residents to use Kuliga Park yard waste drop site for Christmas trees.
Anderson Township 43,857	No	Not applicable	Yard waste, including Christmas trees, can be taken to Evans Landscaping for recycling (a County drop-off site)	No leaf collection program.

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Community Population	Yard Waste Separate?	Materials Collected at Curb	Collection Arrangement	Notes
Springfield Township 37,587	Yes	Brush Bagged leaves -- Seasonal Christmas trees	Township crews collect all yard waste. Brush is call-in service; Bagged leaves collected Tuesdays and Thursdays from October 23 – November 29. Christmas trees collected January 1–17.	Leaves are delivered to Rumpke for composting. Brush and Christmas trees are ground by Township's Service Department.
Delhi Township 30,104	No	Not applicable	Residents can drop off at County site. One private hauler, Bavarian, a KY hauler, collects yard waste, but Township officials believe it is landfilled.	Residents can bring Christmas trees to the Senior Center first Saturday in January. Chipped by Private contractor, who uses the wood chips in his landscaping business. Township estimates 250 Christmas trees received last year.
Norwood 21,675	Yes	Leaves Brush Tree limbs Christmas trees Leaves must be bagged in Kraft bags or placed in cans (no more than 35 gallons and 75 pounds) marked YARDWASTE. Brush must be tied in 4' bundles. Tree trimmings and branches must be securely tied with sting into bundles weighing no more than 50 pounds.	Collection is weekly on regular trash collection days from April through November. Public works collects Christmas trees day after regular trash collection during first two weeks of January.	Rumpke does collection of leaves and brushy waste – composted at their facility. City gives out free yard waste bags with proof of residency – to discourage sweeping leaves into street. Public Works uses leaf vacuum system to collect leaves from curb, but does not want to encourage this. Christmas trees are ground for mulch – processed by Public Works. Mulch used by City and given to residents.
Sycamore Township	Yes	Leaves	Collection is weekly at no extra charge to resident -	Residents can bring brush and limbs to rear

YARD WASTE

Community Population	Yard Waste Separate?	Materials Collected at Curb	Collection Arrangement	Notes
19,675			- mid-October through mid-December, by Township crews.	of Township Administration building first weekend of each month for chipping. Christmas trees are chipped at two locations. Residents must bring tree to sites. Leaves are vacuumed at the curb – Township composts and gives away in spring. Township will collect brush at curb for a fee.
Forest Park 19,463	No	Brush Tree limbs	For collection in spring and fall, residents do not have to register. Off-peak, they register and pay. No leaf collection program. City promotes County drop-off location (Rumpke is closest) and distributes information about home composting.	Forest Park operates a "Chipper Chipper" program monthly, where residents can bring limbs and brush. Christmas trees are chipped (must be delivered to site) first Saturday in January. Wood chips are free to residents.

Yard waste that is collected along with refuse is landfilled. In areas where separate yard waste collection is not offered, residents can deliver the materials to a Hamilton County drop-off site or to a municipal composting or chipping program. It is not legal for residents of Hamilton County to burn their yard waste.

Most residential yard waste collected by municipalities is either composted or ground at a municipal site, or delivered to a private composting facility for a fee. The Village of Fairfax has an arrangement with a landscaping company to take the material free of charge. The Village has a curbside leaf vacuum program, and when the vehicle is full, the driver simply delivers the material to a landscaping facility that makes compost. The facility they deal with is located outside of Hamilton County, because they could not find a landscaping facility within the County that would accept it free of charge.

The City of Cincinnati's residential yard waste (including leaves, brushy waste, and grass trimmings) is collected weekly curbside by City crews and delivered to a transfer station operated by R&M Waste Enterprises under the name C&D Waste Services. C&D Waste Services subcontracts the processing to Evans Landscaping. In large part, City crews deliver the yard waste directly to Evans Landscaping's processing facility. In the past, however, in order to avoid City crews accruing overtime, the crews have delivered the materials to a city-owned site, where it was stored, and Evans

Landscaping transferred it to their processing facility. The City pays \$64.00 to tip each 20-yard packer truck at the facility, whether it is full or partially full. When Evans collects the material from the City's "transfer site," the City pays \$7.00 per cubic yard.

2.2.2 Recovery of Commercial Yard Waste

As mentioned above, it is illegal in Ohio to landfill truckloads of clean yard waste, so commercial generators deliver their yard waste to a composting facility. These facilities charge a fee to accept delivery of yard waste. Quoted prices for tipping of yard waste range from \$12 per ton (Pay Gro in Clark County) to \$23 per ton (Barnes Landscaping, Huron, OH) to \$35 per ton (Evans Landscaping, Newtown). Most facilities will also charge by the truckload, for various types of trucks (at Evans, for example, a pick-up truck load of yard waste would cost \$25 to dump, the charge for a pickup truck with sides would be \$30). The NPK composting facility owned by Rumpke in Colerain charges a \$7 per cubic yard tip fee for clean yard waste, with a \$20 minimum. Since compaction varies considerably among incoming loads, the price per ton at the Rumpke facility might be anywhere from \$25-35 per ton of yard waste. Commercial generators of yard waste are not allowed to use the three County drop-off locations; however if they deliver their waste in a small, unmarked truck, there is no way of knowing that they are a commercial generator. It is assumed that some of the materials being collected from these sites are indeed from commercial generators.

Because composters in Ohio are not required by the EPA to report the amount of incoming materials, there are no concise records of yard waste entering these facilities. Last year, the NPK composting facility owned by Rumpke took in 38,000 cubic yards of yard waste from all sources. Approximately 55 percent (~21,000 cubic yards) of that material came from sources within Hamilton County. The majority of the material processed at NPK comes from their own collection routes, some of which are municipal accounts.

2.3 Processing of Yard Waste

Yard waste is generally processed in two ways: mulching and composting. Each of these processes is discussed in more detail below.

2.3.1 Mulching Operations

Mulching operations in Ohio, as in most states, do not fall under the same regulatory requirements as composting operations and often compete with composters for feedstock. In general, the cost to make a salable "mulch" is considerably less than it is to make compost.

Mulching operations are primarily in the business of grinding and screening various types of woody materials, although some facilities may incorporate leaves and other yard waste materials as well. The type of equipment utilized depends on the incoming feedstocks, and also determines the type of product that can be produced. In some

cases, rough grinding in a tub grinder is the only processing that occurs and the resulting product is sold as coarse mulch.

Value can be added to mulch products with further processing. This might include additional grinding, screening or dyeing of the end product. Blending mulch with other materials is another way to expand a product line. Landscaping companies frequently offer a variety of these products for sale and many use the products in their own landscape construction and maintenance projects.

Some mulching operations offer contract grinding as an additional service, often for land clearing or storm debris management. For example, Evans Landscaping in Newton owns two industrial-grade tub grinders used for site clearing, land clearing and storm debris processing. These grinders can process stumps, brush, pallets, demolition and construction debris, railroad ties, bark and green waste.

2.3.2 Composting Operations

The three broad categories of composting facilities are windrow (considered “low technology”), static pile (“intermediate”) and in-vessel (“high technology”). Most yard waste composting facilities in the U.S. are windrow-type facilities. This is the least expensive of the three types and is perfectly suitable for producing high quality compost with proper management. In general, but not always, operating costs rise with the level of technology. However, the quality of the product does not necessarily correspond directly to the level of technology. Simply stated, the most important factors in producing a high quality product are operator expertise, siting factors, feedstock control and contamination levels. A low technology composting operation run by a knowledgeable operator with relatively clean feedstocks is as likely to produce high quality compost as a high technology composting operation with an operator that is not properly trained or a feedstock that is unsuitable.

Composting facilities in Ohio are classified by Ohio EPA according to the feedstocks and volume of materials processed. The majority of facilities in the State are Class IV, which allows only source-separated yard waste and authorized bulking agents. These facilities require registration with the EPA but no permit. Class III facilities accept the same materials as Class IV facilities plus animal wastes and specified agricultural wastes. Class III facilities are limited to less than 15,000 square yards of total area and also require registration but no permit with the EPA. All but one of the composting facilities in Hamilton County are Class III and Class IV facilities. The exception is a Class II facility, Gorman Heritage Farm, that receives produce waste from one source only — Pipkins Produce-- and uses all of the resulting compost on-site. All of the other composting facilities in Hamilton County are Class III or Class IV facilities and they compost only leaf and other yard waste.

There are both public and private composting facilities in Hamilton County that process yard waste. The degree of processing varies considerably between the facilities. Most of the municipal facilities provide minimal processing and quality control, as they are driven more by the need to divert waste than by the need to create a marketable product. For example, some of the municipal composting operations do little more than stockpile leaves and periodically turn them with a backhoe. NPK,

Gorman Heritage Farm, and the Terrace Park operations are the only composting facilities in the County known to use a deliberate windrow system. The other composting operations use various approaches to maintaining and processing their materials according to available resources. Many municipalities also have tub grinders (or hire a private contractor to operate a tub grinder for them) so that brushy waste and Christmas trees can be ground up as mulch.

Some private composting operations may be as simple as the “typical” municipal processing program described above, or just slightly more sophisticated, grinding the leaves first, then letting them decompose on-site. Several C&D landfills in the County also accept yard waste but typically these operations consist of minimal processing such as a rough-grind. Most use the resulting product on-site for mud control instead of selling it. Landscape companies that process yard waste and sell their compost commercially tend to have a more sophisticated processing technique. Evans Landscaping in Newtown processes the yard waste from the City of Cincinnati and other sources and makes several grades of “soil additives” that contain composted yard waste.

NPK Composting Facility in Colerain operates a Class IV windrow facility that took in 38,000 cubic yard of material last year. They make several products and are working to develop sustainable markets for each of them.

Barnes Nursery, outside of Hamilton County, has a typical processing operation, where incoming materials are ground once, windrowed, and screened to remove large pieces of organic materials or contaminants. Composted material is then blended with topsoil or sand to provide the consumer with a blended product that is ready to use in their particular application.

Pay Gro, located in Clark County, utilizes an in-vessel composting system, which results in making compost in 12 to 14 days. They also blend the compost to make specialty products, and have a bagging operation as well.

Kurtz Bros., another Ohio composter, operates several yard waste composting facilities throughout the State in conjunction with local municipalities. This is an example of a public/private partnership wherein the public sector “provides” the waste and the private sector processes and markets the end products.

2.4 Uses and Markets for Compost and Mulch

2.4.1 Mulch

The term, “mulch,” describes a function more than a specific material; i.e., the manner in which the material is applied. There are a variety of materials that can be used as mulch; e.g., freshly ground wood chips, composted wood chips, fresh grass clippings, shredded bark or any type of compost.

In landscaping or park applications, mulch is commonly used for aesthetic reasons as much as for its benefits to plants. In addition to aesthetic reasons, benefits of mulch include increased moisture retention, erosion control, weed control, and moderation of

soil temperature. Continued use of mulch adds organic matter to the soil and slowly releases nutrients to plants over time.

Wood chips, often freshly ground, are frequently used in playgrounds and to create walking paths. The Village of Fairfax, for example, chips wood and uses it on a walking trail. Consideration in these applications must be given to aesthetics and safety with respect to possible contaminants or sharp pieces of wood that could pose problems with public use.

Several communities in Hamilton County grind Christmas trees and offer the resulting wood chips to residents for free. One municipality hires a private landscaper to grind its Christmas trees and the landscaper keeps the resulting mulch.

Mulch sold through landscaping businesses varies considerably in type and quality. Finely shredding and aging mulch adds value to it. The highest quality mulches are not made from processed yard waste, but instead come from cypress bark and other barks. These mulches sell for \$20 to \$35 per cubic yard, bulk. Aged bark mulches are very popular with homeowners and landscapers in general, as these products have been established much longer in the marketplace. Yard waste mulch, unless highly processed, can typically not compete for top price at a landscape yard when aged bark products are available.

2.4.2 Compost

Compost is the product that results from controlled biological decomposition of organic materials — well beyond the processing that occurs in most strictly mulching operations. The compost industry in the U.S. has experienced significant growth in the last decade and in general the quality of compost products is improving.

High quality compost is beneficial in many different applications ranging from home gardens to agriculture. The primary universal benefit of compost is that it increases the amount of organic matter in the soil. Organic matter drives the natural process of nutrient cycling by feeding the microorganisms that inhabit the soil ecosystem. As the diversity and overall health of this ecosystem increases, the benefits to the plants that are growing there also increase. A healthy soil ecosystem is better able to utilize moisture and nutrients, combat diseases and pests, and in general has increased vigor. Sustained compost use can produce long-term benefits that include reduced need for fertilizers and pesticides, reduced soil compaction, healthier plants, reduced runoff (subsequently reducing siltation of surface waters), and water conservation. Although compost awareness is growing, there is still much room for consumer education as to the many benefits and applications of compost.

Compost and compost blends are used in landscaping, home gardens, container nurseries, roadside vegetation, erosion control and turf applications including golf courses. Compost is used in production agriculture in some parts of the country, where driven by awareness, supply and favorable economics.

Of the registered municipal composters in Hamilton County, most do not receive payment for their compost. They simply give the product away to residents, or use it

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in municipal applications, such as in parks and landscaping around municipal buildings.

Some C&D landfills are also registered as composters. In most cases, however, these operations (including Burger Environmental and Newtown Landfill, for example) simply rough-grind leaf and brushy wood waste, and use it on-site for mud control.

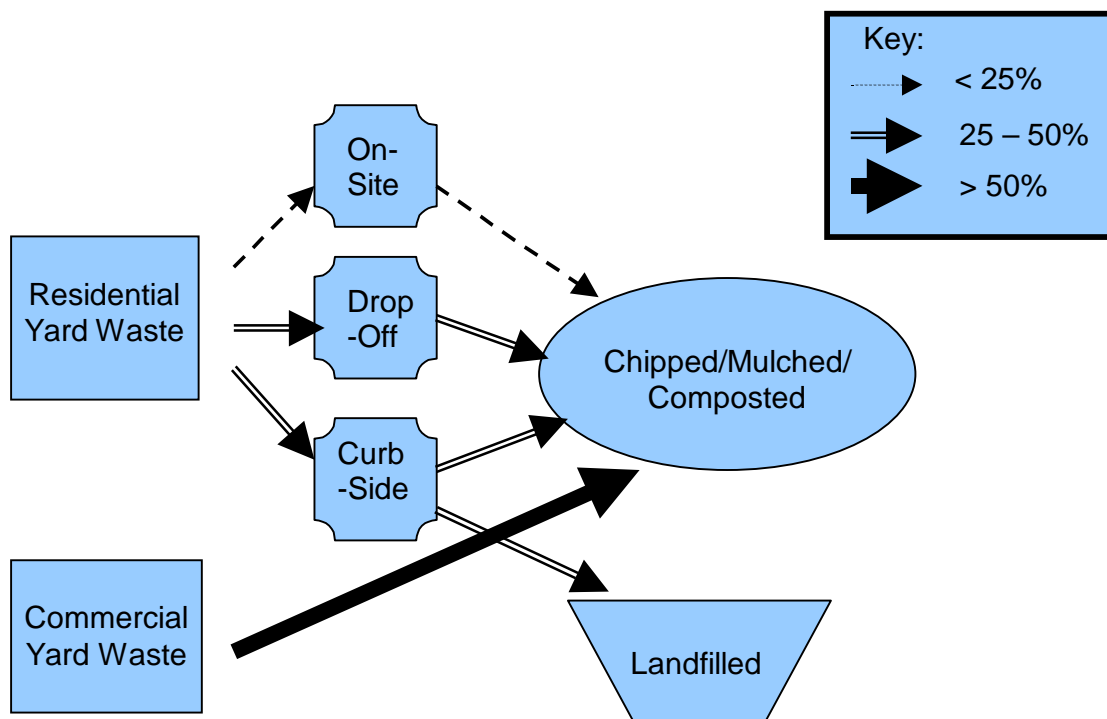
Hafner and Sons also produces mulch, compost, and blended compost products. They report that they have no shortage of end markets, and sell their bulk blended products for \$30 per yard, or \$18 per yard if four or more yards are sold.

Barnes Nursery in Huron, Ohio, which has been in business for 50 years and composting for 12, has been very successful in securing markets for their products. They are unique in that they are vertically integrated – manufacturing mulch and composted materials, owning two retail nurseries, and specializing in landscape design and implementation services. In essence, they have a “built-in” end market for their products, although they also sell them at the wholesale and retail levels.

Compost prices vary considerably. Wholesale prices are generally lower than retail, and the unit price is typically much lower for higher volumes. Barnes Nursery sells their straight compost for approximately \$12 per yard wholesale, compared to \$25 per yard retail. Their blended products sell for \$15 to \$25 per yard wholesale versus up to \$50 per yard retail.

Figure 2-1 below shows the flow of yard waste in Hamilton County.

Figure 2-1



* Percent represents portion of waste generator – e.g. Residential or Commercial Yard Waste

2.5 Barriers to Recovery/Utilization of Yard Waste

Yard waste recovery and utilization in Hamilton County is not market driven, essentially because there is no infrastructure in place for value added product distribution and market development. Processors exist because there is a supply of feedstock primarily driven by waste management policies; e.g., source-separated yard waste is banned from the landfill. The existing processors compete with low landfill tipping fees and subsidized municipal operations that give away product. Compost facilities further compete with mulching facilities (that are virtually unregulated) for both feedstock and product market share.

- **The collection infrastructure is limited by economics** -- Separate curbside collection of yard waste is expensive, and not all municipalities provide the service.
- **Where curbside service exists, contamination is thought to be a serious issue for the processors receiving the material** -- This contamination can have a negative impact on the marketability of the product, or can cause the processor to have to undertake significant efforts to “clean” the material, compromising profitability.
- **Convenience** -- Despite the fact that the drop-off centers are staffed, there is some indication that drop-off material often has contamination issues. Furthermore, many residents do not have a yard waste drop off location in close proximity to their home, as the County spans 414 square miles and has just three drop-off locations.
- **Lack of understanding among potential consumers regarding the benefits of compost** -- Some potential users of compost are using alternative products, and may not fully understand the benefits of compost.
- **Private compost producers must compete with product that is often “free” to residents** -- Some residents receive compost free of charge from their municipal compost program. This can make it difficult for commercial processors to compete for that segment of the market. Furthermore, it promotes the idea that compost is not a product that should be paid for.

2.6 Potential Opportunities to Expand Recovery/Utilization of Yard Waste

Hamilton County has the opportunity to increase the amount of yard waste currently being recovered for beneficial use. The primary beneficial use options for yard waste are composting and mulching. In order for these options to become economically viable, the infrastructure for composting and mulching of yard waste must be more fully developed at all levels: collection, processing and markets. Because the markets for compost have not been well developed, the existing supply of both yard waste (feedstock) and compost (end product) is not being fully utilized.

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Compost producers in Ohio and elsewhere have successfully developed markets for their products where none previously existed. Experts in the composting industry familiar with Ohio suggest that the demand for compost in Hamilton County could easily meet or exceed the potential supply.

Potential actions to develop the infrastructure for yard waste composting in Hamilton County include the following:

Support economical flow of clean yard waste materials into existing mulch production and composting facilities

- **Add additional drop-off locations.** This would allow processors to have a more steady supply of feedstock, however quality of materials would need to be ensured. Drop-off centers particularly in suburban, unincorporated regions of the County would be likely to be most beneficial.
- **Improve quality of feedstock collected.** Minimizing contamination at drop-off sites or curbside reduces operational costs at the processing facility and ultimately improves the consistency of the end products. Increased monitoring and rejection policies during collection will reduce contamination.
- **Consider establishing solid waste collection franchises in the townships to add curbside yard waste collection programs where they don't currently exist.** This again would help establish a steady stream of feedstock, potentially allowing processors to expand their operations.

- **Assist owners of composting facilities overcome regulatory barriers to siting or expanding their operations.** The County or municipalities may have resources to assist private operators in siting and permitting their facilities.
- **Encourage municipalities and compost facilities to work together,** such that municipalities supply feedstock to private composters, rather than making and giving away their own compost and mulch, putting private businesses at an unfair disadvantage. Another public/private opportunity is one in which a private company operates the facility on publicly owned property.
- **Develop awareness regarding the benefits of compost.** This includes education and outreach; develop and/or subsidize targeted pilot or demonstration projects with sustainable goals; resume backyard composting education program.
- **Develop awareness among yard waste generators of the importance of setting out clean yard waste.** It is imperative that processors have clean yard waste for processing, so that they can make quality compost economically.
- **Implement preferred procurement program in Hamilton County.** County and municipal procurement of soil amendments should give preference to locally produced compost (or mulch) if specifications can be met. This includes ballfields, parks, golf courses, cemeteries, schools, housing projects, roadside vegetation projects, etc.

- **Encourage compost manufacturers to test and certify their compost and to produce high-quality products for market.** Ensuring that compost is of high quality helps stimulate demand. Consumers will also have to be educated regarding the benefits of certification.

Section 3

UNTREATED SCRAP WOOD

For the purposes of this analysis, untreated scrap wood consists of untreated C&D lumber and scrap pallets. They are being discussed together, as they would likely be used by many of the same types of end markets. R.W. Beck estimates that job development potential for products made from scrap wood is low to moderate, and that the waste diversion potential is high.

3.1 Untreated Scrap Wood Generation

3.1.1 C&D Scrap Lumber Generation

Residential construction, remodeling, and demolition are the primary sources of untreated C&D lumber. Traditional waste handling practices at construction or demolition sites are not particularly efficient in terms of material recovery; i.e., they are typically commingled with other materials in one pile or container. New residential construction is more likely to generate clean scrap lumber than demolition, which typically contains a higher degree of contaminants such as paint or coverings that hinder recyclability. Commercial construction is generally not considered a significant source of scrap lumber.

3.1.2 Scrap Pallets

Shipping pallets are used by any entity receiving large quantities of materials, such as hardware stores, grocery stores, drug stores, department stores, warehouses, printers and plastic recyclers. Most shipping pallets are made of wood, but there are some plastic pallets also. Businesses that receive large pieces of machinery often receive equipment in large wooden shipping crates. Some generators of pallets use only 20 to 30 pallets on a weekly basis (a Dollar Store, for example), whereas large generators, such as large home improvement stores and discount department stores, might generate 500 to 600 pallets per week. Most of these pallets are recycled within an existing infrastructure of pallet remanufacturers.

One pallet remanufacturer estimates that only half of the pallets generated in the greater Cincinnati area are being recovered. Two pallet remanufacturers interviewed for this project indicate that they believe most large-scale generators are recycling, as there is a financial incentive to do so. Small-scale generators may not have as much of an incentive to recover their pallets, and are more likely to landfill them. Scrap pallets, therefore, are pallets that are too damaged to repair or otherwise not refurbished.

3.2 Recovery and Reuse of Untreated Scrap Wood

3.2.1 Recovery and Reuse of C&D Scrap Lumber

It is estimated that very little untreated lumber is recovered and reused in Hamilton County, unless the contractor himself sees it, and sets it aside for future use. Most contractors rent a single roll-off container for placement at a job site, and do not separate out re-usable, untreated lumber. While it is feasible to separate out untreated lumber from C&D (construction and demolition) waste at the landfill, this is not done in the Hamilton County area. Therefore, it is believed that the majority of untreated C&D lumber goes to a C&D landfill or MSW landfill.

3.2.2 Recovery and Reuse of Pallets

There are several pallet recovery operations in Hamilton County. In addition, those wishing to either supply or receive pallets can post a listing on Hamilton County's Interchange – an Internet-based “swap shop.” Often, artisans will approach pallet companies for scraps of wood to make birdhouses and other wooden crafts. Most pallet manufacturers will give scrap wood away to anyone willing to take it, as this saves them disposal costs.

Some pallet recovery operations are fairly selective about what they will accept. Some will only accept the standard 48x40 size pallets. Some will only accept pallets in good condition. Most pallet refurbishment operations, however, try to recover the material at the highest value possible. If the pallet is in good condition, for example, it is re-sold, if it is in need of repair, it is repaired, and some scrap pallets are pulled apart in order to use the lumber to rebuild other pallets.

What is not usable, is generally taken to a mulching operation for a tipping fee, where the material is chipped and sold as animal bedding, compost bulking agent, filter material, or mulch.

One business, Irvine Wood Recovery, Inc., located in Miamiville (12 miles outside of Cincinnati), sets up onsite grinding or stages trailers for pallet pick-up. The owner of this operation is trying to work with other pallet refurbishing businesses to grind their unusable pallets as well. He dyes the wood and sells it as mulch. Another pallet recycler mentioned that he would like to become vertically integrated and purchase a tub grinder. This would save him on disposal fees. One pallet refurbisher states that he no longer receives money to haul away pallets, but actually has to pay for the material now from some of his suppliers. He indicates that there has been an increase in the number of pallet recyclers in the area in the past five years, causing an increase in demand for feedstock.

3.3 Markets for Untreated Scrap Wood

3.3.1 Markets for Rebuilt Pallets

The market for rebuilt pallets is reported to be strong in general, however, the lull in the economy also means that the demand for pallets has declined. Most consumers of pallets, particularly those shipping products within the United States, reportedly have no problems purchasing refurbished pallets versus new pallets. Pallet users shipping to Europe, however, are more prone to purchase new pallets, as the pallets must be certified to be treated for pests anyway, which adds cost to the pallets. Many pallet refurbishers are not set up to offer this value-added service. Used pallets sell for between \$2.50 and \$5.00 each, depending upon the quality, quantity, and shipping distance. One pallet remanufacturer indicated that new pallets sell for at least twice the cost of used pallets. Pallet remanufacturers in the Hamilton County area will sell truckloads of pallets to a region spanning several states.

3.3.2 Markets for C&D Lumber on Construction Sites

Construction-grade lumber scraps may be incorporated into new work at the same construction site, or for use on another project. On-site uses for wall studs and other construction-grade lumber and timber include temporary or permanent framing and general construction. Plywood scrap can be used in concrete forms, for floor protection, or as replacement for new plywood.

3.3.3 Markets for Untreated Scrap Wood in Manufacturing

Clean dimensional lumber scrap can be finger-jointed into longer pieces, a practice that has become common in other regions. The finger-jointed lumber is reported to be generally straighter than ordinary 2x4's and is approved for structural applications. Other uses of untreated scrap wood include milled wood products such as flooring and wood furniture. Composite wood products can also be made from scrap wood, including medium density fiberboard and particleboard. In addition, scrap wood can be utilized to manufacture wood panelboard, wood-plastic composites, and wood-inorganic composites for utilization in the construction and furniture trades.

3.3.4 Markets for Untreated Scrap Wood as Mulch

C&D lumber or scrap pallets can be made into mulch for a variety of applications. A high-end market exists for mulch products that have been dyed to retain a consistent coloring. Chipped or shredded lumber is reported to accept colorants better than some other wood waste materials. Large-scale processors generally will accept nails and staples in the wood, which are removed magnetically in the grinding process. Smaller mulch manufacturers, however, such as those located at many of the C&D facilities in Hamilton County, often have less sophisticated grinding equipment, which would be damaged by staples and nails. Most of these facilities, therefore would not accept scrap pallets and/or lumber for mulching – they only mulch yard waste.

3.3.5 Markets for Untreated Scrap Wood as Boiler Fuel

Because it is kiln dried, dimensional lumber chip has a high fuel value. Specifications for this market may be limited to large generators or consistent quality material, however. There is one company in Hamilton County, Cincinnati Machine, that uses scrap wood for boiler fuel in an EPA permitted boiler. The company rents roll-off containers to waste generators, which consists mostly of pallet refurbishers and generators, and charges a fee of \$250 per pull. The company chips the wood, and feeds it in the boiler as a supplemental source of energy. The boiler is used to generate steam, chilled water, and compressed air for their own use, and those companies that are a member of a cooperative arrangement with Cincinnati Machine.

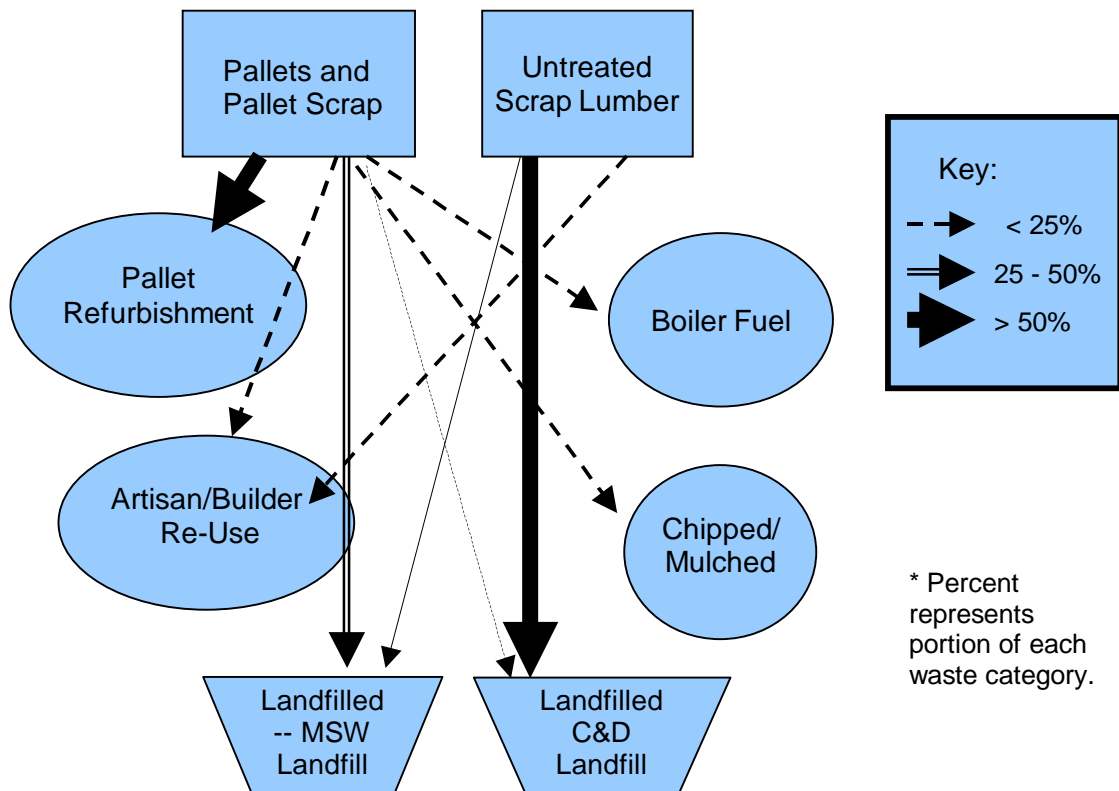
Scrap wood generators throughout several counties dispose of their scrap wood by “selling” it (at a negative price) to Cincinnati Machine. The facility manager estimates that most suppliers save approximately \$100 per truckload over disposing of the material at a landfill. The facility manager reports that they are generally able to keep plenty of wood on hand, however they only accept from generators who can supply a steady stream of material.

3.3.6 Markets for Untreated Scrap Wood as Bulking Agent for Composting

Wood chips made from untreated scrap wood can be used as bulking agent for composting a variety of materials, including municipal biosolids and food waste.

Figure 3-1 shows the flow of untreated scrap wood in Hamilton County.

Figure 3-1



3.4 Barriers to Recovery/Utilization of Untreated Scrap Wood

3.4.1 Barriers to Recovery/Utilization of Pallets

- **Lack of education** - Some generators are simply not aware of the cost savings they might incur by recycling their pallets vs. landfilling them.
- **Resistance to change** - Some businesses are leery of changing the way their businesses operate. They might have to retrain their staff, for example, or perceive that taking the time to find and deal with a pallet recycler will be too time-consuming to be worthwhile.
- **Space constraints on-site** - Some businesses claim that they do not have adequate space for a second roll-off container for pallets.
- **Lack of financial incentive** - Once again, the relatively low tip fees in the Hamilton County area do not provide a strong financial incentive for generators of pallets to divert their pallets from being landfilled.

- **Bad experiences with unprofessional companies** - Some generators may have had poor experiences with small pallet businesses promising services that they simply were not equipped to provide.
- **Refurbished pallets may be thought to be of a lesser quality than new pallets-** One pallet remanufacturer indicates that manufacturing and testing equipment has evolved considerably in recent years, and rebuilt pallets today are of much higher quality than they were a few years ago.

3.4.2 Barriers to Recovery/Utilization of Untreated C&D Lumber

- **Untreated lumber that could be recovered from a job site has relatively low economic value.** There is little incentive for contractors to separate out untreated wood from other disposed materials, as the tip fees at C&D landfills in the area are low relative to the cost of renting a second roll-off container and/or additional transportation arrangements. Contractors try to minimize their costs, and most would not recover enough untreated lumber, which is relatively inexpensive, to justify source-separation and transport of the material to a recovery site.
- **Poor economics for separation and recovery of untreated lumber at C&D landfills.** Because virtually all C&D materials are brought to the C&D landfills commingled, recovery of untreated wood would be labor-intensive and relatively costly. Such lumber is also often of inconsistent quality, and may contain nails or screws which would need to be removed before being reused.
- **No existing economically viable high-value-added markets for untreated wood.** There does not appear to be a large-scale manufacturing operation in the County that could use the lumber scraps in manufacturing products. Therefore, there is relatively little value associated with the wood.
- **Generation generally low per user – not suitable for boiler fuel.** The one user of boiler fuel only accepts large loads, by consistent generators.
- **Untreated lumber is not the best feedstock for mulch.** Mulch from untreated lumber is lighter in color, which is considered to be less valuable mulch, and may contain nails or screws, which can be problematic to some processing equipment.

3.5 Potential Opportunities to Enhance Recovery/Utilization of Untreated Scrap Wood

- **Maximize the amount of pallets being directed to re-manufacturers.** This could be done by identifying generators that consistently discard usable pallets and providing information and technical assistance to divert them from disposal.
- **Designate a pallet recovery area at municipal or County transfer stations and landfills.** Pursue a contractual arrangement with a pallet recycler to service the recovered pallets.

- **Explore the application of ground scrap wood simultaneously with food waste composting considerations.** Food waste tends to have high moisture content and requires a readily available source of absorbent material to manage it properly. Wood chips from scrap pallets or other sources of untreated scrap wood may be suitable for this application.
- **Explore opportunities for new businesses that could utilize recovered scrap lumber in manufacturing a product.** A non-profit organization could establish an end use using untreated, donated lumber. Suppliers could receive tax benefits for their donations.
- **Offer some kind of incentive for source separation at construction sites and ensure that source-separated material goes to beneficial reuse.** One possibility would be to offer financial assistance to one or more hauling companies that collect source-separated wood waste from residential developments under construction. Through such an approach, wood waste is stored in contained piles on each home job site, and collected on a scheduled basis by the hauler, who then transports the recovered wood to a designated market.

Section 4

Findings and Recommendations

Hamilton County has an opportunity to divert a significant portion of its organic waste stream from the landfill to beneficial use, potentially benefiting the County's economy in the process. Several applications and related opportunities pertaining to the use of organic waste materials are discussed in material-specific sections of this report.

Composting is an appropriate technology for all of the materials discussed, though some materials are more suitable for composting than others. Furthermore, composting opportunities appear to be under-realized in Hamilton County, whereas other uses of organic materials appear to be more fully developed. Therefore, R. W. Beck recommends that Hamilton County focus its Phase II project resources on enhancing and expanding compost production and use of compost products derived from organic waste materials.

Successful application of compost technology in Hamilton County would require adequate material recovery and processing infrastructure, and aggressive market development for the resulting products. Key barriers that are thought to inhibit generators, processors, and/or end users from composting organic materials are:

- Lack of economic incentive due to inexpensive disposal;
- Difficulty in siting composting facilities other than Class IV;
- Lack of compost quality standards; and
- General lack of public awareness of the benefits of compost and the suitability and uses for compost made from recovered organics.

Strategies to overcome these barriers and to expand markets for compost materials in the future include:

- Development of compost quality standards;
- Provision of technical and facilitation assistance on behalf of existing and potential new processors to help them obtain the necessary permits to compost organic waste materials and to apply best practices in compost production so that high quality compost is produced;
- Creation of public/private partnerships that support the development of viable composting businesses which provide reliable outlets for organic waste materials diverted from the waste stream;
- Education of potential compost users about the benefits and appropriate uses of compost derived from organic waste materials;
- Establishment of preferred procurement practices that favor the use of compost products derived from organic waste materials; and

Section 4

- Establishment of projects that demonstrate beneficial use of compost.

Phase II of this project – Market Development Opportunities Analysis and Strategy Development – will provide further exploration and prioritization of opportunities and strategies for compost market development. As stated in the Scope of Work, members of R. W. Beck project team will be available to present the findings of Phase I and facilitate a half-day forum involving commodity-specific discussions among invited stakeholders. Stakeholder comments will be used to fine-tune the Phase I findings. Additionally, any interest on the part of specific existing end-users or ideas regarding new potential end-users mentioned during the discussions will be documented for inclusion in the final project report.

R. W. Beck will provide the District with a suggested ranking of opportunities in terms of priority for action. The results of this assessment will be presented for review and subsequent fine-tuning by the District. Representatives from R. W. Beck will meet with District staff to obtain feedback and make adjustments to the priority listing as determined appropriate. Once these priorities have been agreed upon, R. W. Beck will identify strategies that can be implemented by the District in support of realizing the priority opportunities. To the extent appropriate, up to three local recycling market development projects will be identified. For each project, R. W. Beck will present a discussion on the costs savings (if any) to potential project participants; waste reduction benefits accruing to the District if the project were implemented; and technical assistance needs, costs, and potential sources of funding.

Appendix A



March 15, 2002

Christy Kellner
Business Specialist
Hamilton County Solid Waste Management District
250 William Howard Taft Road
Cincinnati, Ohio 45219

Subject: **Selection of Materials for Study Focus**

Dear Christy:

Task 2 states that R.W. Beck will develop and apply criteria, using District-provided data, to select one to three materials to be addressed in the Markets Assessment Study. In addition, R. W. Beck will prepare a memorandum listing the materials recommended for study, for review and approval by the District. This letter report serves to satisfy the requirement of Task 2.

Materials Suggested for Study Focus

The materials that R.W. Beck suggests as the focus of the remainder of this recycling market development study are:

- Old and New Scrap Tires;
- Food Waste; and
- Untreated C&D Lumber and Scrap Pallets.

The sections below describe why R.W. Beck selected these secondary materials, and offer some potential end markets for them.

Old and New Scrap Tires

New and old scrap tires are being targeted by special waste management provisions by the State of Ohio. The 1995 State Waste Management Plan required Solid Waste Management Districts to include a strategy to address scrap tires in their solid waste management plans. These tires may not be landfilled in MSW landfills. Instead, they must be recycled or landfilled in a special tire landfill. Improperly disposed tires can be a breeding ground for mosquitoes, and therefore increase the incidence of mosquito-borne diseases. Tire landfills are fire hazards, and often after tire fires are extinguished, harmful oils are released into the soil and water table. These fires also very difficult to extinguish, utilizing a huge amount of water and personnel resources.

The District has thus far provided a local company, Cinergy, with a grant to pursue the viability of energy recovery from waste tires. Other potential end uses for scrap tires

include chipping them to use for civil engineering purposes, or processing them into crumb rubber, which can be used to make a number of products. The District might consider working in partnership with the State to develop one or more of these additional markets.

Scrap tires have an extremely low value (typically negative). Consequently transportation costs are an issue affecting their marketability. If local end markets for scrap tires existed, then the District and its residents would save the monetary and potential environmental and health costs of landfilling tires, and/or the cost of shipping them elsewhere to be processed. Environmental and economic benefits would most likely result, as well.

Local end markets might also help serve the disposal/recycling needs of surrounding counties. It is estimated that each year approximately 12 million passenger tire equivalents (or PTEs, which are 20 pounds) enter the waste stream in Ohio, and that there are between 23 million and 38 million old scrap tires dumped and stockpiled in the State.

There are certain state regulations, such as restrictions regarding the volume of scrap tires that can be stored at a recycling facility, which may currently act as barriers to market entry, which will need to be addressed by the State. This does not, however, preclude the District from assisting in the successful development of end uses for scrap tires.

Food Waste

Food waste is suggested as a desirable material to target because it represents a large portion of the landfilled waste stream, and is being recovered and beneficially utilized in other U.S. localities. R.W. Beck's waste composition study for Montgomery County, Maryland estimated that food waste was 15.3 percent of the County's landfilled materials. Similar results are found in other communities. Besides constituting a large portion of the waste stream, food waste and other organic wastes can cause leachate and gas problems in landfills. Some food waste can be recovered for human consumption. The remainder can be used for compost, animal and fish feed, or to produce fertilizer, tallow, or industrial chemicals.

Food waste is generated by residential and commercial/industrial sectors. Industrial/commercial generators tend to produce more homogeneous wastes, and are the only source for potential reuse for human consumption. Very few communities have implemented curbside collection of residential food waste, although San Francisco is an example of a community that is successfully operating such a program. An infrastructure for recovering food waste is not currently in place in the County. Recovery programs would need to be initiated with the industrial/commercial sector initially in order for this material to be available for beneficial end use.

Untreated C&D Lumber and Scrap Pallets

Although not originally considered in the same category, untreated C&D lumber and scrap pallets would likely be used by many of the same types of end markets.

Untreated scrap wood can be used to make milled wood products, such as flooring, re-milled lumber, and wood furniture. Composite wood products can also be made from scrap wood, including medium density fiberboard and particleboard. In addition scrap wood can be utilized to manufacture wood panelboard, wood-plastic composites, and wood-inorganic composites for utilization in the construction and furniture trades. Lower qualities of wood waste can be used for mulch, hydromulch, landfill cover, wood fuel, bulking agents, soil amendments, animal bedding, biofilter media, pulp and paper, and fuel pellets.

Although C&D wood is not considered to be a solid waste according to the State definition, these materials are prevalent in the waste stream, take up space in C&D landfills, and offer recycling business development opportunities. As mentioned previously, the market for refurbishable pallets appears to be strong in Hamilton County; however the pallet companies may not always have a use for non-refurbishable scrap pallets.

R.W. Beck estimates that job development potential for products made from scrap wood is low to moderate, and that the waste diversion potential is high. Manufacturers of end products made from untreated C&D lumber and scrap pallets might also be able to utilize tree residues and scrap shipping containers as feedstock, depending upon the products being manufactured. Treated C&D lumber can generally not be recycled.

Methodology

As outlined in the Project Scope of Work, assessments were based on information supplied to R.W. Beck by the District, selected R.W. Beck projects, and limited research efforts undertaken for this project in particular. The criteria applied to the materials under consideration are:

- Potential for effective District intervention;
- Tonnage diversion potential;
- Defined as a solid waste by the State of Ohio;
- Local market value and market volatility;
- State expectation that the District address the material through special management provisions;
- Potential that market development will result in universal or large-scale public benefit;
- Extent to which the material is problematic to dispose of; and
- Whether the material is targeted by a program or business previously awarded grant funding by the District.

Definitions of the criteria as well as their relative importance are provided in Attachment A, along with a listing of all of the secondary materials assessed for Task 2.

The following sections describe how R.W. Beck assessed each material according to the criteria selected.

Potential for Effective District Intervention

The first criterion "Potential for effective District intervention," was applied only on the materials that were "short listed" after applying the other seven criteria. By applying this criterion at the end of the evaluation, the "Potential for effective District intervention" criterion was used as a final filter for selecting the one to three materials to be the focus of the market development study.

Potential for Effective Tonnage Diversion

To assess the potential for effective tonnage diversion, R.W. Beck utilized the results of a waste composition study that the firm conducted for Montgomery County, Maryland, in 1998. This approach was taken because Hamilton has not had a residential/commercial waste composition study conducted since 1990. Additionally, Montgomery County is similar to Hamilton County in that:

- It is not in a bottle-bill state;
- Does not allow the disposal of yard waste in MSW landfills;
- It includes residential/commercial and industrial-generated waste;
- Communities within the county have access to curbside recycling programs, and
- Does not have a heavy industrial base.

The Montgomery County is most likely a more accurate representation of the Hamilton County waste stream than the U.S. EPA's national waste composition data (*Municipal Solid Waste in the U.S.: 1999 Final Report*; EPA Publication Number 530-R-01-014). The National study averages waste composition data on a national level, and includes data from bottle-bill states, non bottle-bill states, as well as communities offering curbside recycling and those that do not. Results of the Montgomery County Waste Composition Study are provided in Attachment B.

The Montgomery County Waste Characterization study was utilized to provide guidance regarding the quantities of each type of recyclable material being landfilled in MSW landfills. As a guideline in the assessment process, if the amount of material that could be diverted (beyond what is currently diverted) is less than one percent of the total amount of waste being landfilled, potential tonnage diversion was categorized as "low." If the amount of additional material that could be diverted is between one and three percent, then the potential tonnage diversion was categorized as "moderate." If greater than three percent could be diverted, then the material was determined to have a "high" tonnage diversion potential.

Defined As a Solid Waste By the State of Ohio

All of the secondary materials considered are defined as a solid waste by the State of Ohio according to Chapter 3745-27-01 (43) of the Revised State Code, with the

exception of latex paint (which is a landfillable solid waste when dried, but not in liquid form), C&D materials, and C&D land clearing debris.

Local Market Value and Volatility

Information regarding local market value and volatility was gained by using R.W. Beck's research from previous projects in the State; the Hamilton County Environmental Services' Industrial and Commercial Recyclers in Cincinnati, Ohio; and from telephone interviews with representatives of some of those companies. R.W. Beck also utilized expertise gained from researching recycling programs and market development of secondary materials in other areas of the Country as necessary to understand the nature of the markets, the pervasiveness of market volatility, and the extent to which other communities have successfully implemented secondary materials marketing programs. Waste News Online (www.wastenews.com) was also used as a reference for level and volatility of commodity prices nationally and in the Chicago region.

State Expectation that the District Address the Material through Special Management Provision

The District informed R.W. Beck that the State expects Solid Waste Management Districts to address electronics through special management provisions. Further research also indicated that the 1995 State Plan sets the expectation that Solid Waste Management Districts make special management provisions for scrap tires, as well. No other secondary materials are expected to be addressed through special management provisions by the State.

Potential that Market Development Will Result in Universal or Large-Scale Public Benefit

To assess this criterion, R.W. Beck relied upon expertise of materials recycling, including a study prepared in part by a member of R.W. Beck's project team, for The Chelsea Center for Recycling and Economic Development, and identified recycling market development opportunities for the State of Massachusetts. The Document, "Strategic Plan to Promote the Use of Recyclable Materials in Massachusetts Project Phase II Report: Identification of Recycling Market Development Opportunities," by Dorn and Associates, November 1998, provides extensive information regarding levels of employment expected to be gained by potential industries that use the secondary materials as feedstock.

Factors other than employment potential contribute to large-scale public benefit, including:

- Potential environmental benefits;
- Potential health benefits; and
- The potential to provide a wide array of generators an alternative to disposal of a particular material.

Extent to which Material is Problematic to Dispose

R.W. Beck researched State laws and County regulations to discern which materials are problematic to dispose. Scrap tires are somewhat problematic, in that they can not be landfilled in MSW landfills, but must be landfilled in one of three special tire monofills in the State, or disposed in some other fashion, such as through recycling or incineration. Latex paint is difficult to dispose in that it may not be landfilled when it is in its liquid state, and must therefore either be dried then landfilled or recycled. All electronics can be landfilled by households (both CRT and other electronics), however businesses and institutions can not landfill any electronics. There is concern that even non-CRT electronics contain hazardous materials which may leach into the soil and groundwater and may cause harm to humans and the environment. Other materials were determine to pose some difficulty to dispose, based on common knowledge, such as bulky materials, including mattresses, furniture, and white goods.

Whether the Material is Targeted by a Program or Business Previously Awarded Grand Funding by the District.

The District has provided several businesses with grants to help them recycle secondary materials. Of the materials being considered, grants have helped businesses recycling the following secondary materials:

- Yard Waste;
- Scrap Tires;
- Pallets and Shipping Containers; and
- Film Plastics.

Short List of Materials for Further Consideration

When R.W. Beck applied these seven criteria to all of the materials being considered, a "short list" of materials emerged -- those materials that seemed to offer the most potential benefit from the District's aid in developing local materials markets. These materials included:

- Food Waste
- C&D Wood
- New and Old Scrap Tires
- Electronics
- Carpet
- Used Clothing
- Mattresses
- Used Wood Pallets
- Used Commercial Storage Drums (Steel, Plastic, and Fiber)

■ Plastic Film (#2 and #4)

The basis for selecting the three materials that R.W. Beck chose for further study are described below.

Assessment of Materials

The assessment of these materials relative to the selection criteria is available in the tables below.

Table 1

Assessment of Secondary Glass Materials

	Diversion Potential	Solid Waste?	Value/Volatility	District Expected to Manage?	Large Public Benefit?	Problem to Dispose?	Targeted by Grant?
Sorted Container Glass	Moderate	Yes	Low/Low	No	Low	Low	No
Mixed Cullet	Moderate	Yes	Low/Low	No	Low	Low	No
Other Glass	Low	Yes	Low/Low	No	Low	Low	No

While glass can represent a moderate portion of landfilled municipal solid waste (container glass representing nearly 3 percent of landfilled materials, and "other glass" representing almost 1 percent according to the Montgomery County study), the price for glass has been depressed for several years. Because substitutes for glass are inexpensive, the price of glass will always remain relatively low, and because glass is a dense material of low value, hauling it for long distances is not cost-effective. This makes using glass locally a smart option. Most uses for glass, however, are not high-value added, and therefore are not likely to boost the local economy to a large degree. Glass is also an inert material in landfills, and therefore is not the least bit problematic to dispose. There are many ways glass could be used locally, however, to save on transportation and disposal costs. These opportunities are discussed more in depth below.

Table 2

Assessment of Plastic Secondary Materials

	Diversion Potential	Solid Waste?	Value/ Volatility	District Expected to Manage?	Large Public Benefit?	Problem to Dispose?	Targeted by Grant?
PET Bottles	Low	Yes	Moderate/ Low	No	Low to Moderate	Low	No
HDPE Bottles	Low	Yes	Moderate/ Low	No	Low to Moderate	Low	Yes
#3-#7 Mixed	Low	Yes	Low/High	No	Low to Moderate	Low	No
Other PET	Low	Yes	Moderate/ Low	No	Low to Moderate	Low	No
Other HDPE	Low	Yes	Moderate/ Low	No	Low to Moderate	Low	No
PVC (#3)	Low	Yes	Low/High	No	Low	Low	No
LDPE (#4)	Low	Yes	Low/ Moderate	No	Low	Low	No
PP (#5)	Low	Yes	Moderate/ Moderate	No	Low	Low	No
PS(#6)	Low	Yes	Low/High	No	Low	Low	No
Film (#2)	Moderate to High	Yes	Low/Low	No	Low to Moderate	Low	Yes

As Table 2 shows, most plastics do not present the opportunity for significant additional tonnage diversion. The infrastructure is in place for most plastics that are used extensively to be recycled. Plastics that are used in limited quantities, such as PVC, are more difficult to find ways to recycle, however efforts to generate markets would be less beneficial due to the small amount of material generated. Some environmental groups are instead focusing on convincing manufacturers use PET and HDPE, materials that can be recycled more cost-effectively, rather than focusing on ways to recycle these lesser known materials.

According to the Montgomery County study, PET disposed represents approximately 0.7 percent of landfilled municipal solid waste, and HDPE comprises approximately 0.5 percent. Some communities have found that by implementing an "All Bottles" campaign, whereby they accept all bottles for recycling, including #3 - #7 as well as the more commonly recycled HDPE (#1) and PET (#2), the amount of HDPE and PET collected increases more than the addition of #3 through #7 plastics. The District might consider implementing such a policy to increase the amount of HDPE and PET plastics recycled, however end users for the materials are in place; however PET and

HDPE markets would not benefit greatly by focusing on market development for these materials.

Film Plastics

Film plastics (#2 and #4) are more prevalent in the waste stream. According to the Montgomery County Study, they comprise approximately 4.7 percent of landfilled municipal solid waste. The processing and end use infrastructure for moving and consuming plastic film is already in place, and local businesses are aware of the opportunity to recycle this material, according to local recyclers who were interviewed for this project. The price for this material, however, is currently low. When businesses can earn money by recycling film plastics, they most likely will do so. OnSpec Composites received an ODNR RMD grant to purchase equipment to help make their processing more efficient. OnSpec Composites manufactures plastic lumber, and uses LDPE film plastics in their feedstock.

Table 3
Assessment of Metal Secondary Materials

	Diversion Potential	Solid Waste?	Value/ Volatility	District Expected to Manage?	Large Public Benefit?	Problem to Dispose?	Targeted by Grant?
Steel Cans	Low	Yes	Low/Low	No	Low	Low	No
Al Cans	Low	Yes	High/Low	No	Low	Low	No
White Goods	Low	Yes	Low/Low	No	Low	Moderate	No
Ferrous Scrap	High	Yes	Low/Low	No	Low	Low	No
Non-Ferrous Scrap	Low	Yes	Moderate/ Low	No	Low	Low	No

Metal markets are highly developed in Hamilton County. Proximity to river transportation has made the area attractive to scrap metal processors. The Hamilton County Environmental Services' Listing of Industrial and Commercial Recyclers lists 31 metal recyclers. Generally a large number of businesses signals a robust market. Much of the steel in the area is shipped to Gallatin Steel in Ghent, KY (located on the Ohio River, less than an hour from Cincinnati), and Nucor Steel's Jewett, TX facility. Other steel mills and processing facilities are located in Delta, Ohio as well as Youngstown, Ohio. Steel prices are expected to rise, strengthening those markets, in response to recently imposed import tariffs.

Non-ferrous is of higher value and lighter than ferrous, therefore it is shipped nationwide, and some is exported. Locally developed markets would therefore face competition with existing markets. Telephone interviews with local scrap dealers

indicate that despite relatively low prices in recent years, they are receiving large quantities of materials.

Table 4
Assessment of Paper Secondary Materials

	Diversion Potential	Solid Waste?	Value/ Volatility	District Expected to Manage?	Large Public Benefit?	Problem to Dispose?	Targeted by Grant?
ONP	High	Yes	Low/ Moderate	No	Low	Low	No
OCC	High	Yes	Low/Low	No	Low	Low	No
OMG	Moderate	Yes	Low/Low to Moderate	No	Low	Low	No
High Grade	High	Yes	Moderate/ Low	No	Low	Low	No
Mixed	High	Yes	Low/ Moderate	No	Low	Low	No

Paper markets provide a high potential for diversion from landfills. Higher-grade fibers face lower volatility. The low-grade markets tend to be more volatile. Paper markets are highly developed. There are over 50 paper mills in Ohio, however further research would be required to discern the number of mills and feasibility of adjusting feedstock of mills in close proximity to Hamilton County. Because these materials are inert when landfilled, not problematic to dispose, and have not been the focus of District grants to date, R.W. Beck did not select paper materials as the focus of the study.

Table 5
Assessment of Wood Secondary Materials

	Diversion Potential	Solid Waste?	Value/ Volatility	District Expected to Manage?	Large Public Benefit?	Problem to Dispose?	Targeted by Grant?
Pallets/ Shipping Containers	Moderate to High	Yes	Low/Low	No	Low to Moderate	Low	Yes
Tree Residues	Low to Moderate	Yes	Low/ Not Fully Developed	No	Low	Low	No
C&D Wood/ Land Clearing/ Etc.	Moderate to High	No	Low/Not Fully Developed	No	Low to Moderate	Low	No

Although pallets and shipping containers, tree residues, and C&D wood and land clearing debris were not initially considered together, they can often be used as substitutes for each other, or in conjunction with each other, to manufacture wood products. C&D wood and land clearing debris are not considered solid waste according to the State of Ohio's definition, however, C&D wood does take up landfill space. As described above under the "Materials Selected" section of the report, treated C&D wood is not suitable for most recycling purposes. R.W. Beck therefore proposes considering tree residues, untreated C&D wood and land clearing and non-refurbishable wood pallets and shipping containers together for feedstock in wood manufacturing industries. The pallet refurbishing business appears to be robust in the area. There are several pallet refurbishing companies in the area, as well as Cincinnati Machine, which accepts wood pallets and wood waste to burn as boiler fuel.

Table 6
Assessment of Organic Secondary Materials

	Diversion Potential	Solid Waste?	Value/ Volatility	District Expected to Manage?	Large Public Benefit?	Problem to Dispose?	Targeted by Grant?
Yard Waste	Moderate	Yes	Low/Not Fully Developed	Yes	Moderate to High	Low	Yes
Food Waste	High	Yes	Low /Not Developed	No	Moderate to High	Low	No

According to the Montgomery County waste composition study, food waste comprises approximately 15 percent of the municipal solid waste landfilled. Although it is organic, food waste is not inert in landfills. Markets for products made with food waste are generally developed on the local level, as they are low value. The public benefit, however, could be significant, in that development of markets utilizing food waste would introduce a new industry to the area. Food waste is also created by residential, commercial, and industrial generators. Some food can be reused for human consumption. Because of its large potential public benefit, and because the diversion potential is high, R.W. Beck selected food waste as a material to be further studied for potential market development.

Markets for processing yard waste are also generally local, however there is a strong infrastructure in place in the County for processing these materials. Therefore, a full study regarding yard waste market development might not be the best use of the District's resources; however the District might consider enhancing the marketing of these materials, as suggested below.

Table 7
Assessment of Tires as Secondary Materials

	Diversion Potential	Solid Waste?	Value/ Volatility	District Expected to Manage?	Large Public Benefit?	Problem to Dispose?	Targeted by Grant?
New Scrap	Low to Moderate	Yes	Low/High	Yes	Moderate to High	Moderate to High	Yes
Old Scrap	Low to Moderate	Yes	Low/High	Yes	Moderate to High	Moderate to High	Yes

As discussed above, under the "Materials Selected" section of this report, old and new scrap tires are problematic to dispose, and present not only landfill issues, but potential health and safety issues as well, when disposed or stored improperly. In addition, markets for used tires are generally local in nature, as many of the products made from

tires are of low value. Furthermore, transporting tires as feedstock may not be cost effective due to their relative low value and high weight. R.W. Beck therefore selected old and new tires for further study.

Table 8
Assessment of Electronic Secondary Materials

	Diversion Potential	Solid Waste?	Value/ Volatility	District Expected to Manage?	Large Public Benefit?	Problem to Dispose?	Targeted by Grant?
CRTs	Low	Yes	Moderate/ Moderate	Yes	Medium to High	Moderate to High	No
Other	Low	Yes	Moderate/ Moderate	Yes	Medium to High	Moderate to High	No

There are several electronics recyclers in Hamilton County, and the County has held some successful collection events. The District has been asked to target electronics by the state; however it appears that the District's involvement might be to simply coordinate a successful collection of materials, rather than focus on developing markets for the materials. There are several high-value materials that can be harvested from electronics, and this market is therefore developing successfully. Ongoing collection events, however, might ensure that a larger portion of electronics is recovered, which helps electronics recycling companies operate more cost-effectively. Furthermore, a steady stream of incoming materials may aid in operational efficiencies and the ultimate viability of electronics recycling.

Table 9
Assessment of Other Secondary Materials

	Diversion Potential	Solid Waste?	Value/ Volatility	District Expected to Manage?	Large Public Benefit?	Problem to Dispose?	Targeted by Grant?
Carpet	Moderate	Yes	Low/Not Developed	No	Low	Moderate	No
Used Clothing	Moderate	Yes	Low/High	No	Low	Low	No
Used Furniture	Low to Moderate	Yes	Low/High	No	Low	Moderate	No
Used Mattresses	Low	Yes	Low to Mod./High	No	Low	Moderate	No
Latex Paints	Low	No	Low/Not Fully Developed	No	Low	Moderate to High	Yes

Carpet

Recycling of carpet has proven to be a complicated task; many large companies are having difficulty finding feasible means of doing so due in part to the wide variety of fibers comprising carpet and the lack of cost-effective fiber recognition technology. Furthermore, the carpet industry itself is trying to formulate a carpet recycling infrastructure. Hence, District intervention would be most successful after the industry has developed such an infrastructure.

Used Textiles

Used textiles can be a moderate portion of the landfilled waste stream. Goodwill Industries has an infrastructure in place for selling reusable as well as non-reusable textiles. The District might consider partnering with them or other such entities to divert more used textiles from the landfill. The District could, for example, provide special curbside collection days specifically for textiles. However with respect to developing new markets, the market for textiles is currently very depressed on a national level. Factors that affect the textile marketplace are global as well as national in nature, given that a large percentage of recovered textiles are shipped overseas for reuse to developing countries. Consequently, the District may not be able to successfully improve markets for used textiles on a local basis.

Mattresses

While mattresses do not constitute a large portion of landfilled MSW by weight, they are exceptionally bulky. The materials recovered from mattresses are: cotton fiber, foam, wood (cellulose) and steel springs. The steel is the most valuable item, and would likely sell for approximately \$30 per ton. The foam is usually sold to grinders

who process the material to carpet underlay manufacturers. The unprocessed material currently sells for \$0.20 to \$0.28 per pound. The fiber market is more volatile, and sells for \$.01 to \$.03 per pound. The toppers (made of foam ticking) sell for \$0.6 per pound. The challenge with recycling mattresses is that retrieving the recyclable materials from the mattresses is labor intensive. If low-cost labor could be utilized, the effort might be sustainable, however this would most likely not be a successful prison industry due to the sharp tools required to deconstruct the mattresses and the sharp steel springs that result – both of which could be used as weapons.

Pallets

There are several used pallet refurbishing companies already in operation in Hamilton County. Companies are being paid for their 40 x 48 pallets, and therefore are recycling them. Odd sized pallets are not purchased; however most local companies will take a limited number at no charge and use the lumber in-house. Given the extent of the existing infrastructure, it appears that District intervention is not needed to enhance this market, except perhaps to enhance the demand for pallets that are not suitable for refurbishment. The District could, for example, provide financial assistance to a local business that could use scrap pallets as feedstock. This material could be targeted in conjunction with untreated C&D scrap lumber, as proposed above in the "Materials Selected" portion of this report.

Drums

The drum refurbishment business is also active in Hamilton County. There are several recyclers in the area. Conversations with some of them indicate that they feel the market is self-sustaining. In general, there are financial incentives for entities to recycle their drums, so they do so. They expect the market to be even stronger for steel drums, now that the price of new steel is increasing. Plastic drums that are in poor condition are ground, and the ground plastic is sold to plastic formulators. Steel drums in poor condition are sold to scrap dealers. Fiber drums in poor condition may be landfilled; however fiber drums are not nearly as widely used as steel and plastic, according to the local recyclers interviewed.

Latex Paint

There appear to be some opportunities to assist with developing a demand for latex paint, as described below in the "Other Materials Marketing Suggestions" portion of this report, however it seems that the District has an infrastructure in place to recycle the paint effectively. Latex paint also does not comprise a large segment of the waste stream. Although the District has awarded NuBlend, their contracted paint blender, a grant in the past, focusing on latex paint for an extensive market development study may not be the best use of the District's resources.

Other Materials Marketing Suggestions

While examining Hamilton County recycling market development opportunities R.W. Beck, noted that the following additional strategies be implemented by the District to increase diversion and/or marketability of recovered materials:

Latex Paint Marketing

NuBlend, the non-profit company that is contracted to blend the District's recycled latex paints, has an oversupply of paint. The District could assist NuBlend in the marketing of this paint to ensure that this program can continue.

Mulch Marketing

The District has an oversupply of mulch. The District might consider marketing this material, or adding value to the product to enhance its marketability, such as dyeing, producing various chip sizes, or bagging the product.

Developing Local Uses for Glass Cullet

If supply of mixed glassed cullet exceeds local demand (such as that of On Spec Composites), then the District might consider using mixed cullet for municipal purposes, instead of having the processor (Rumpke) ship the material to other markets, which would most likely cost at least \$10 per ton. The District and/or Rumpke could use a glass pulverizer, which would process the mixed cullet into a fine material that can be used for several municipal purposes, including pipe underlay, mixing with paint for reflectivity, etc.

Paper Fiber Substitution

The District could investigate whether there are any mills in the region that could use a lower grade fiber(s) instead of higher grade(s), to support the lower grade markets. In some cases mills can adapt their processing in order to make such a substitution. Additionally, the District could work with Rumpke and other fiber marketers, to ensure that they are working closely with local mills, so that the local economy will benefit from recycling fiber.

Next Steps

R.W. Beck suggests that the District confirm that they want R.W. Beck to study the selected three materials more in depth, or decide upon an alternative list of one to three materials for further study. For each material selected, R.W. Beck will evaluate the flow from generation to final disposition. As described in the Contract, the analysis will include the identification of:

- Primary material sources;
- Current waste management and recycling practices;
- Existing collection, handling, and processing infrastructure;
- Key players; and
- Existing end users in Hamilton County and the Tri-State area.

Following this analysis, R. W. Beck will identify recycling market barriers and potential recycling market development opportunities.