The University of Georgia

College of Agricultural & Environmental Sciences

Engineering Outreach Service

Commercial Foodwaste Composting Feasibility Study for South Metro Atlanta

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EXECUTIVE SUMMARY

In response to Georgia's diminishing landfill capacity and public concern over air and water quality issues, the state set a 25% waste reduction goal to be achieved by 1996. While this goal was not achieved, both legislative and voluntary programs have been undertaken which have significantly reduced the amount of material disposed of in landfills. The state's first action was a statewide ban on yardwaste going into landfills. While this targeted primarily municipalities and homeowners, there are industries within our economy that also provide considerable opportunity for the state to reach its 25% waste reduction goal.

In 1999, a national Municipal Solid Waste (MSW) study performed by the U.S. Environmental Protection Agency indicated that 61.1% of the total MSW is organic in nature (USEPA, 1999). The organic portion of the waste stream consists primarily of paper and paperboard (38.1%), yardwaste (12.1%) and 27 million tons of foodwaste (10.9%). In 2000, an assessment of Georgia's recovery potential of waste from the food processing and institutional food sectors reported that 231,100 tons/year of food processing waste, mainly fruits and vegetables, and 474,000 tons/year of institutional foodwaste were disposed of in landfills. Based on this study it is apparent that there are considerable opportunities for foodwaste composting, primarily within the industrial sector and secondarily within the commercial sector in the state of Georgia. It is these fractions of the foodwaste stream that were surveyed and targeted as part of the Commercial Foodwaste Composting Feasibility Study for South Metro Atlanta.

A useful explanation of the process of composting is the controlled biological process of the decomposition of organic materials into a humus rich product than can be used beneficially as a soil amendment or in erosion control techniques. A workable definition for compost is that it is an organic soil conditioner that has been stabilized to a humus-like product, is free of viable human and plant pathogens and plant seeds, does not attract insects or vectors, can be handled and stored without nuisance, and is beneficial to the growth of plants (Haug, 1993).

Composting at a strategically located composting operation in or near the south metro Atlanta area appears to have great potential and could divert and recycle an enormous amount of foodwaste annually. Through site assessments and technical assistance provided by the Georgia Environmental Partnership (GEP), it was determined that the majority of Atlanta's industrial foodwaste is concentrated in the south metro Atlanta region. While attempts have been made to connect food processors with

compost operators, one of the major impediments of this plan were the high transportation costs associated with moving the waste material from the site of generation to the nearest compost operation that is capable of accepting large volumes of foodwaste. The Georgia Department of Agriculture expressed an interest in a study conducted by the Engineering Outreach Service of the University of Georgia to develop a cost-effective composting alternative for the large amount of waste materials generated at the State Farmer's Market located in the south metro Atlanta area. Currently, the Department of Agriculture shares the cost of disposal with the Farmers Market businesses. In addition, the hospitality industry as well as Hartsfield International Airport were identified as potential target groups that could participate in a strategically located composting program.

A preliminary study was conducted to both quantify and characterize the foodwaste generated in the south metro Atlanta area. The center of the study area was identified as the City of Hapeville, Georgia that is located near Hartsfield International Airport in the south metro Atlanta area. The 31,416 square kilometer (12,130 square mile) study area encompasses most all of the 22 county metro Atlanta area. An initial list of foodwaste generators were identified within the study area. These comprised 310 industrial food processors, 62 commercial and 8 institutional foodwaste generators. The 380 foodwaste generators were then contacted and provided with background information on the project. Based on the generator's interest level and quantity of waste material produced, a subsequent site visit was conducted to obtain more detailed information. Information included: type of products, type of wastes, quantity of wastes, size of waste containers, cost for waste disposal, how often waste is hauled away, assessment of contaminated and uncontaminated waste generated, and the ability and willingness to pay less than or equal to current waste disposal costs.

Based on this information, a compost facility to be located in the south metro Atlanta area was designed. Included in this design are:

1) a hypothetical composting operation design,
2) a detailed estimate of both the capital and operating costs of the hypothetical design,
3) a potential site location(s) based on economic criteria,
4) a list of compost product buyers, market prices and products in Georgia,
5) a suggested competitive tipping fee for the handling of foodwaste materials
6) a suggested market price for the finished compost product, and

7) letters of intent obtained from foodwaste generators interested in participating in such a composting operation.

Georgia has 38 compost facilities that process over 550,000 tons/yr of organic waste. Currently, foodwaste accounts for only 5% of all the organic material that is composted in Georgia. 13 operations compost foodwaste, 11 are institutions (8 prisons and 3 schools), and two are private facilities; including an organic farm and a small compost operator. Only the two private operations accept materials generated off site and only one of these foodwaste composting operations markets the finished compost (mostly to homeowners and the landscape industry). The other twelve use the compost internally for agricultural purposes. Of the 38 compost facilities in the state, only 18 distribute or market their finished product.

A total of 44,200 tons of foodwaste per year are available as feedstock for a composting operation in the south metro Atlanta area. This includes 18 industrial food processors, 4 hotels, 8 correctional facilities, and public and private schools in 22 metro Atlanta counties. The industrial sector represents 26,775 tons or 60.6% of the total, hotels represent 1,078 tons or 2.4%, schools represent 14,711 tons or 33.3% and prisons 1,636 tons or 3.7%.

A closer look at the industrial sector finds that 13,989 tons/yr or 52.2% of the foodwaste in that sector is generated at the State Farmers Market. Likewise, 72% of all the foodwaste generated by the schools can be found in Clayton, Cobb, Gwinnett, Fulton, and Dekalb counties. No meat or meat byproducts were included in the study because these products are primarily rendered at a cost to the waste generator lower than the estimated cost composters could provide.

A total of 34 compost product venders were identified as supplying/marketing compost products in the south metro Atlanta area. Eighteen of these vendors buy wholesale from manufacturers in the state for retail sales. The remaining 16 vendors manufacture their compost, however, four vendors make their compost available at no cost to the consumer. Municipalities run these four operations.

Compost is typically sold in bulk by the cubic yard (about 1000 lbs.) or in 38-50 lb bags (a cubic foot). Bulk prices range from $0.00 to $50.00/cu. yd and bags range from $2.35 to $7.95/bag. Prices are influenced by availability, quality, feedstock, and by the type of operation (public or private). It should be noted that the operation that receives $50.00/cu. yd is the state's only commercial foodwaste compost manufacturer.

Using a windrow composting method and assuming that all of the foodwaste identified in the study was available for composting, a composting facility 20 acres in size would be required. Included are 8.4 acres for active composting, 2.1 acres for curing, 0.8 acres for storage and product marketing, and a 1.5 acre pond. Assuming the land is provided at no cost, the operation would require $2,053,611 in capital investment (construction, equipment) or $2,453,611 with land purchase. Operational expenses (equipment, fuel, personnel, contract services) for the potential facility would cost $886,520/yr or $10.29 per processed ton of material (foodwaste and carbon). At full scale, this operation could gross up to $1,252,340/yr (combined tipping fees and product sales) and net $23,958/yr, while providing 6 new jobs. The proposal to compost 44,200 tons of foodwaste in the south metro Atlanta region appears to be feasible, although the profit margin is approximately 2%. This profit margin is extremely low for a commercial business venture. The 10 and 20-year rates of return on the initial capital investment of $2,453,611 is -29% and 3% respectively. After ten years, all original construction and equipment costs can be recovered which can result in a dramatic increase in the operation's net yearly income, however, an extremely low rate of return on investment still resulted.

The success of this operation and the amount of revenue it can generate hinges on the tipping and transportation fees as well as the price that can be negotiated for the final product. While no waste generating company would enter into disposal cost negotiations without speaking with the potential composting company, it is recommended that in the beginning, the potential company place greater emphasis on generating revenue from disposal fees rather than product sales. A tipping fee of $20-25/ton is recommended, however this may increase or decrease based on quantity of material, distance to facility, and willingness of the waste generator. It is recommended that the potential operation enter only into bulk sales during the first 1-2 years of operation. The bagged compost require greater product consistency and capital investment, both of which can be difficult in the initial stages of a new operation. Likewise, no compost vendor or buyer would agree to buy the compost before seeing what the product looked like (e.g. quality). It is recommended that the compost operation sell the compost for not less than $10.00/cu. yd once the product is available.

Two other sites have been identified as potential composting venues for the South Atlanta region; Lafarge Aggregate of Lithonia and Fort Gillem military base of the U.S. Department of Defense. At Fort Gillem, total acreage was difficult to interpret because of the amount of site preparation required and density of forest cover. Both locations had sites that could handle the total quantity of foodwaste identified. While both Lafarge Aggregate and Fort Gillem have expressed interest in participating and partnering with a compost company, both required a detailed business plan and presentation from the potential compost company as a next step towards approval. Fort Gillem noted that the potential company must handle all of Fort Gillem's foodwaste in return for land use and they would not supply any capital start up funds. They also noted that there may be legal issues involved in locating any operation, that would generate a profit, on federal property. Lafarge Aggregate noted that the potential company must incorporate their granite pond fines, a byproduct of granite quarrying, in return for land use. Lafarge Aggregate also noted that they might assist in land preparation if the potential composter can handle a large percentage of their granite fines.

A detailed design was created for the two potential composting sites using the amount of available land as the basis for how much foodwaste each site could compost. Lafarge Aggregate has 20 usable acres that would be able to process approximately 44,200 tons of foodwaste. The Fort Gillem site also has about 20 acres that could be used to compost the same amount of foodwaste. Because of the nature of the Lafarge Aggregate site, a collection pond and a liner based composting pad is not needed, thus significantly reducing the initial capital costs for this site. Total capital costs for Lafarge Aggregate and Fort Gillem are $1,702,782 and $2,041,827, respectively. Because Fort Gillem is only four miles away from the State Farmers Market, the largest foodwaste generator in the study area, it has much lower transportation costs. Although costs for wastewater treatment are higher at the Fort Gillem site, the operational cost of $1,145,106/yr for this site is slightly lower when compared to the Lafarge Aggregate site at $1,154,198/yr. Revenue generation would be the same for both sites. Lafarge's 10-year rate of return is -11% compared to Fort Gillem's rate of -21%. The 20-year return for both Lafarge and Fort Gillem increases to 7% and 4%, respectively. Although each location has its particular strengths, the Lafarge Aggregate site appears to be the most financially sound of the two sites to start a foodwaste composting operation.

Recommendations and Future Needs

Based on the interest level from foodwaste generators and the capital and operational cost estimates to run a commercial foodwaste composting operation, such an endeavor appears to be economically feasible and sustainable. Some recommendations that may benefit this potential operation and similar endeavors are outlined below.

1) While quantifying and characterizing foodwaste from the industrial sector is not difficult; it can be extremely difficult in the commercial sector. Detailed foodwaste and/or organic waste audits for the commercial sector may yield more precise information in this area.
2) Source separation is always a critical need for a composting operation. For some food processors this is already being done as a function of their processing. For commercial and institutional establishments, simple training may be all that is required, however each establishment needs to do a cost analysis to see if financial savings in waste disposal fees offsets extra equipment or labor cost.
3) A survey that includes all organic wastes, not just foodwaste, generated around the south metro Atlanta region could prove to be more profitable and feasible for inclusion in a large commercial composting operation. The metro Atlanta area produces large volumes of biosolids, woodwaste, scrap drywall, and animal manure (mostly from horse stables) that could be located, mapped, quantified, and characterized as potential feedstocks for a commercial composting operation. The composting operation may find some of these sources to be easier or more cost effective to include in their program.
4) The potential locations identified to establish a commercial composting operation need a formal business plan from the potential composting company. While there is significant interest from both Fort Gillem and Lafarge Aggregate, both require a formal business plan and presentation by the interested company before they can move further on any proposal to compost foodwaste.
5) While it is currently economically feasible to partner with large food processors in a commercial composting operation, it is not for smaller generators of foodwaste characteristic of the commercial and institutional sectors assuming landfill tipping fees stay constant. It may be more feasible to have central foodwaste or organic waste containers that several commercial and/or institutional establishments can

utilize. This would only be feasible if it meant an overall reduction in their waste disposal bill.

6) The acquisition of a foodwaste collection truck through state funds can make collection and transportation costs more economically feasible for small and medium foodwaste generators. A commercial foodwaste composting operation in North Carolina was awarded state funds through the Division of Pollution Prevention and Environmental Assistance to acquire a foodwaste collection truck and has since expanded its operation to three trucks. These small collection trucks make it more feasible and cost effective to move around in the city where there are many small sources of foodwaste. Rendering operations in Atlanta have begun to experiment with this type of collection system as well.
7) If “free” use of land is not an option, then the feasibility of this hypothetical facility is in question as was shown by the negative rate of return on investment. This is because of the high cost of land, its availability in continuous tract for industrial use and the ability to get the tract of land adequately zoned and permitted. It is recommended that a survey be conducted to locate further potential partnerships for the use of land for commercial composting. It was beyond the scope of this study to research real estate prices in the south metro Atlanta region yet doing so may yield new opportunities for a potential facility.
8) Demonstration sites that encourage and provide education on the uses of compost to stimulate market demand are needed. Compost has many uses and benefits that can be demonstrated in an urban area. For example, erosion and sediment control demonstration sites utilizing compost have the potential to create a demand larger than the industry can currently supply. Creating and sustaining a real market demand for compost and compost products is critical for the growth and sustainability of this potential operation and for the industry as a whole.

1. INTRODUCTION

1.1 Purpose of Study

In response to Georgia's diminishing landfill capacity and public concern over air and water quality issues, the state set a 25% waste reduction goal to be achieved by 1996. While this goal was not achieved, both legislative and voluntary programs have been undertaken which have significantly reduced the amount of material disposed of in landfills. The state's first action was a statewide ban on yardwaste going into landfills. While this targeted primarily municipalities and homeowners, there are industries within our economy that also provide considerable opportunity for the state to reach its 25% waste reduction goal.

The food processing sector, as defined in the Standard Industrial Classification (SIC) system, represents a major portion of Georgia's industrial base. In 1995, this sector employed 58,700 workers, had a total payroll of $1.42 billion, consumed $9.41 billion in raw materials, produced $16.21 billion in manufactured goods and $6.80 billion in value added products (Magbanua, 2000). The commercial restaurant industry is also a major employer with 253,800 persons employed statewide, 139,700 of these people are employed in the Atlanta, Metropolitan (metro) Service Area. Industries of this magnitude produce a significant amount of waste products each year.

In 1999, the U.S. Environmental Protection Agency estimated that 390 million tons of municipal solid waste (MSW) is disposed of in this country annually, with 27 million tons or 7% of this total estimated to be foodwaste. In 2000, an assessment of Georgia's recovery potential of waste from the food processing and institutional food sectors reported that 231,100 tons/year of food processing waste, mainly fruits and vegetables, and 474,000 tons/year of institutional foodwaste were disposed of in landfills. Based on this study it is apparent that there are considerable opportunities for foodwaste composting, primarily within the industrial sector and secondarily within the commercial sector in the state of Georgia.

The Meat Processing Industry, which accounts for the largest employee base within the food processing sector, generates the largest single byproduct stream of foodwaste (See Table 1.1). This industry generates over 821,000 tons/yr of inedible animal parts and meat (Magbanua, 2000). The majority of this waste stream is generated in the Atlanta Regional Commission (127,6000 tons/yr), Georgia Mountains (192,900 tons/yr) and Northeast Georgia (134,900 tons/yr) Regional Development

Table 1.1 Estimated generation rates for food processing and institutional foodwaste in the state of Georgia.

Waste Stream & Major Constituents	Estimated Quantity (tons/year)	Utilization/Disposal Method
Food Processing Waste		
-Animal Matter		
Offal, meat, bones, blood	821,200	Animal feed
Fish/Seafood waste	6,800	Animal feed
DAF sludge	249,600	Animal feed
Eggshells	30,700	Land application, animal feed
Total Animal Matter	**1,108,300**	
-Grain		
Waste flour, dough, cereal	95,300	Animal feed
Brewer's grain/yeast	297,500	Animal feed
Unusable feed	200	Landfill
Total Grain	**393,300**	
-Fruit and Vegetable		
Trimmings, fruit pomace	231,100	Landfill, land application
Waste sauces, salad dressings	4,100	Composting/land application
Total Fruit and Vegetable	**235,200**	
-Nut and Oilseed		
Nut/seed hulls	358,800	Animal feed/bedding, composting
Oilseed meals	810,000	Animal feed
Total Nut and Oilseed	**1,168,800**	
Total Food Processing Waste	**2,905,600**	
Institutional Foodwaste		Landfill, limited composting
-Commercial Establishments	422,000	
-Educational Institutions	2,500	
-Military Installations	8,500	
-Health Care Establishments	6,400	
-Correctional Facilities	34,800	
Total Institutional Foodwaste	**474,200**	
Overall Total	**3,379,800**	

*Reprinted from *An Assessment of the Recovery and Potential of Residuals and By-Products from the Food Processing and Institutional Food Sectors in Georgia* (Magbanua, 2000)

Council (RDC) areas. However, this industry is rather self-contained with almost all of these by-products converted by the rendering industry into animal feeds. Brewers' and distillers' grains and yeast (297,500 tons/yr), and oilseed meals (810,000 tons/yr) wastes all produce substantial by-product streams but are also typically rendered and used as animal feed. Therefore, these by-products were not included in this study.

The intention of this study is to identify and characterize those foodwaste materials that pose a considerable opportunity for landfill diversion through composting efforts within a limited study area. Three major foodwaste generators identified by Magbanua are fruit and vegetable trimmings (231,100 tons/yr), nuts and oilseed hulls (358,800 tons/yr) and institutional and commercial foodwaste (474,200 tons/yr) which appear to be underutilized and widely landfilled. It is these fractions of the foodwaste stream that were surveyed and targeted as part of the Commercial Foodwaste Composting Feasibility Study for South Metro Atlanta.

1.2 Background of Project

Composting at a strategically located composting operation in or near the south metro Atlanta area appears to have great potential and could divert and recycle an enormous amount of foodwaste per year. Through site assessments and technical assistance provided by the Georgia Environmental Partnership (GEP), it was determined that the majority of Atlanta's industrial foodwaste is concentrated in the south metro Atlanta region. While attempts have been made to connect food processors with compost operators, one of the major impediments of this plan were the high transportation costs associated with moving the waste material from the site of generation to the nearest compost operation that is capable of accepting large volumes of foodwaste. The Georgia Department of Agriculture expressed an interest in a study conducted by the Engineering Outreach Service of the University of Georgia to develop a cost-effective composting alternative for the large amount of waste materials generated at the State Farmer's Market located in the south metro Atlanta area. Currently, the Department of Agriculture shares the cost of disposal with the Farmers Market businesses. In addition, the hospitality industry and Hartsfield International Airport were also identified as potential target groups that could participate in a strategically located composting program.

1.3 Aspects of this Study

It is believed that a large scale composting operation located in the south metro Atlanta region would divert and recycle a significant amount of foodwaste currently going to the state's landfills. Therefore, a preliminary study was conducted to both quantify and characterize the foodwaste generated in the south metro Atlanta area.

Based on this information, a compost facility to be located in the south metro Atlanta area was designed. Included in this design are:

1) a hypothetical composting operation design,

2) a detailed estimate of both the capital and operating costs of the hypothetical design,

3) a potential site location(s) based on economic criteria,

4) a list of compost product buyers, market prices and products in Georgia,

5) a suggested competitive tipping fee for the handling of foodwaste materials

6) a suggested market price for the finished compost product, and

7) letters of intent obtained from foodwaste generators interested in participating in such a composting operation.

2. METHODS OF DATA COLLECTION

The first step was to determine if a need and market existed for the development of a composting operation that would service the south metro Atlanta area. Such an operation would be regional in nature and would need to have both a consistent supply from foodwaste generators as well as a significant number of buyers to purchase the final product. The assumed major impediment of a compost operation of this type is transportation costs. Therefore, a study area of 100 kilometers (62 miles) radius was decided upon. Based on our estimates, waste generators located outside an area of this size would find it too great a distance to make transportation of these type waste materials economically feasible.

The center of the study area was identified as the City of Hapeville, Georgia that is located near Hartsfield International Airport in the south metro Atlanta area (Figure 2.1). The 31,416 square kilometer (12,130 square mile) study area encompasses most all of the 22 county metro Atlanta area. An initial list of foodwaste generators were identified within the study area. These comprised 310 industrial food processors, 62 commercial and 8 institutional foodwaste generators. The 380 foodwaste generators were then contacted and provided with background information on the project. Based on the generator's interest level and quantity of waste material produced, a subsequent site visit was conducted to obtain more detailed information. Information included: type of products, type of wastes, quantity of wastes, size of waste containers, cost for waste disposal, how often waste is hauled away, assessment of contaminated and uncontaminated waste generated, and the ability and willingness to pay less than or equal to current waste disposal costs. The generators that were willing to participate and generated over 10 tons per year of foodwaste were included in this study.

The amount of foodwaste generated by both public and private schools were included in this study although the exact amount of foodwaste generated by each school was not readily available. School foodwaste data was calculated based on the number of students in the study area. Literature values (Goldstein, 2002) were used assuming that each student produced 1/4 pound of foodwaste per student per day (Goldstein, 2002). Most commercial and government operations were excluded from this study because the quantity of foodwaste generated at their operation would not make it cost effective to pick up and transport to a separate facility.

The total amount of foodwaste generated in the study area by interested companies was used to calculate and design a windrow composting operation. A windrow operation was chosen because it is generally regarded in the composting industry as the most cost effective and efficient system to handle large quantities of source separated organic materials. Locations for a potential composting operation were explored and determined based on partnerships for "free land" from interested organizations. Prior to this study, it was assumed that such an operation would not be economically feasible, because of the high cost and availability of real estate in the proposed region, if the land required for an operation of this type were required to be purchased. Therefore, entities which might have available land such as Hartsfield International Airport, Lafarge Aggregate of Lithonia and Fort Gillem military base were evaluated as potential partners with a composting company.

Information involving windrow composting was researched as part of this project. Database search engines such as AGRICOLA, CRIS (Current Research Information System - USDA), and the American Society of Agricultural Engineers (ASAE) literature search engine were used using the following keywords: foodwaste composting, commercial foodwaste composting, large scale foodwaste composting, benefits of composting and composting. Grey literature and/or trade journals such as Biocycle: Journal of Composting and Organics Recycling were also used. Research literature on regional composting was reviewed using the 1996, 1998 and 2000 Conference Proceedings of Composting in the Southeast.

Figure 2.1 The 100 km (62 mile) radius around Hapeville, Georgia, encompassing the study area used in this report

3. LITERATURE REVIEW

3.1 Foodwaste Recycling

In most major cities urban sprawl is placing a severe demand on the infrastructure of waste disposal systems. Industrial, agricultural, commercial, institutional and residential sectors all produce waste that must be discarded. Historically the most inexpensive and common method of waste disposal is landfilling. However, it is often difficult under current legislative, permit structure and social scrutiny to construct new economically feasible and adequately sized landfills that will pass public discretion. Because economic issues are normally given top priority in most waste management decisions, more consideration is being given to alternative methods of waste disposal.

In 1999, a national Municipal Solid Waste (MSW) study performed by the U.S. Environmental Protection Agency indicated that 61.1% of the total MSW is organic in nature (USEPA, 1999). The organic portion of the waste stream consists primarily of paper and paperboard (38.1%), yardwaste (12.1%) and foodwaste (10.9%).

JG Press (authors of Biocycle: Journal of Composting and Organics Recycling and Compost Science and Utilization) conducts a survey annually in which government officials from all 50 states are asked to provide information on solid waste generation and recycling. Based on this survey it was determined that national recycling rates have increased steadily over the last decade from 8% in 1990 to 32% in 2001. During that same time period, the number of landfills has decreased dramatically from 8000 in 1990 to 2142 in 2001 (Goldstein and Madtes, 2001). Of the 38 states reporting their recycling rates, only seven reported recycling rates below 20%. The Southeastern United States is slightly below the national average, reporting a recycling rate of only 27%. Of the nine Southern states reporting, only Louisiana and Mississippi reported recycling rates less than 20%. Georgia was one of 12 states that did not participate in the survey.

The need for organics recycling is recognizable as waste generation increases and local and state governments set recycling and reduction goals. While 18 states have set waste reduction goals over 50%, some states have established goals as high as 70% (Massachusetts and Rhode Island). In the South, North Carolina has set a 40% waste reduction goal, followed by South Carolina at 35%, Florida and Kentucky at 30% and Georgia at 25% (Goldstein and Madtes, 2001). Georgia's waste reduction goal was set in 1996 and has not been achieved despite an increase in curbside recycling and pollution prevention programs. The potential for further waste reduction may lie in foodwaste composting where in this same survey 22 states reported that foodwaste composting accounted for approximately 10 to 50% of the total organic materials which they recycled.

States governing bodies cannot set meaningful recycling and waste reduction goals unless first a study of their waste stream is performed. Quantification and characterization studies of food processing waste streams for potential recycling and composting programs have been performed by Kansas, Nebraska and Washington (Riggle, 1989; Youde and Prenguber, 1991: Flores et al., 1999). Other studies have been performed which have included food service waste characterization as well (Ferris et al., 1995: Jacob, 1993, Freeborne, 1993).

Of equal importance to setting recycling goals is the cost that generators pay to dispose of their waste products. For example, the Grocery Industry represents a $34 billion dollar industry annually with the average grocery store in the United States generating 1,000 to 1,500 lbs of foodwaste per week. The Grocery Industry Committee on Solid Waste issued a report that the grocery industry pays $482 million annually in foodwaste disposal (Goldstein, 1992).

Once wastes are quantified and characterized and the associated disposal costs are calculated, only then is it possible to determine if alternative waste disposal methods such as composting are feasible.

3.2 Foodwaste Composting in Georgia and the United States

A popular waste disposal method that many communities are considering to reduce the amount of materials being placed in landfills, is composting. Composting describes both the process the materials undergo as well as the completed degradation of a mixture of materials. A useful explanation of the process of composting is the controlled biological process of the decomposition of organic materials into a humus rich product than can be used beneficially as a soil amendment or in erosion control techniques. A workable definition for compost is that it is an organic soil conditioner that has been stabilized to a humus like product, is free of viable human and plant pathogens and plant seeds, does not attract insects or vectors, can be handled and stored without nuisance, and is beneficial to the growth of plants (Haug, 1993). Composting of foodwaste is an age-old process and will take on an even more critical role in the future because of waste reduction policies and water quality issues.

In a national survey conducted by JG press on foodwaste composting programs and operations, 23 states provided data on commercial and on-site composting operations (Goldstein and Madtes, 2001). Commercial operations were classified as those operations that accept waste materials from outside sources for a fee and then sell the finished compost for a profit. While on-site operations were classified as those operations managed by the generator of a waste material and utilized composting as a waste reduction tool. In this survey, 121 commercial operations were identified with 40 of these located in Massachusetts. In this same survey 204 on-site foodwaste operations were identified with 140 of these operations located in either California or New York.

In the Southeastern United States (Alabama, Georgia, Florida, Louisiana, Mississippi, North Carolina, South Carolina and Tennessee) most foodwaste composting is performed by institutions. Only a few large-scale municipal and private foodwaste composting operations exist. North Carolina leads the Southeast in foodwaste composting. North Carolina has six state universities that compost their foodwaste including: University of North Carolina (UNC)-Chapel Hill, UNC-Ashville, UNC-Greensboro, UNC-Charlotte, UNC-Wilmington and Appalachian State University (Sherman-Huntoon, 2001). North Carolina also has two private operations that compost foodwaste. The larger of the two is a large-scale commercial composting operation in the Research Triangle Park region that processes over 38,000 tons per year of foodwaste material. In addition, North Carolina has three correctional operations that compost its foodwaste and one municipality that composts seafood residuals (Sherman-Huntoon, 2001). North Carolina's developed foodwaste composting infrastructure is likely the result of Executive Order 12101, which dictates foodwaste recycling should be done where possible (Sherman-Huntoon, 2001). In addition, the creation of a full-time organics recycling specialist and organics recycling grants program, administered through the North Carolina Department of Environment and Natural Resources, has helped North Carolina become a leader in foodwaste composting in the Southeast.

Other Southeastern states have foodwaste composting programs, however on a much smaller scale. The Medical University of South Carolina actively composts its foodwaste (Sherman-Huntoon, 2001). South Carolina, Tennessee and Florida all have one or more of their correctional operations composting foodwaste. A municipality in Florida composts over 20,000 tons of foodwaste per year. All of the composting operations cited in the Southeast either use their product internally or give the material away with the exception of the two commercial composting operations.

Foodwaste composting on a commercial scale is a relatively new development for Georgia. A pilot program to compost foodwaste was conducted by the City of Conyers during the 1996 Olympic Games. The Biological and Agricultural Engineering Department at the University of Georgia has conducted two pilot programs to compost the University's cafeteria foodwaste. The University of Georgia has future plans to compost its foodwaste on-site using an in-vessel rotary drum system. Currently, Georgia composts only 28,206 tons/yr of foodwaste among 13 composting operations comprised of 8 state correctional operations, 3 schools and 2 private operations. Only the two private operations accept materials generated off site. Of the 13 composting operations only one markets their product commercially (mostly to homeowners and the landscape industry) with the other twelve operations using their compost internally for agricultural uses. Currently, foodwaste accounts for only 5% of all the organic material that is composted in Georgia.

3.3 Compost Use

The use of compost and composted products is highly dependent on availability and quality. Current uses of compost include agricultural field operations, field nursery and nursery beds, silviculture, turf and lawn care, sod production, potting soil mixes, soil blends, horticultural substrate, landscape mulch, planting backfill, biolfilter media, bioremediation of contaminated soils, land reclamation and habitat restoration, erosion and sediment control and compost teas (USCC, 1996). Research during the last decade has determined the many positive benefits of compost use, such as suppressed plant diseases which can lead to reduced pesticide applications (Graham, 1998; De Ceuster and Hoitink, 1999; Maynard, 2000), and water conservation and reduced irrigation requirements because of the increased water holding capacity and rainfall infiltration rates of soils (Agassi, 1998; Demars, 1998; Demars, 2000). One of the major impediments of a composting operation is transportation costs, therefore, the availability and use of compost often reflects what feedstocks are produced in a given area or region.

3.4 Environmental Benefits of Composting and Compost

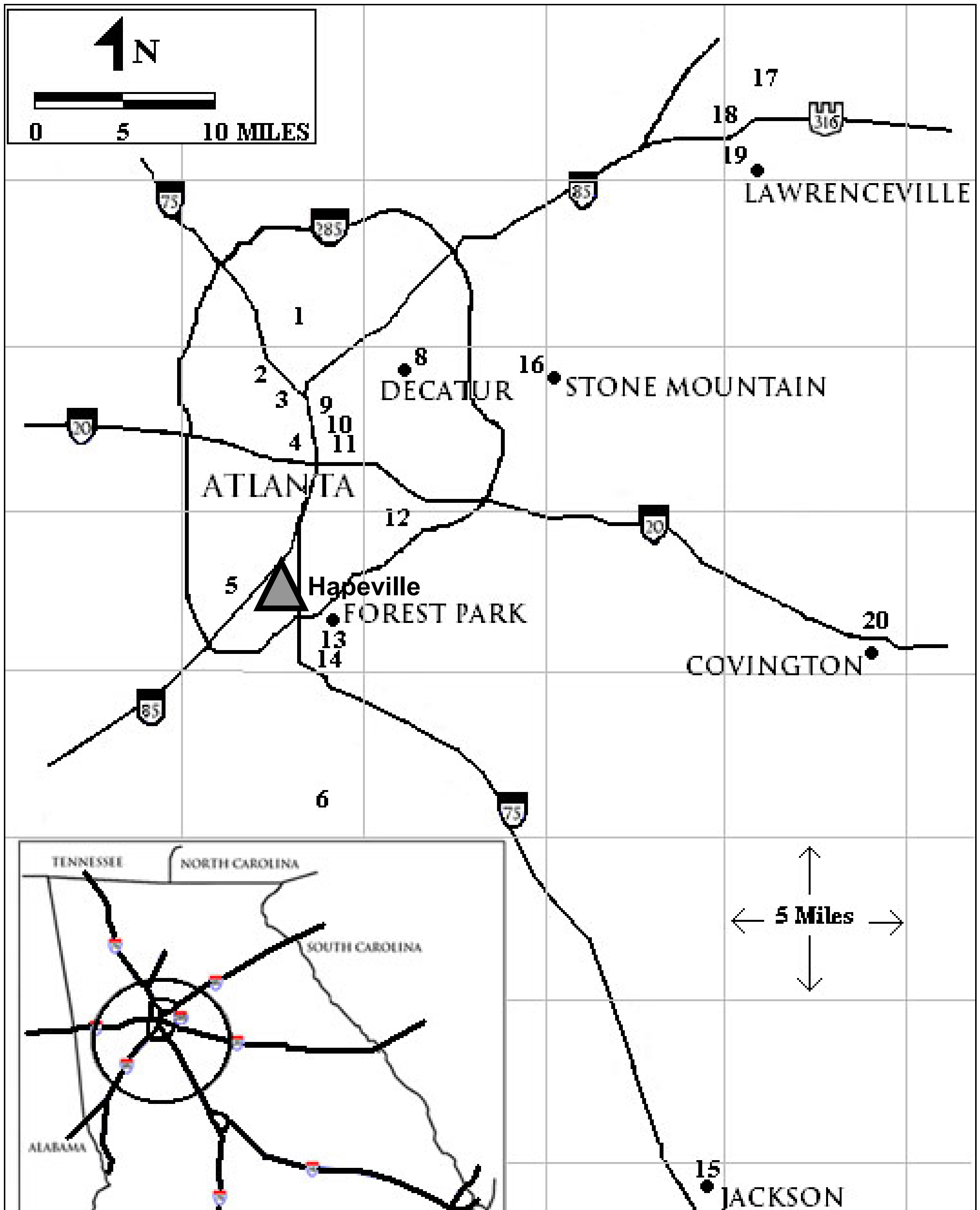
Diverting foodwaste materials from landfills and producing usable compost can lead to many environmental benefits. According to the USEPA (1999) organic waste (specifically foodwaste and paper) in our landfills is the number one source of methane, a greenhouse gas 25 times more potent than carbon dioxide. The microbial decomposition process that occurs during composting provides many important benefits. The heat generated as a by-product of microbial decomposition serves to kill human and plant pathogens, invasive weed seeds and root feeding nematodes (USEPA, 1999). In addition, composting has also been shown to reduce, eliminate and/or partially degrade insecticide and herbicide residues, many types of xenobiotics, hormones and antibiotics in the environment (Bueyueksoenmez, et al. 1999). Correct utilization and application of composts can help reduce fertilizer requirements (Maynard, 2000), pesticide applications (De Ceuster and Hoitink, 1999), water usage (Mamo et al., 2000), soil erosion (Demars and Long, 1998) and storm water runoff (Alexander, 1999).

4. QUANTIFICATION OF FOODWASTE

The objective of this section is to quantify industrial, commercial and institutional foodwaste produced in the south metro Atlanta region by participating generators. This region encompasses most all of the 22 county metro Atlanta area with the center of the study in the City of Hapeville, GA. Participating generators are those entities located in the study area and willing to divert their foodwaste to a composting operation. The industrial sector is comprised of food processors. A map of cooperating industries is shown in Figure 4.1. The industrial sector is separated into those industries located within the Georgia State Farmers Market and the remaining industries within the study area. The commercial sector represented the hotel and restaurant industry and is shown in Appendix A along with the industrial generators. Only restaurants that were interested in participating in a partnership with a potential composting operation were considered in this study. Only four large hotels that generate large quantities of foodwaste choose to participate. Because of the lack of participation and the economic inefficiencies of source separation and hauling small amounts of foodwaste to a central location, restaurants and small hotels were not included in this study. The institutional sector included foodwaste generated by schools and prisons. Foodwaste generated from schools by county is shown in Appendix B. A list of prisons cooperating in this study is shown in Appendix C.

4.1 Method of Foodwaste Quantification

Foodwaste in this study is defined as any organic byproduct generated during the processing of food items for human consumption. Few businesses participating in this study had previously quantified the amount of foodwaste they produced annually, the fraction of their waste stream represented by foodwaste and the associated disposal fees. Site visits were conducted to visually estimate and verify company estimates of the amount of foodwaste produced from participating generators. Information concerning the institutional sector was readily available in the literature and contact was made to individual generators only when additional information was needed. Schools were estimated to produce 0.25 pounds of foodwaste per student per day (Goldstein and Madtes, 2001) and were assumed to operate 180 days per year. For prisons, it was estimated that each inmate generates approximately two pounds of foodwaste per day (0.37 tons/yr) (Appendix C).



1. Five Seasons, 2. Dogwood Brewing, 3. La Chiquita Tortilla, 4 Hilton Atlanta Towers, 5. Crowne Plaza Hotel, 6. Clayton County Prison, 7. Spalding State Prison, 8. Masada Bakery, 9. Atlanta Transitional Center, 10. Los Amigos Tortillas, 11. Swiss Hotel, 12. Metro State Prison and Metro Transitional Center, 13. Fresh Express, 14. State Farmers Market, 15. Taminura and Antle Southeast, 16. Thermo-Pac, 17. Philips State Prison, 18. Valentine Enterprise, 19. Gwinnett County Prison, 20. General Mills.

Figure 4.1 Foodwaste generators visited within 100 km (62 mile) radius of Hapeville, GA.

4.2 Foodwaste Quantification

The estimated amount of foodwaste generated by the industrial, commercial and institutional (schools and prisons) sectors is shown in Figure 4.1. A total of approximately 44,200 tons of foodwaste is generated per year from these three sectors, 60.6% of this amount was generated by the industrial sector.

Four large hotels located in the study area represent the commercial sector, which disposes of 2.4% or 1,078 tons of foodwaste per year. Schools totaled 654,000 students and produced approximately 33.3% of the total foodwaste in the region. The eight prisons located in the study area produced only 3.7% of the foodwaste.

4.2.1 Industrial Sector

The industrial sector was the largest foodwaste generator in the study area. Industrial foodwaste is any foodwaste material that is generated either as a byproduct from manufacturing of materials or is discarded because of quality concerns. Of the

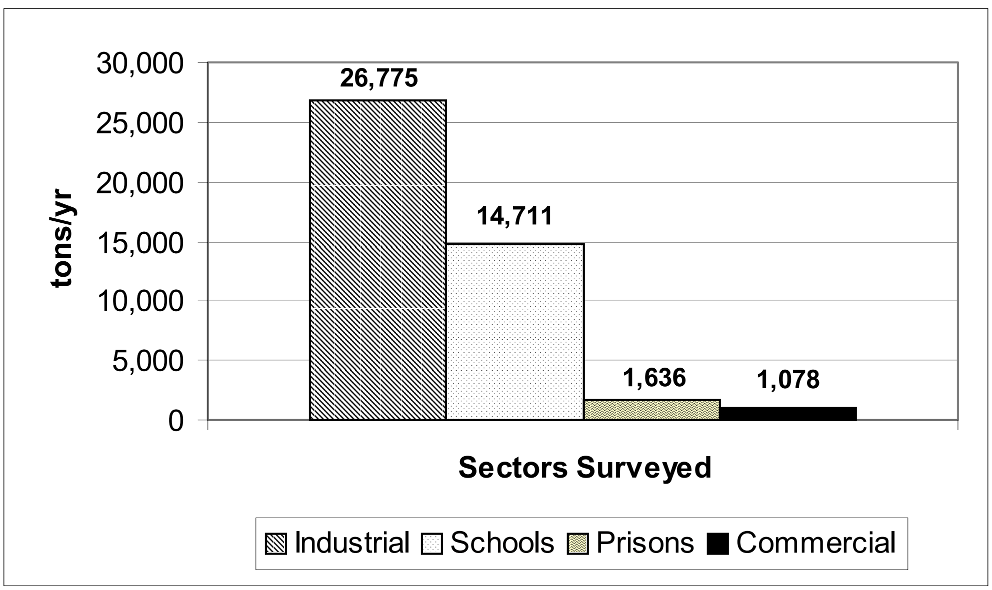


Figure 4.2 Quantification of foodwaste generated by the industrial, commercial and institutional sectors within a 100 km (62 mile) radius study area with its center located in Hapeville, GA.

eighteen companies identified in this sector, seven were located at the State Farmer's Market (Appendix A). The Georgia State Farmer's Market is located in south Atlanta and is used as a shipping and receiving location for food processors, distributors and marketers. The majority of the businesses at the Farmers Market handle fruit and vegetable produce. Food processors generated the largest quantity of foodwaste at the Farmer's Market followed by distributors and then marketers. Marketers were not included in this study because their waste generation is seasonal and extremely variable. Approximately 13,989 tons or 52.2% of the total industrial foodwaste generated in this study were from the seven businesses located at the State Farmer's market. The remaining 12,786 tons were from the other businesses surveyed in the study area.

4.2.2 Commercial Sector

The commercial sector includes that foodwaste generated by hotels and restaurants. While the total amount of foodwaste generated by the commercial sector is large, these generators are often dispersed and the amount of "clean" or "useable" foodwaste generated at any one site is small compared to the food processors in the industrial sector. This makes foodwaste collection and transportation costs expensive. In this study the commercial sector comprised only 1,078 tons/yr or 2.4% of the total foodwaste generated, and included only four hotels within the study area (Appendix A). These four hotels each have large kitchens and were interested in participating in the study because they saw composting as an alternative waste disposal solution that could provide potential savings. Of the restaurants contacted, none chose to participate in this study.

4.2.3 Institutional Sector

4.2.3.1 School Foodwaste

The 22 county study area is predominately urban and contains nearly 50% of Georgia's population with numerous public and private schools. For the purpose of this study, the student population was defined as those students enrolled in grades K-12 at either public or private schools located in the study area. Urban areas, such as this study area, typically contain a large number of private schools. The number of students enrolled in public schools was readily obtainable, however, the number of students attending private schools on a county-by-county basis within the study area was not known (Schrenko, 2002). Based on the urban setting and the population demographics it was assumed that 70% of all children attending private schools in the State of Georgia were located in the study area. Schools were estimated to produce 0.25 pounds of foodwaste per student per day (Goldstein and Madtes, 2001) and were assumed to operate 180 days per year. In the 22 county region study area there are estimated to be 654,000 students which produced 14,711 tons/yr or 33.3% of the foodwaste quantified in this study. Sixty seven percent of the students in the study area were located in Clayton, Cobb, Dekalb, Fulton and Gwinnett Counties, all of which had student populations in excess of 40,000 students. If a compost operation chose to include schools as a portion of its foodwaste supply, a majority of the foodwaste stream could be obtained by hauling foodwaste from only those five counties.

4.2.3.2 Prison Foodwaste

Eight prisons were included in this study. Although prisons are the smallest foodwaste generators, they have a labor force that provides “free” source separation of foodwaste. This ensures a clean foodwaste stream at no cost for a composting operation. Prisons generated 1,636 tons/yr of foodwaste that comprised only 3.7% of the total foodwaste generated in the study area. The variation in the amount of foodwaste generated is directly related to the number of inmates housed at each facility.

5. COMPOST PRODUCT SURVEY

In Georgia, compost is used and/or distributed in one of four ways; used internally by the manufacturer, sold in bulk, sold in bag or given away free. Of the 38 compost manufacturers and suppliers surveyed, 42% used their product for internal purposes, 31% sold in bulk quantities, 19% were small scale landscape suppliers and nurseries which sold bagged compost and 8% were municipal and private manufacturers that gave their compost away to the public. Those private manufacturers that gave away compost free were contracted by municipalities to offer their compost for no direct charge.

5.1 Compost Product Manufacturers, Buyers & Sellers

Three types of compost suppliers were identified: municipalities, institutions and private vendors. Municipal suppliers were local operations that collected and composted organic materials (typically yardwaste and/or biosolids) from the community to reduce materials going into the landfill. Institutions consisted of schools and prisons that composted foodwaste on-site and used the finished product on their own property. The third group was made up of private vendors who both manufacture and sell compost or who buy compost from a manufacturer for resale. Appendix D contains a list of all compost operations, both buyers and sellers, identified through this study.

5.2 Municipalities

A summary of the municipal compost operations in Georgia is presented in Table 5.1. Of the eight municipal composting operations, four used biosolids (biosolids are solid residuals from wastewater treatment facilities) as a primary feedstock, two used yardwaste, one used tobacco-manufacturing byproducts and one used municipal solid waste (Gaskin et al., 2002). The majority of the compost produced at these operations were either given away to county residents or used internally for landfill cover or roadside plantings. The compost ranged in price from no charge to ten dollars per cubic yard.

Table 5.1 Municipal compost operations in Georgia (Gaskin et al., 2002)

Compost Operation	County	Feedstock	Price per cu. yd
City of Athens	Clarke	Biosolids	$ 10.00
Cobb County	Cobb	MSW	$ 4.00
City of Brunswick	Glynn	Biosolids	$ 1.00
City of Douglas	Coffee	Biosolids	Free
Crisp County	Crisp	Tobacco waste	Free
City of Manchester	Meriwether	Biosolids	Internal Use
City of Pelham	Mitchell	Yardwaste	Internal Use
City of Griffin	Spalding	Yardwaste	Internal Use

5.3 Institutions

Institutional compost operations typically use their compost internally and do not market to the public. The driving factor behind composting at institutions was either for waste reduction purposes, associated financial savings, or for environmental educational programs in schools.

5.4 Private Compost Vendors

Private compost vendors are those operations that either sell compost they manufactured or sell compost they bought wholesale. Private vendors were further classified as either bulk or bagged product suppliers. A list of private compost vendors is shown in Appendix D. A list of Georgia compost manufacturers that use their compost internally is shown in Appendix E.

Typically, vendors of bagged compost are small-scale nurseries and home garden centers. These vendors sell between 333 cu. yd and 780 cu. yd per year. The smaller number is representative of that sold by a family-owned nursery while the larger number represents the amount of bagged compost sold by an average Home Depot Garden Center. A bag of compost can weigh from 38 to 50 pounds per bag, but is most commonly sold in 40 lb bags that are approximately one cubic foot in volume. Prices range from $2.35 to almost $8.00 per bag with an average price across all suppliers of $4.72 per bag. Factors affecting the market price included: compost quality, nutrient content, feedstock material and quantity of compost sold.

Vendors of bulk compost were typically large nurseries or landscaping companies and compost manufacturers. These vendors sell on average nearly 950 cu. yd of compost per year. Compost normally weighs between 800 to 1,200 lbs/cu. yd. The average bulk price of a cubic yard of compost was found to vary from $13.00/cu. yd for yardwaste compost up to $35.00/cu. yd for foodwaste compost. The large variation in price was a function of the feedstock material used to make the compost and the quality of the finished product (See Table 5.2).

Composted agricultural residuals are those materials composted from crop residues such as cotton gin trash, vegetable culls and pine bark. Manure based composts used either poultry litter or cow manure as a feedstock material. Composted yardwaste had the lowest average selling price at $13.00/cu. yd; this price does not take into account the significant amount of yardwaste compost that is generated each year and distributed at no charge.

Table 5.2 Average bulk prices of marketed compost by feedstock produced in Georgia

Primary Feedstocks	Cost ($/cu. yd)
Yardwaste	$13.00
Agricultural Residuals	$15.00
Biosolids	$18.00
Animal Manure	$26.80
Foodwaste	$35.00

5.5 Compost Buyers

The two largest volume buyers of compost are landscapers and nurseries. The amount of compost purchased by nurseries and landscapers varied considerably from 150 tons/yr to nearly 2,000 tons/yr. Landscapers typically bought compost in larger quantities. On average, landscapers bought approximately 800 tons/yr at an average price of $9.00/cu. yd. Nurseries typically bought both bulk and bagged compost. The bulk compost was used internally while the bagged compost was sold to their customers. On average, nurseries bought compost at an average price of $12.33/cu. yd. The higher cost of compost purchased by nurseries takes into account the bagged compost, which is normally of higher quality, and lower volumes. High quality bagged compost was on average purchased for $5.00/bag and sold for $6.50/bag to the public while low quality bagged compost was on average purchased for $2.50/bag and sold for $3.50/bag. Table 5.3 presents the final use of compost for operations producing compost in Georgia.

Table 5.3 Final use of compost for composting operations in Georgia

	Number of Facilities			
Type of facility	Internal use only	Free to the public	Sold by the yard[1]	Sold by the ton
Institutional	12	0	0	0
Municipal	3	2	2	1
Private	5	2[2]	11	0
	20	4	13	1

[1] Four operations that sell by the yard also sell compost in bags
[2] Both of these operations are under contract by municipality to provide compost to public for free

5.6 Compost Manufacturer Comparison by Location

Compost manufacturers were identified not only by the type of manufacturer (municipal vs. private) but also by their location. Compost manufacturers were separated by location into those selling inside and outside of the 22 county study area. Of the 38 composting operations surveyed, 76% were located outside the study area while 24% were within the study area. The price of compost outside the study area was determined to be 46% greater than that within the study area. It has already been shown in Table 5.2 that compost prices are normally dictated more by the compost quality and source material than on the location of the compost operation.

5.7 Amount of Compost Processed According to Facility Type

In the Georgia Compost Infrastructure Survey, conducted by the UGA Engineering Outreach Service, it was determined that Georgia currently has 38 active composting operations in the state which compost 553,600 tons/yr of organic materials. Of those 38 operations 18 were private, 12 were institutional and 8 were municipal. Private operations composted all types of feedstocks but the predominant ingredients composted were animal manures and yardwaste, which comprised 33.3% and 27.8%, respectively. Although only one private operation composted biosolids, it accounted for 33.8% of all private materials composted and 25% of all materials composted in the state. Of the twelve institutional sites, one operation was responsible for 28.2% of the 14,206 tons per year composted. Eleven of the twelve institutional operations were found to be composting foodwaste while one composted yardwaste, although pilot foodwaste tests had also been conducted at this site. Of the eight sites classified in the municipal category, four composted biosolids, two yardwaste and two industrial wastes (MSW and tobacco sludge) (Governo, 2002).

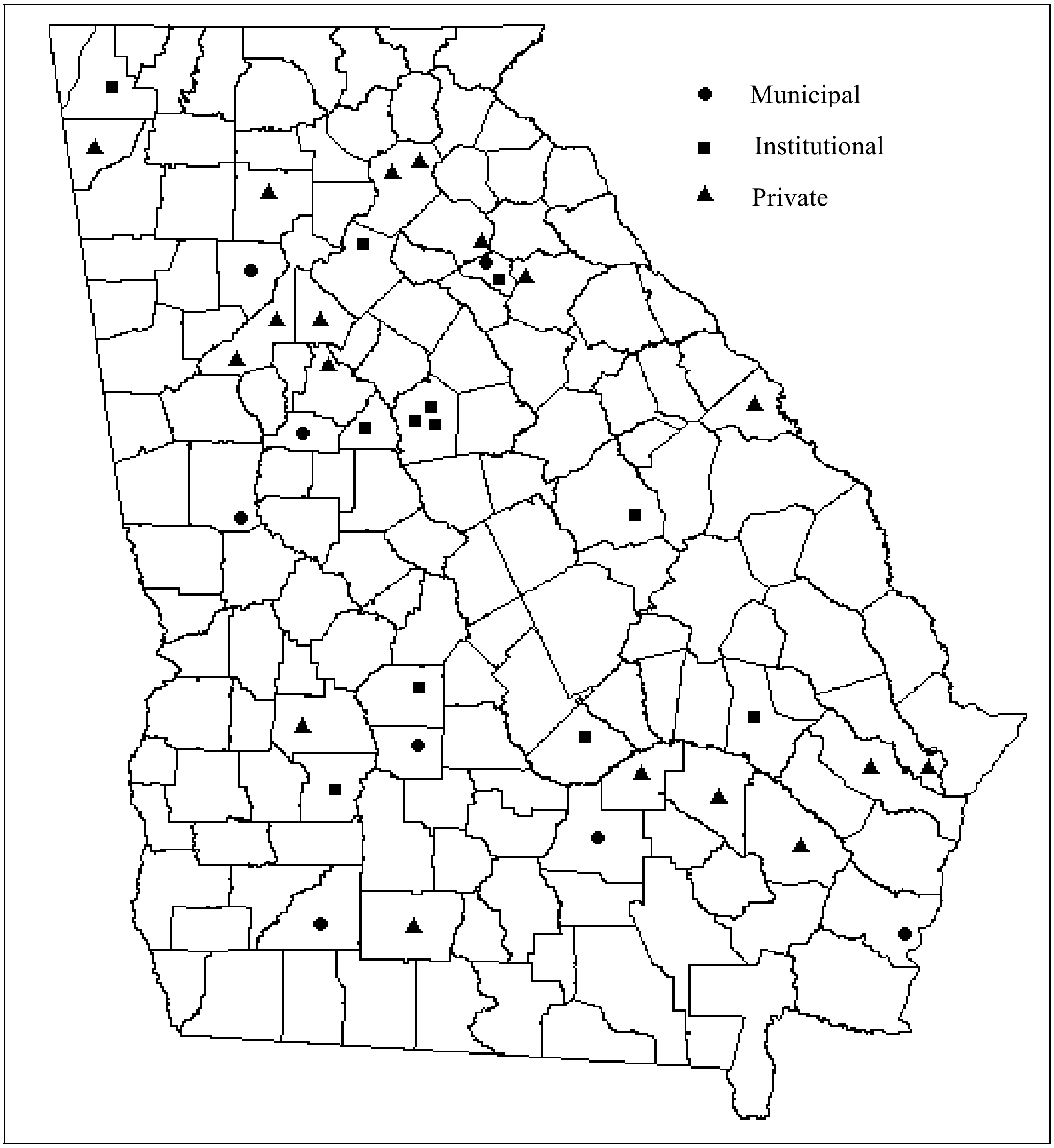


Figure 5.1 Map of existing composting operations in Georgia as of Fall 2001.

6. COMPOSTING FACILITY DESIGN AND ECONOMIC ANALYSIS

A properly designed commercial composting operation has seven defined steps; feedstock recovery, feedstock preparation, composting, stabilization, curing, refining and storing (USCC, 1994). Feedstock recovery involves removing the compostable fraction from a mixed waste stream to provide a contamination free feedstock. Feedstock preparation involves processes that initially establish optimum particle size; nutrient balance and moisture content to best facilitate microbial growth and subsequent degradation. Composting and stabilization are each steps where conditions of moisture and aeration are maintained to ensure thermophilic temperatures in the range of 113-149°F. Stability is achieved when biological activity is minimal and is characterized by low oxygen uptake rates, biological heat production and minimal odor. Refining of compost involves screening, metals separation and removal of inert and large organic contaminants.

Included in this section is a detailed feasibility design for a hypothetical windrow composting operation. A windrow composting system consists of long piles of materials that are turned or aerated by mechanical equipment to maintain optimal composting conditions. The operation was designed to compost 44,200 tons of foodwaste per year. This value was chosen based on the amount of foodwaste previously identified in the 22 county study area. Because of the high level of variability of individual feedstocks from the variety of generators, various assumptions were made in order to provide an initial base design. The following is a list of general assumptions that were made:

1) All foodwaste is source separated and free of inert non organic materials
2) Collection and transportation of the foodwaste and carbon material is performed by transportation contractors
3) Foodwaste is brought to the site on a continuous basis in the range of 150 to 200 tons/day.
4) Carbon material is stockpiled at the site prior to receiving foodwaste shipments.
5) Foodwaste is able to be handled without any special equipment or extensive site modifications
6) All required land, zoning and permits can be acquired for the site

6.1 Hypothetical Compost Site Design

The key material characteristics are: particle size distribution, carbon to nitrogen ratio (C:N) and moisture content. Too little moisture inhibits microbial activity and therefore the rate of degradation during composting while similar consequences occur when the moisture is too high. Proper particle size distribution provides a composting substrate with adequate surface area for microbial degradation and with adequate porosity for the movement and storage of oxygen. A proper C:N ratio for decomposer microorganisms enables the compost process to operate at an optimum level and results in bio-stabilization of the composting material in a timely fashion. Recommended targets include particles sizes of 5 to 25 mm (1/4" to 1"), a C:N ratio of 30 to 45 and a moisture content of 60 to 65% (Haug, 1993).

In order to design a proper composting mixture, knowledge about the feedstocks and the foodwaste materials must be determined. Because of the variability of the foodwaste over the 22 county study area the following assumptions were made:

	Foodwaste	Carbon Material
Moisture Content	80%	48%
Bulk Density	1,500 lb/cu. yd	850 lb/cu. yd
C:N Ratio	15	50

Based on the these assumptions, the foodwaste must be mixed with the carbonaceous material (i.e. yard trimmings, woodwaste or other materials) at a 1 to 3 volumetric ratio or a 1 to 1.7 ratio by weight. This mixture would provide a C:N ratio of 30 and moisture content of 60%. To compost 44,200 tons of foodwaste per year, 75,140 tons of carbon materials would be required.

In order to ensure a high quality finished product the following operational time schedule was assumed. Composting required 60 days, curing for 60 days and followed by 30 days of finished product storage.

A composting period of 60 days was assumed in order to ensure pathogen and vector attraction reduction for the materials being composted. The US Environmental Protection Agency's (USEPA, 1993) Title 40 of the Code of Federal Regulations (CFR) Part 503, which is a set of rules developed for biosolids management, will be followed although it is not necessary for the feedstocks that are being used. This rule requires that the composting windrows maintain an internal temperature of 131°F (55 C) for fifteen days after construction and the windrows must be turned a minimum of five times during this period. This time/temperature regime ensures that all pathogens and vector attracting characteristics in the compost are eliminated; helping to ensure the finished compost will be of exceptional quality.

A curing period of 60 days was assumed after composting. While curing, the compost becomes biologically stable as microbial activity in the compost slows.

During composting the materials experience shrinkage. Typical volumetric shrinkage during composting is 25 to 50%, however, foodwaste experiences much higher shrinkage values because of its high moisture content. Therefore, a volumetric shrinkage reduction factor of 75% was assumed.

6.1.1 Sizing of the Composting Operation

Because of the limited availability and high cost of land in the south metro Atlanta area, the required land footprint for the compost operation must be optimized to minimize the required facility size. The foodwaste composting operation will be designed assuming a continuous operation that receives approximately the same amount of material on a daily basis (150-200 tons/day of foodwaste or a total of 477 tons/day organic materials). At this operation, processes involving feedstock recovery, feedstock preparation, composting, stabilization, curing, refining and storing will be performed. The capacity, efficiency and cost of such a composting operation are all affected by assumptions made regarding the land requirements and equipment needed for each step in this process. Because of the wide range of variables that impact the nature of composting, a small change in any design parameter can make a significant difference in the needs of the facility. When an operation is not properly designed to meet the process requirements, common problems such as odor, low product quality, high operational costs and capacity limitation can occur.

The primary unit operation at this operation is the compost processing area or composting pad. The size of the pad is based on the type and quantity of feedstock that is composted, the initial feedstock mixture/recipe and the type of equipment that is used for processing. All feedstock preparation (e.g. receiving and mixing) and active composting takes place on this pad. Composting of foodwaste material on this scale is often required by the Georgia Environmental Protection Division (EPD) of the Department of Natural Resources (DNR) to be done on an impermeable surface. Impermeable surfaces are often expensive; therefore, minimizing the necessary pad size without negatively impacting the environment or process is of primary concern while at the same time providing for future growth of the operation.

In order to accommodate the volume of incoming material while minimizing the size of the impermeable composting pad, large industry standard, self-propelled compost turners were specified. These compost turners are capable of providing windrow aeration and porosity maintenance needed for good quality compost and can turn windrows 8 feet tall by 20 feet wide. Large front-end loaders (4 yard capacity) were specified in all areas of material handling. Given the assumed initial feedstock characteristics and the percent reduction, a compost pad of 8.4 acres is required.

After composting, the material will be moved off of the composting pad to an adjacent area where the compost is cured. A 2.1-acre area will be required for this process.

After curing, the compost will then be moved to a screening and storage area. During screening, inert and large organic particles are removed. Once screened, the final product is moved to a storage area where it further cures until it is distributed as finished compost. A 0.8-acre area will be required for this process.

In addition, the EPD often requires large foodwaste composting operations to contain storm water runoff from the composting areas. Based on the curing and storage areas of the composting operation and its geographic location, a collection pond was designed based on a 25-year, 24-hour rainfall event. For this operation, a 1.5-acre collection pond with a depth of 15 feet is required to be constructed downgrade from the composting areas in order to capture and retain storm water runoff from the site. The EPD also requires the ability to treat all wastewater that is captured in the pond each month. At some composting sites, treatment is accomplished using a land application system. However, because of land availability, wastewater was assumed to be pumped directly to the local municipal wastewater system and a surcharge paid to the municipality for treatment of this wastewater.

Buffer areas around the operation are also included to provide ingress and egress for material haulers. Wooded buffers around a composting operation are recommended as both a visual barrier and for reducing the migration of odors off-site. The actual width of these buffer areas depends on the site-specific characteristics and usually depends on the relative sensitivity of neighbors and surrounding areas.

An overall layout of the proposed composting operation to compost 44,200 tons of compost per year is shown in Figure 19.1 (Appendix F). The composting operation requires a total area of 20 acres.

6.2 Economic Evaluation

Often, determining the economic feasibility of a composting operation is based solely on the cost per ton to process the waste. Is it less expensive to compost organic wastes rather than disposing of them in a landfill. Composting must be less expensive and also provide enough revenue for the operation to be economically sustainable.

In the economic evaluation process, it is often assumed that an operation immediately receives top return on compost sales. In reality, it often takes market development much longer than planned to realize high-end sales of finished compost. This lag period makes it difficult for composting facilities to maintain proper operations while meeting financial agreements. In the design of this foodwaste composting operation, efforts were made to accurately estimate all costs. To be conservative, all expenses were estimated on the high side while all revenues from this operation were estimated on the low side. If an operation can meet financial demands on paper using conservative estimates, then it is more likely to be sustainable over the long term.

6.2.1 Capital Costs

Capital costs are those expenses that are often amortized over a period of years. Capital costs include land purchases, construction of infrastructure and purchase of operational equipment. Total capital costs for this operation were estimated to be \$2,453,611. Table 6.1 contains a summary of capital costs for the 20-acre composting operation.

Prices for vacant land in the south metro Atlanta area can fluctuate from \$10,000 to over \$30,000/acre depending on which county the operation is located. Using an estimate of \$20,000/acre, the 20-acre operation has a land cost of \$400,000. If the required land could be acquired for free or under a minimal leased price arrangement, this cost could be eliminated or substantially reduced. This scenario is explored in Section 8.

Construction costs including the cost to construct the compost pad, curing area, storage area, collection pond, road construction and wastewater pumping system were estimated to be \$397,611. Land clearing and preparation of the compost pad, curing and storage areas were calculated assuming 3 days/acre working time at \$1,150/day for personnel and equipment. To minimize construction costs of the compost pad, a liner-based pad design was chosen rather than a concrete pad. The liner-based pad involves using a 30 mm Medium Density Polyethylene (MDPE) liner, overlaid by lime stabilized compacted clay. This type of construction was estimated to cost \$21,177/acre. The curing and storage areas were not required to have an impermeable surface and resulted in a total construction cost of \$10,005 for the combined 2.9 acres. The collection pond, used to capture all storm water runoff, is lined in a similar manner to that of the compost pad. A similar MDPE liner system was used. Construction costs associated with collection ponds are very site specific because of the unique geologic conditions associated with each site, along with the amount of land clearing required and excavation. Taking these factors into account, the total cost of construction for the collection pond was estimated to be $49,101. Installation of a water pumping system to transport water from the collection pond to the nearest wastewater line was estimated to be $15,000. Many large trucks will enter and exit the operation each day, therefore, proper road construction is critical around the site. Approximately two acres of land was included in the design for construction of a half-mile long, 20-foot wide road. Using asphalt, the paving costs were estimated to be $10.50/sq yd. The total cost of this road system, which includes land clearing and paving, was $79,350. Because of the many unknown variables in this design, an additional 20% contingency expense was added to all construction and equipment costs.

This composting operation was designed to process 477 tons of organic materials per day using multiple pieces of equipment estimated to cost a total of $1,656,000. The list of required equipment includes: 2 self-propelled windrow turners, 3 bucket wheel loaders, 3 dump trucks and 1 screener. It was estimated that 2 self-propelled windrow turners, at $250,000 each, are needed to aerate and mix the windrows. It was assumed that one of the turners is used at all times while the second turner is used when needed or as a back up. For material handling, 3 bucket wheel loaders, at $175,000 each, are needed. One loader is used for daily windrow construction with new foodwaste, one for carbon material handling, and one for windrow harvesting, screener loading and distribution loading. Three dump trucks at approximately $35,000 each are used to transport materials within the site. One compost screener at $175,000 is used to remove inerts and large particles and to ensure market specific compost particle size. Six groundwater-monitoring wells, at $10,000 each are installed around the site to monitor groundwater contamination by leachate from the compost operation. Miscellaneous equipment such as probes, meters, lab equipment, computers and software were estimated to cost $15,000. In a similar manner, a 20% contingency expense was added to all equipment costs.

Table 6.1 Capital cost summary table

Capital Costs	# of units	$/unit	Total Cost
Land required (acres)			
Compost areas	11.3	$20,000	$226,000
Collection pond	1.5	$20,000	$30,000
Buffer property	3.5	$20,000	$70,000
Road and carbon storage	3.7	$20,000	$74,000
Total Land Required	20.0		$400,000
Construction			
Compost pad (acres)	8.4	$21,177	$177,887
Curing and storage (acres)	2.9	$3,450	$10,005
Collection pond (including liner)	1.5	$32,734	$49,101
Road, ½ mile including land clearing &			$79,350
Wastewater pumping system	1	$15,000	$15,000
Contingency at 20% of total construction			$66,269
Total Construction			$397,611
Equipment			
Self propelled windrow turner	2	$250,000	$500,000
Large wheel loader	3	$175,000	$525,000
Screener	1	$175,000	$175,000
Dump truck	3	$35,000	$105,000
Monitoring wells	6	$10,000	$60,000
Miscellaneous equipment	1	$15,000	$15,000
Contingency at 20% of total equipment			$276,000
Total Equipment			$1,656,000
		Total Capital Costs=	**$2,453,611**

6.2.2 Operating Costs

Operating costs of the operation were estimated to be $886,520/yr and took into account those costs required to perform business and maintain the composting operation. For this facility, operational costs were grouped into equipment, personnel and contract work. A summary table showing the estimated annual operating costs are shown in Table 6.2 on page 42.

Equipment costs were estimated to be $416,520/yr and take into account the cost of fuel, maintenance and repair, equipment replacement and insurance for all equipment used at this facility. A synopsis of the required equipment is shown in Table 6.1. Fuel costs were estimated assuming 3,197 hrs/yr of total equipment operating hours with fuel costs of $1.50/gal. Using these assumptions and the estimated fuel consumption rate of each piece of equipment, the total fuel cost for the operation was estimated to be $60,783/yr. Ongoing maintenance and equipment replacement is a critical part of normal operating procedures in order to ensure a sustainable operation. Equipment maintenance and equipment replacement were both estimated to cost 10% per year of the original cost of the equipment. Facility insurance was estimated at 1% of the total capital cost of the operation.

Personnel costs were estimated to be $205,500/yr. A total of 6 employees, 4 skilled and 2 unskilled, were estimated to be needed for this operation. Skilled labor was assumed to be paid $15.00/hr and was defined as those individuals that are trained and able to operate all pieces of heavy equipment. Unskilled labor was assumed to be paid $7.50/hr and was defined as those persons who do not operate heavy equipment. These persons will operate trucks and perform daily monitoring tasks at the site. Annual salaries were based on each employee working 2,000 hours per year (50 weeks @ 40 hrs/week). Employee insurance and benefits were estimated to be 37% of the individual yearly salaries.

Contract work at this facility was estimated to be $264,500/yr. Contract work takes into account monthly wastewater treatment, laboratory analysis and wood/yardwaste grinding done at this facility.

In composting, large amounts of carbon feedstocks are required in the process. Many common carbonaceous feedstocks require particle size reduction prior to use in composting. However, an outside contractor performs grinding of carbonaceous feedstocks at many composting operations because grinding occurs too infrequently to justify the purchase and maintenance costs associated with an industrial size grinder. At this operation, it was assumed that 75% of the incoming carbonaceous feedstocks required particle size reduction. Assuming 530 hours of grinding per year at $250/hr, this cost was estimated at $132,500/yr. Because of the large volume of carbon feedstocks required by this operation, it might be economical in the future for this operation to acquire a grinder to grind materials in-house.

The annual cost for wastewater treatment was assumed to be $126,000/yr. This cost is believed to be overly conservative since a large portion of the water collected at most windrow composting operations is sprayed directly back onto the windrows to maintain moisture. At large foodwaste composting operations such as this, the Georgia EPD often requires that storm water runoff from the composting areas be contained. Wastewater collected as storm runoff from the composting areas was assumed to be pumped directly into the local municipal wastewater system and a surcharge paid to the municipality for treatment of this wastewater. The on-site collection pond had a total monthly storage volume capacity of 4,964,000 gallons. It was assumed that 50% of the total monthly capacity was treated as wastewater at a cost of $21 per 10,000 gallons (Jordan, 1998).

Incoming feedstocks and finished compost at commercial operations should undergo laboratory analysis. Tests are performed to quantify both the physical and chemical characteristics of the materials. It was assumed that 12 tests of this type were performed each month with a total annual cost for laboratory analysis of $6,000.

Table 6.2 Operating cost summary table

Operating Costs		**$/unit**	**Total Cost**
Equipment	% per Yr		
Fuel cost (gallon)		$1.50	$60,783
Maintenance & repair	10%		$165,600
Equipment replacement	10%		$24,536
Facility insurance	1%		$165,600
Total Equipment			$416,520
Personnel	# Employees		
Skilled labor	4	$15.00	$120,000
Unskilled labor	2	$7.50	$30,000
	% of Salary		
Personnel benefits	37%		$55,500
Total Personnel			$205,500
Contract work			
Carbon/wood grinding	530 hrs	$250	$132,500
Monthly wastewater treatment	12 mth	$10,500	$126,000
Monthly laboratory analyses	12 mth	$500	$6,000
Total Equipment			$264,500
		Total Operating Costs ($/Yr) =	**$886,520**

6.2.3 Revenue Generation

This operation has two potential sources of revenue generation, tipping fees from incoming foodwaste and product sales of the finished compost. From these two sources of income it was estimated that this operation could generate $1,252,340/yr. A summary of the potential revenue generation is shown in Table 6.3.

6.2.3.1 Tipping Fees

Tipping fees are surcharges collected by landfills for waste disposal while "processing fees" as some compost operators prefer to call them are those fees charged by composters to both collect and compost the waste material. Processing fees should generally be lower than tipping fees collected at most landfills and often contribute substantially to a composting operation's revenue and economic sustainability. These reduced fees provide incentive to waste generators to participate in composting programs. A conventional waste disposal bill is based on quantity of material handled, size of container used for disposal, number of pick-ups per week and often the distance of the waste generation facility to the landfill. Tipping fees as well as processing fees are negotiable and flexible and not all waste generators pay the same rate. An average total disposal fee (combined tipping and transportation cost) of $35/ton is standard in the south metro Atlanta area. In order to give a financial incentive to participate in the composting program, a total fee of $30/ton was assumed to be charged to the foodwaste generators. This fee included both an assumed transportation cost ($15/ton) and a process fee ($15/ton) that is paid directly to the facility. It was assumed that no revenue was generated from receiving carbonaceous feedstocks and that $15/ton associated with transportation costs was required to transport these materials. Normally, tipping fees at landfills for carbon feedstocks such as woodwaste and yard trimmings are very low. Total revenue from incoming feedstocks was estimated to be approximately $663,000/yr.

6.2.3.2 Product Sales

Approximately 59,000 cu. yd of compost will be produced annually from this compost operation. Market prices for compost depend on the quality of the material that is produced and the type of product that is being marketed. Generally, there is a strong correlation with price and product quality and whether the operation is run by a municipality or by a private business. Municipalities are often more concerned with a cost effective alternative for organic waste materials management, while private composting operations are motivated by profit through tipping fees and product sales. Revenue that is not generated in tipping fees is made in product sales, however, relying solely on product sales for revenue is generally not profitable or economically sustainable for a composting operation.

Bulk market prices for finished compost in Georgia range from \$0/cu. yd to \$50/cu. yd while bagged prices range from \$2.35 to \$7.95/bag (typically 40 lbs). Compost operators rarely enter the bagged market until the operation is fine-tuned and the product is consistently of the same high quality. Currently, only three privately owned operations in Georgia bag their product. Bagged products are generally of higher quality and cater to higher end markets such as homeowners and gardeners. While still demanding a high quality product, landscapers, nurseries, organic farmers, turf and sod growers and erosion control specialists normally buy compost in bulk and pay the next highest amount. Low-end market consumers, usually influenced by low availability of funds and large volume requirements, consist of land reclamation projects, agricultural operations and landfill covers.

For this study it was assumed that the finished compost was initially sold in bulk rather than in bagged form. It was assumed that the finished compost was of high quality and could be sold at a price of \$10/cu. yd. Although this is a low unit price for high quality foodwaste compost, a new operation is readily assured of receiving this price for compost in the competitive soils amendment market. Based on these assumptions, total product sales revenue for the finished compost was \$589,340/yr.

Table 6.3 Revenue generation summary

Revenue Generation	Tons/yr	\$/unit	Total
Tipping Fees			
Carbonaceous Materials	75,140	\$0.00	\$0
Foodwaste	44,200	\$15.00	\$663,000
	cu. yd/yr		
Product Sales	58,934	\$10	\$589,340
	Total Revenue for the Facility (\$/yr)=		**\$1,252,340**

6.2.4 Feasibility Assessment

In Table 6.4 is an overall financial evaluation of the composting operation accounting for operating costs, monthly expenses and monthly revenue. It was assumed in this evaluation that all capital costs were paid based on a 10-year loan at an interest rate of 7.00%. This time period was chosen based on the working life of the equipment. In this analysis the capital cost recovery has been separated using a cost per month basis for both land and construction and equipment. This was determined to be $28,489/mth. Total monthly operating expenses for this operation were estimated to be $73,877 and included monthly loan payments and operational costs which this operation needed to be sustainable. Based on the assumptions, the total monthly expenses for this facility were estimated to be $102,365. Taking into account both foodwaste processing fees and compost sales, total monthly revenue was estimated be $104,362. It was estimated that after the operation makes its financial obligations and expenses are paid it should generate $1,997/mth or $23,958/yr. Because of the seasonal nature of compost sales, actual monthly revenue will not be equal each month. Based on an annual processing capacity of 44,200 tons/yr, the total cost per ton to compost was estimated to be $27.79/ton of foodwaste while the total revenue generated per ton of foodwaste was $28.33/ton. This produced a profit of $0.54/ton.

Assessing the feasibility of starting a new composting operation is difficult because of the many design parameters which must be assumed. However, based on the site design, feedstock availability, financial costs and revenue generation potential, the proposal to compost 44,200 tons of foodwaste in the south metro Atlanta region appears to be feasible, although the profit margin is approximately 2%. This profit margin is extremely low for a commercial business venture. The 10 and 20-year rates of return for the initial capital investment of $2,453,611 is -29% and 3% respectively. After ten years, all original construction and equipment costs have been recovered which results in a dramatic increase in the operation's net yearly income. Regardless of the increase, an investor would realize greater returns on his money in any number of other investment vehicles.

Table 6.4 Evaluation of operation

Revenue Generation	**Units**	**Total**
Capital cost recovery (10 years)		
- Land & construction	($/mth)	($9,261)
- Equipment	($/mth)	($19,228)
		($28,489)
Operating costs	($/mth)	($73,877)
Total monthly expenses	($/mth)	($102,365)
Total monthly revenue	($/mth)	$104,362
Facility net yearly income	($/yr)	$23,958
Cost per ton to compost all materials	($/ton)	($10.29)

7. SAMPLE BUSINESS PLAN FOR COMPOSTING OPERATIONS

Business plans thoroughly describe all facets of a business operation and explain the potential impact that a business can have on investors and/or consumers. Financial institutions decide whether or not to loan capital to new startup companies based on business plans. A well-prepared business plan is crucial to the future success of a new company.

Business plans have four basic sections:1) business description, 2) management plan, 3) marketing plan and 4) a financial plan. Each section should be described and presented, within confidential limitations, in as much detail as possible. For this study, a basic business plan was prepared assuming that an independent entrepreneur was going to begin the previously described compost operation in the south metro Atlanta area. The following business plan is only an example assuming fictitious business names, personnel data and location information.

7.1 Business Description

CompostAtlanta is an organic recycling company that will begin recycling organic materials, primarily preconsumer foodwaste, yardwaste and woodwaste, from the south metro Atlanta region by composting. CompostAtlanta, a division of CompostUSA, is the 13th foodwaste composting facility owned and operated by CompostUSA across the continental United States. The Principles of CompostAtlanta have 55 years of experience in the organics recycling industry and have been evaluating the startup of a foodwaste composting operation in Atlanta for the past three years.

7.1.1 Location

CompostAtlanta will be located on a 20-acre tract of land near Hapeville in Clayton County, Georgia. This land is located south of the metro Atlanta area and Interstate 285. CompostAtlanta is strategically located near the largest metro Atlanta waste generators, compost markets and is ideal for a variety of reasons:

- transportation of materials to and from the site is timely and economical for the entire south metro Atlanta area,
- the site is located in a highly industrial area that already accommodates traffic associated with industrial operations,

- the site has much of the needed infrastructure required for this type operation such as good roads, availability of municipal utilities; electricity, water and sewage lines,
- the site has the required buffer area needed to provide both a visual barrier and for reducing the migration of odors off site.

7.1.2 Licenses and Permits

Composting of preconsumer foodwaste requires that a Solid Waste Handling Permit be obtained as dictated under the Solid Waste Management Program of the Environmental Protection Division of the Georgia Department of Natural Resources. Even though the site is located in an industrial area, the host county requires that land use ordinances be met and if necessary, CompostAtlanta will apply for the necessary licenses and zoning in order to comply with the county regulations. It is estimated that the permitting process will require 6-8 months.

7.1.3 Services and Products

CompostAtlanta will provide an economical and environmentally sound alternative to landfilling and waste disposal for the food processing, commercial, institutional and woodwaste industries. This low cost alternative will create a demand for CompostAtlanta services, thus ensuring a constant and consistent feedstock flow and source of revenue generation.

The main products sold by CompostAtlanta will be high quality compost and compost blends derived from foodwaste, woodwaste and yard trimmings. Initially, CompostAtlanta will sell compost and compost blends to the bulk market. After initial operating and marketing procedures are well established and exhibit success, CompostAtlanta will aggressively explore entering the bagged soil amendment market.

7.1.4 Environmental Impact

CompostAtlanta addresses three environmental issues:

1) establishes an environmentally friendly and economic alternative to landfilling for foodwaste and woodwaste generators
2) creates the largest outdoor organic materials recycling/composting operation in south metro Atlanta with a direct goal of reducing materials going to landfills

3) produces new products that can be used in a variety of applications including; erosion and sediment control, home gardens, agricultural, horticultural and various environmental applications.

7.2 Management Plan

In the south metro Atlanta area, waste disposal costs are approximately $30 to $35/ton. However, it is expected that waste disposal costs will increase in the future as accessibility to landfill space becomes a premium. This will require many industries to explore alternative methods of waste disposal. CompostAtlanta will provide such an alternative method of waste disposal to specific industries.

The management plan for CompostAtlanta is the key to its success. Most private composting operations rely on the sales of compost as the primary source of revenue generation. A historic lack of compost market development and proactive marketing by other composting operations has led to failures within the industry. The plan for CompostAtlanta is to generate over 50% of all revenue on the "*front end"* (tipping fees) rather than on "*back end"* (sales). CompostAtlanta will offer tipping fees below current landfill disposal costs to the food processing and wood/yardwaste industries. Reduced costs are a great incentive for companies generating these type waste materials to consider alternative waste disposal techniques such as composting. This change will not only benefit those industries by providing lower disposal costs but will generate positive public relations through pollution prevention and recycling efforts.

7.2.1 Structure

CompostAtlanta will compost approximately 44,200 tons of foodwaste and 75,140 tons of carbonaceous materials from the south metro Atlanta region once the operation has reached full capacity. CompostAtlanta will utilize these by-products and potentially others to produce a high quality product with high potential sales value. The 20-acre tract of property will be purchased and owned by CompostAtlanta. CompostAtlanta will only hire qualified and trained personnel to operate and manage the compost facility

7.2.2 Manufacturing/Production

Harnessing the natural process of decomposition within a set of specific parameters is the basis for composting systems. While this process appears to be rather simple in nature, knowledge about all aspects of this process is required in order to perform it effectively and efficiently. CompostAtlanta is a company with that knowledge.

Composting of preconsumer foodwaste requires that a proper mixture of carbonaceous materials and foodwaste be combined at the optimum moisture content, particle size and carbon/nitrogen ratio. This ensures that the correct microbiological conditions are present to facilitate the composting process. Ground woodwaste/yard trimmings will be mixed with the foodwaste collected from waste generators in the south metro Atlanta area. The woodwaste/yard trimmings will be ground to a particle size between 0.25 to 2 inches prior to being incorporated into this process. Grinding of woodwaste will initially be outsourced using an independent contractor. The ground woodwaste will be mixed with foodwaste at a volumetric ratio of 3 to 1.

It is the goal of CompostAtlanta to produce high quality compost. To do this, long windrows 8 feet tall and 20 feet wide at the base will be constructed from the mixed feedstocks. The windows will be turned or agitated using large self-propelled windrow turners to ensure proper aeration, porosity and temperature. The windows will be turned multiple times per week (2 to 3 times) during a 60-day composting period. The windrows will be managed to maintain temperatures of greater than 131F for at least 15 days to meet EPA quality guidelines. Maintaining thermophilic temperatures at this level for as long as possible ensures proper pathogen kill and product quality. After the 60-day composting period, the windrows will be allowed to cure for an additional 60 days. After curing, the compost will then be screened to remove large particles that have not been fully composted. These “overs” will be reintroduced into future windows as a beneficial inoculant of decomposer microorganisms. The screened material will remain on-site until it is sold in the bulk soil amendment market as finished compost.

7.2.3 Quality Control

The goals of CompostAtlanta are to produce the highest quality compost that meets all pertinent environmental and agricultural standards. Although the foodwaste and woodwaste/yard trimmings that CompostAtlanta will be composting on-site does not require the use of the same strict composting standards associated with biosolids composting, our policy as a company is that all compost produced must follow guidelines proposed by EPA Part 503 - The Standards for the Use or Disposal of Sewage Sludge (EPA, 1994). Compliance with these standards ensures an “Excellent Quality Class A” compost and will help ensure high quality standards for compost and soil blends sold by CompostAtlanta.

7.3 Marketing Plan

CompostAtlanta will use two parallel marketing strategies to facilitate revenue generation. The first track is to present CompostAtlanta's capabilities and services to targeted industries as an environmental waste management option that can save them money and provide positive public relations for their company. The second track, and the one that will receive the most emphasis, is the marketing and use of the finished compost. The compost and compost blends will be marketed mainly as an all-natural soil conditioner and/or soil amendment. However, market niches in water conservation and fertilizer reduction, erosion control, bioremediation and custom soil blends will be explored and capitalized.

There are two target markets for the sale of the finished products. The first market is in bulk sales to the landscape, construction, Department of Transportation (DOT), other small/medium compost manufacturers, turf grass and agriculture sectors. After the first market is well established, the second market will be the bagged market. This market will focus on wholesale distribution to the large home improvement supply and department store garden centers in the Atlanta region.

7.3.1 Quality Assurance

CompostAtlanta is a division of Compost/USA, one of the largest organic recycling companies in the United States. Compost/USA has over 55 years of experience and has a wide-spread marketing network of compost buyers in the agricultural and construction industries. Compost/USA requires that all products sold by any one of its subsidiaries be certified by The United States Composting Council's (USCC) Seal of Testing Assurance (STA) program (USCC, 2002). The STA program is a process and product reporting procedure to ensure consistent high quality compost. By complying with the guidelines of this program, a company obtains the right to use the STA seal on their products and advertising, thus making these products more appealing to customers.

7.3.2 Industry Advantage

In the south metro Atlanta region, there are very few local manufacturers of high quality compost and compost/soil blends. As a large-scale manufacturer and supplier of high quality compost, CompostAtlanta will have both a location and transportation advantage over its competitors. Hauling distances, one of the greatest obstacles to the compost industry, will be minimized because of the relative closeness of this operation to both foodwaste and wood/yardwaste generators. This is essential to the success of the operation.

7.3.3 Financial Plan

In Tables 7.1 and 7.2 are estimates of the Prospective Balance Sheet and a Statement of Projected Revenue for the CompostAtlanta based on production at full capacity. Full capacity production assumes that the operation has 477 tons/day of incoming material and produces approximately 58,934 cu. yd/yr of compost as a marketable product.

CompostAtlanta has $100,000 in cash on hand for initial startup expenses. Additional monies will be generated from tipping fees and compost sales. The disposal fee for foodwaste will be $30/ton. Fifty percent of the disposal fee will be used to pay for loading and transportation costs of foodwaste and carbon material. The remaining portion of the disposal fee will go towards capital and operating costs of composting. Bulk compost sales are estimated at $10/cu. yd.

Table 7.1 Prospective balance sheet

		Capital Outlay
Assets	Cash	$100,000
	Accounts receivable	$0
	Inventory	$0
	Prepaids	$0
	Other assets	$0
	Property, plant and equipment	$2,453,611
	Total Assets	$2,553,611
Liabilities	Accounts payable	$0
	Accrued liabilities	$0
Equity	Paid in capital	$2,553,611
	Total Liabilities and Equity	$2,553,611

Table 7.2 Statement of projected revenues and expenses (yearly)

At Full Scale Operation	**Total**
Tipping fees	
- Foodwaste	$663,000
- Wood/yardwaste	$0
Compost sales (bulk)	$589,340
Total Revenue	$1,252,340
General expenses (fuel costs)	$60,783
Salary and wage expense	$205,500
Maintenance expense	$165,600
Equipment replacement expense	$165,600
Facility insurance expense	$24,536
Contract work	$264,500
Capital recovery expense (loan repayment)	$341,862
Total Expenses	$1,228,382
Net Income	**$23,958**

8. ASSESSMENT OF POTENTIAL COMPOSTING SITES

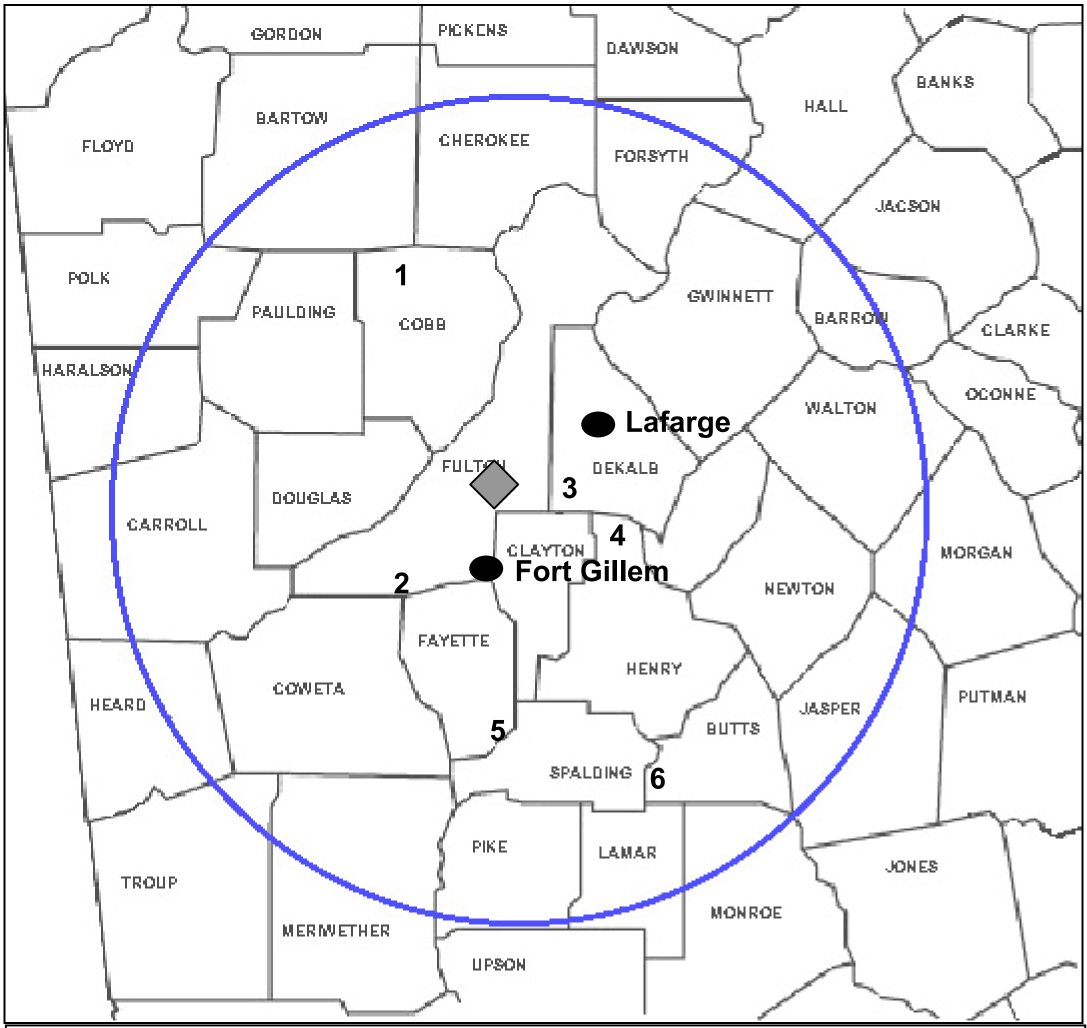
In section 6.2.1 of this report, the economic analysis for a foodwaste composting operation indicated that it would be economically viable assuming that 20 contiguous acres of land could be purchased at a cost of $20,000/acre in the south metro Atlanta area near Hapeville, Georgia. However, other options for a composting operation located in the south metro Atlanta area were explored and determined based on partnerships for "free" land from interested organizations who currently own significant amounts of land in this region. Hartsfield International Airport, Fort Gillem Military Base and Lafarge Aggregate of Lithonia were assessed as potential partners with a compost company. Hartsfield International Airport concluded that they did not have available land for a compost operation. Lafarge Aggregate indicated that they would be interested in a partnership if the compost operation utilized its granites fines (a by-product of rock quarrying), generated from collection pond dredging. Fort Gillem expressed interest in a compost operation but had concern with a private operation generating revenue on federal property. Both Lafarge Aggregate and Fort Gillem also required a business plan as the next step in the approval process. Figure 8.1 shows the two potential composting locations, Lafarge Aggregate and Fort Gillem. Fort Gillem is located in South Fulton County, near the center of the 22 county south metro Atlanta study area, while Lafarge

Aggregate is located in DeKalb County northeast of Fort Gillem. Also included in Figure 8.1 are the locations of current compost manufacturers within the 22 county study area. There are six compost manufacturers within the 22 county study area. Four of these operations use their compost for internal use, while the remaining two sites market their products.

8.1 Lafarge Aggregate, Lithonia, GA

Lafarge Aggregate of Lithonia is a granite quarrying operation that produces construction grade aggregate material. Lafarge Aggregate owns approximately 1,600 acres at the Lithonia site, located 15 miles east of Atlanta and 5 miles north of Interstate 20 in DeKalb County. The quarry has been in continuous operation at the site for over 100 years and is still currently one of the largest producers of aggregate in the Atlanta region. The Lafarge site is zoned M2 for heavy industrial use and much of the existing infrastructure needed to operate a composting facility is already on-site. A potential site for composting is located at the bottom of a granite quarry pit on land previously quarried. The site is approximately 60 acres in area with a 30 acre, 40 ft deep collection pond located in the middle. The advantage of this site is that the rock surface surrounding the pond is naturally impermeable and relatively level. Therefore, with minimum construction and leveling, the hard rock surface would be ideal for composting because it provides an adequate surface for heavy composting equipment and an impermeable surface. This would prevent vertical hydraulic flow of leachate. The smooth rock surface would also minimize the construction costs associated with the compost pad and naturally assist in storm water runoff management for the site.

As with any land partnership between two companies, there are other inherent disadvantages in the Lafarge Aggregate site. Because Lafarge Aggregate is an active quarry, their management might have some concerns with another company beginning operations in the middle of their site because of potential disruption to current quarry operations. Depending on the agreement between the two parties, the land would remain Lafarge Aggregate property and any improvements and/or changes to the compost area would need to be approved by Lafarge Aggregate management and would need to equally benefit Lafarge Aggregate.



Hapeville, Georgia **Proposed Composting Sites**

Market Product
1. Cobb County MSW Compost (Marietta)
2. Consolidated Resources Recovery (Atlanta)

Internal Use
4. East Lake Farm (Decatur)
5. TaylorOrganics (Ellenwood)
6. City of Griffin (Griffin)
6. Ga Diagnostic & Classification Prison (Jackson)

Figure 8.1 Proposed composting sites and current manufacturers in the 100 km (62 mile) radius study area around Hapeville, GA.

8.2 Fort Gillem, GA

Fort Gillem is a military installation of the United States Department of Defense. The Fort Gillem base is located on 1,700 acres and has been used to train Army Reserve units for over 50 years. Fort Gillem is located just outside of the Atlanta city limits in Fulton County approximately 0.5 miles from Interstate 675, 2 miles from Interstate 285 and 7 miles from Interstate 75. This site is attractive because of its close proximity to Atlanta, the primary foodwaste generators and the three previously mentioned interstate highways.

Fort Gillem was originally designed to be a self-sufficient military operation that required all waste management to be handled on site. The military base is interested in pollution prevention and cost reduction strategies. Fort Gillem is interested in becoming a zero waste military base and is highly interested in composting their own foodwaste and other organic wastes on-site. Foodwaste generated at Fort Gillem would have to be included if a composting operation was at this site.

Three locations were identified by the Fort Gillem Environmental Office as potential composting sites; 1) a 15 to 20 acre tract, 2) an 8 to 10 acre tract and 3) a 6 to 8 acre tract. All three sites would require significant clearing of trees and grading to be acceptable for composting.

One major disadvantage associated with locating a composting operation on this site is that Fort Gillem is an active military base. Any start-up plans and subsequent operational plans must be approved by the United States Department of Defense and can in no way disrupt or compromise the integrity or operations of the base. Fort Gillem has also expressed concerns about allowing a private company to operate a facility on federal property for the purpose of generating revenue.

8.3 Capital Costs

Both Fort Gillem military base and Lafarge Aggregate have expressed an interest in locating a third party foodwaste composting company on-site. In an effort to determine which location would be most financially feasible for such an operation, a detailed design and cost estimate were conducted for both sites. The cost estimation for both sites is included in Table 8.1. The same assumptions previously used for the Hapeville, Ga. location and listed in Section 6 of this report were used in this analysis, excluding the cost of land.

8.3.1 Lafarge Aggregate

The Lafarge Aggregate site is located in an old granite quarry pit and because of mining techniques, the potential composting area consists of a relatively level, solid granite floor. This natural impermeable surface provides a good foundation for composting and operating heavy equipment without the need for constructing concrete or liner based pads. Lafarge Aggregate has a well-maintained road system on site. This site has an existing large collection pond to collect runoff from the composting area. Water stored in this pond is currently used in part of the mining process, therefore savings would be incurred by not having to provide the system infrastructure to pump leachate water into a wastewater treatment collection system for treatment and not having to pay wastewater treatment fees. The potential compost site is 20 acres in size, which could handle the estimated 44,200 tons/yr of foodwaste and 75,140 tons/yr of carbonaceous materials. The total estimated capital cost for this facility is $1,702,782.

8.3.2 Fort Gillem

The Fort Gillem composting site is located on a section of land that is not in use. The land is primarily forested with very little infrastructure available. This would require a significant amount of land preparation and construction prior to beginning a composting operation. A 30 mm MDPE liner beneath compacted and lime stabilized clay would be required beneath the composting area. A collection pond lined with an MDPE liner would also need to be constructed on site. The potential compost site is approximately 20 acres in size. A composting operation at this location could also handle the estimated 44,200 tons/yr of foodwaste and 75,140 tons/yr of carbonaceous materials. This site would have higher initial capital costs because of the significant amount of land preparation work, construction of a collection pond, compost pad and liner installation and necessary road construction. The total estimated cost for this facility is approximately $2,041,827 .

Table 8.1 Capital cost summary for proposed composting sites

	Lafarge Aggregate Site			Fort Gillem Site		
Capital Costs	units	$/unit	Total Cost	units	$/unit	Total Cost
Land required (acres)						
Compost areas	11.3	-	-	11.3	-	-
Collection pond	-	-	-	1.2	-	-
Buffer property	-	-	-	-	-	-
Road	3	-	-	4	-	-
Total Land Required	14.3		$0	16.5		$0
Construction						
Compost pad (acres)	8.4	$3,450	$28,980	8.4	$21,177	$177,887
Curing and storage	2.9	$3,450	$10,005	2.9	$3,450	$10,005
Collection pond	-	-	-	1.2	$32,734	$39,281
Road construction (ft^2)	-	-	-	6,000	$13	$79,350
Wastewater pumping	-	-	-	1	$15,000	$15,000
20% contingency			$7,797			$64,305
Total Construction			$46,782			$385,827
Equipment						
Self propelled turner	2	$250,000	$500,000	2	$250,000	$500,000
Large wheel loader	3	$175,000	$525,000	3	$175,000	$525,000
Screener	1	$175,000	$175,000	1	$175,000	$175,000
Dump truck	3	$35,000	$105,000	3	$35,000	$105,000
Monitoring wells	6	$10,000	$60,000	6	$10,000	$60,000
Miscellaneous	1	$15,000	$15,000	1	$15,000	$15,000
20% contingency			$276,000			$276,000
Total Equipment			$1,656,000			$1,656,000
Total Capital Costs =			**$1,702,782**			**$2,041,827**

8.4 Transportation Cost Analysis

In Table 8.2 and 8.3 are the estimated transportation costs, which would be included in waste disposal fees and are based on hauling foodwaste to either the Lafarge Aggregate or Fort Gillem compost sites. Only foodwaste generated by industrial, commercial and prison sectors were considered in this analysis (maximum 29,489 tons/yr). The foodwaste generated by the school sector (14,711 tons/yr) was not included because of the small amount of foodwaste generated per school per year combined with the collection system required to handle the waste would make it financially unsustainable.

In this analysis the following assumptions were made:

1) foodwaste was collected 52 weeks per year,

2) the number of hauls per week from a generator were determined based on the yearly tonnage of foodwaste produced,

Tons Produced Per Year	Number of Hauls per Week
>200	2
200 to 300	3
300 to 500	4
>500	6

3) the transportation vehicle has a maximum haul load of 30 tons
4) the cost per mile for hauling is $3.00 ($0.10/mile/ton)
5) all hauling costs assume roundtrip costs.
6) a minimum charge of $5.00 is charged for each pickup, regardless of the amount of material collected

Transportation costs for each waste generator were then determined based on these assumptions and an overall estimated cost per ton was determined for each proposed composting site. In general, the total cost comprised of the minimum pickup charge, transportation cost and tipping fee is less than what most generators are currently paying for disposal using $35.00/ton as a baseline for waste disposal costs in the south metro Atlanta region. However, this generality is not valid when considering small waste generators such as Masada Bakery and Valetine Enterprise. In reality, a specific route including a number of generators would be arranged so that the truck would not have to make repeated hauls at below full capacity. In the majority of cases, having a nominal pickup charge in addition to the tipping fee actually makes it more cost effective for the generator and the transporter.

A weighted average cost per ton to transport waste was calculated and determined to be $5.46/ton and $2.33/ton for the Lafarge and Fort Gillem sites respectively. These values were used to determine transportation costs in Table 8.4. Transportation of carbon material was assumed to be $5.00/ton for both operations.

Table 8.2 Transportation cost analysis from waste generators to proposed Lafarge composting site

Prisons	Tons/ yr	Hauls/ week	Miles	Trans. fee ($/yr)	Tipping fee[1] ($/yr)	Total cost ($/yr)	Cost/ ton ($/ton)
Atlanta Trans.	91	2	20	$520*	$1,820	$2,340	$25.71
Clayton County	83	2	35	$581	$1,660	$2,241	$27.00
Gwinnett County	169	2	39	$1,318	$3,380	$4,698	$27.80
Metro State	256	3	15	$780*	$5,120	$5,900	$23.05
Metro Trans.	45	2	15	$520*	$900	$1,420	$31.56
Phillips State	392	4	49	$3,842	$7,840	$11,682	$29.80
Spalding County	532	6	51	$5,426	$10,640	$16,066	$30.20
West Central State	68	2	61	$830	$1,360	$2,190	$32.20
Prisons Totals	1,636			$13,817	$32,720	$46,537	
Estimated $/ton				**$8.45**	**$20.00**	**$28.45**	
Commercial							
Crowne Plaza	120	2	26	$624	$2,400	$3,024	$25.20
Four Seasons	133	2	22	$585	$2,660	$3,245	$24.40
Hilton Atlanta Towers	225	3	19	$855	$4,500	$5,355	$23.80
Swiss Hotel	600	6	28	$3,360	$12,000	$15,360	$25.60
Commercial Totals	1,078			$5,433	$21,580	$27,013	
Estimated $/ton				**$5.04**	**$20.00**	**$25.04**	
Industrial							
5 Seasons Brewery	208	3	23	$957	$4,160	$5,117	$24.60
Arden's Garden	520	6	19	$1,976	$10,400	$12,376	$23.80
Atlanta Egg & Produce	1,343	6	21	$5,641	$26,860	$32,501	$24.20
Brito Produce	729	6	21	$3,062	$14,580	$17,642	$24.20
Dogwood Brewing Co.	208	3	26	$1,082	$4,160	$5,242	$25.20
Fresh Express	8,000	6	27	$43,200	$160,000	$203,200	$25.40
Fresh Pac	260	3	21	$1,092	$5,200	$6,292	$24.20
General Mills	429	4	19	$1,630	$8,580	$10,210	$23.80
General Produce	2,300	6	21	$9,660	$46,000	$55,660	$24.20
Georgia Tomato Co.	5,357	6	21	$22,499	$107,140	$129,639	$24.20
La Chaquita	350	4	24	$1,680	$7,000	$8,680	$24.80
Los Amigos Tortilla	206	3	25	$1,030	$4,120	$5,150	$25.00
Masada Bakery	11	2	16	$520*	$220	$740	$67.27
Portion Pac	223	3	20	$892	$4,460	$5,352	$24.00
Southeast Processing	2,000	6	21	$8,400	$40,000	$48,400	$24.20
Tanimura and Antle	2,600	6	57	$29,640	$52,000	$81,640	$31.40
Taylor Farms	2,000	6	21	$8,400	$40,000	$48,400	$24.20
Valentine Enterprise	31	2	39	$520*	$620	$1,140	$36.77
Industrial Totals	26,775			$141,880	$535,500	$677,380	
Estimated $/ton				**$5.30**	**$20.00**	**$25.30**	

[1] Tipping fee based on $20.00 per ton

*Using minimum collection charge of $5.00/pickup

Example Calculations:

Atlanta Trans: [0.875 tons/haul][2 hauls/wk][52 wk/yr][40 mile/haul][$0.10/mile/ton] = *$364.00* < [$5.00 haul][2 hauls/wk][52 wk/yr] = *$520.00* (Use the greater value)

5 Seasons: [1.333 tons/haul][3 hauls/wk][52 wk/yr][46 mile/haul][$0.10/mile/ton] = $957

Table 8.3 Transportation cost analysis from waste generators to proposed Ft. Gillem composting site

Prisons	Tons/ yr	Hauls/ week	Miles	Trans. fee ($/yr)	Tipping fee[1] ($/yr)	Total Cost ($/yr)	Cost/ ton ($/ton)
Atlanta Trans.	91	2	18	$520*	$1,820	$2,340	$25.71
Clayton County	83	2	19	$520*	$1,660	$2,180	$26.27
Gwinnett County	169	2	42	$1,420	$3,380	$4,800	$28.40
Metro State	256	3	8	$780*	$5,120	$5,900	$23.05
Metro Trans.	45	2	8	$520*	$900	$1,420	$31.56
Phillips State	392	4	50	$3,920	$7,840	$11,760	$30.00
Spalding County	532	6	35	$3,724	$10,640	$14,364	$27.00
West Central State	68	2	48	$653	$1,360	$2,013	$29.60
Prisons Totals	1,636			$12,056	$32,720	$44,776	
Estimated $/ton				**$7.37**	**$20.00**	**$27.37**	
Commercial							
Crowne Plaza	120	2	8	$520*	$2,400	$2,920	$24.33
Four Seasons	133	2	18	$520*	$2,660	$3,180	$23.91
Hilton Atlanta Towers	225	3	16	$780*	$4,500	$5,280	$23.47
Swiss Hotel	600	6	24	$2,880	$12,000	$14,880	$24.80
Commercial Totals	1,078			$4,700	$21,560	$26,260	
Estimated $/ton				**$4.36**	**$20.00**	**$24.36**	
Industrial							
5 Seasons Brewery	208	3	18	$780*	$4,160	$4,940	$23.75
Arden's Garden	520	6	14	$1,560*	$10,400	$11,960	$23.00
Atlanta Egg & Produce	1,343	6	4	$1,560*	$26,860	$28,420	$21.16
Brito Produce	729	6	4	$1,560*	$14,580	$16,140	$22.14
Dogwood Brewing Co.	208	3	19	$780*	$4,160	$4,950	$23.80
Fresh Express	8,000	6	6	$9,600	$160,000	$169,600	$21.20
Fresh Pac	260	3	4	$780*	$5,200	$5,980	$23.00
General Mills	429	4	37	$3,175	$8,580	$11,755	$27.40
General Produce	2,300	6	4	$1,840	$46,000	$47,840	$20.80
Georgia Tomato Co.	5,357	6	4	$4,286	$107,140	$111,426	$20.80
La Chaquita	350	4	19	$1,330	$7,000	$8,330	$23.80
Los Amigos Tortilla	206	3	18	$780*	$4,120	$4,900	$23.79
Masada Bakery	11	2	17	$520*	$220	$740	$67.27
Portion Pac	223	3	22	$981	$4,460	$5,441	$24.40
Southeast Processing	2,000	6	4	$1,600	$40,000	$41,600	$20.80
Tanimura and Antle	2,600	6	36	$18,720	$52,000	$70,720	$27.20
Taylor Farms	2,000	6	4	$1,600	$40,000	$41,600	$20.80
Valentine Enterprise	31	2	41	$520*	$620	$1,140	$36.77
Industrial Totals	26,775			$51,982	$535,500	$587,482	
Estimated $/ton				**$1.94**	**$20.00**	**$21.94**	

[1] Tipping fee based on $20.00 per ton

*Using minimum collection charge of $5.00/pickup

8.5 Operating Costs

The operating costs (Table 8.4) between the two locations are very similar. Because both sites can process the same amount of material, the only significant difference in operating costs between the two locations comes from the initial construction cost (cost of insurance is based on initial capital costs), the transportation of foodwaste and the cost of wastewater treatment. Because of the nature of the rock surface at the Lafarge operation, the construction of a composting pad is not required while it is required at the Fort Gillem site. Using the $5.46/ton to transport 44,200 tons to Lafarge Aggregate and $2.33/ton to transport to Fort Gillem, the total cost to transport foodwaste to each site is $241,512 and $103,029, respectively. Because water from the collection pond is utilized in the general mining process, the Lafarge Aggregate site does not need to send any collected runoff to a municipality for treatment unlike the Fort Gillem site.

Table 8.4 Operating cost summary for proposed composting sites

	Lafarge Aggregate Site			**Fort Gillem Site**		
Operating Cost	Units	$/unit	Total Cost	Units	$/unit	Total Cost
Equipment						
Fuel Cost (gallon)		$1.50	$60,783		$1.50	$60,783
Maintenance & Repair	10%		$165,600	10%		$165,600
Equipment	10%		$165,600	10%		$165,600
Facility Insurance	1%		$17,028	1%		$20,418
Total Equipment			$409,011			$412,402
Personnel						
Skilled Labor	4	$15.00	$120,000	4	$15.00	$120,000
Unskilled Labor	2	$7.50	$30,000	2	$7.50	$30,000
Personnel Benefits	37%		$55,500	37%		$55,500
Total Personnel			$205,500			$205,500
Contract Work						
Transport Food (tons)	44,200	$5.46	$241,512	44,200	$2.33	$103,029
Transport Carbon (tons)	75,140	$5.00	$159,675	75,140	$5.00	$159,675
Carbon Grinding (hrs)	530	$250	$132,500	530	$250	$132,500
Water Treatment	-	-	-	12	$10,500	$126,000
Lab Analyses	12	$500	$6,000	12	$500	$6,000
Total Equipment			$539,687			$527,204
Total Operating Costs ($/yr) =			**$1,154,198**			**$1,145,106**

8.6 Revenue Generation

The average disposal fee for foodwaste in the Atlanta region used in this report is $35.00/ton. In order to provide an economic incentive for companies to switch disposal options from landfilling to composting, a tipping fee of $20.00/ton was used plus the transportation fee that includes the minimum pickup charge. Because of the high moisture content of foodwaste (75-90%), a 75% reduction in overall volume is expected. The amount of finished compost available for sale is directly related to this assumption. Although high quality compost can sell for up to $50.00/cu. yd, a moderate $10.00/cu. yd (Shown in Table 8.5) is used to help ensure a conservative estimate and financially successful operation. Both sites may receive a nominal tip fee for receiving carbonaceous feedstocks but that has not been included in this analysis.

Table 8.5 Revenue generation summary for proposed composting sites

	Lafarge Site			**Fort Gillem Site**		
Revenue	Tons/yr	$/unit	Total	Tons/yr	$/unit	Total
Tipping Fees						
Carbonaceous	75,140	-	-	75,140	-	-
Foodwaste	44,200	$20.00	$884,000	44,200	$20.00	$884,000
	cu. yd/yr					
Product Sales	58,934	$10.00	$589,340	58,934	$10.00	$589,340
Total Revenue for Facility ($/yr) =			**$1,473,340**			**$1,473,340**

8.7 Assessment

Based on the design assumptions associated with each of these two hypothetical operations and because of the natural and existing infrastructure available, the Lafarge Aggregate location appears to be the financially stronger of the two sites to begin a foodwaste composting operation (See Table 8.6). Although Fort Gillem has a much lower transportation cost, it loses this financial advantage because of potential wastewater costs. It is recognized that the wastewater charges are rather conservative and on-site management strategies may be able to reduce this value even further. Even though the Lafarge Aggregate operation's cost per ton is only $0.32 lower than Fort Gillem's, Lafarge Aggregate's net yearly income is $38,147 more. Lafarge's 10-year rate of return is -11% compared to Fort Gillem's rate of -21%. The 20-year return for both Lafarge and Fort Gillem increases to 7% and 4% respectively. Although Fort

Gillem may initially seem like a better location because of its close proximity to the foodwaste generators, the capital cost associated with building the required composting infrastructure and the ongoing costs of potential wastewater treatment made this site less desirable than the Lafarge Aggregate location.

Table 8.6 Financial evaluation for proposed composting sites

Revenue Generation	Units	Lafarge Site	Fort Gillem Site
Capital cost recovery			
- Land & construction	($/mth)	($543)	($4,480)
- Equipment	($/mth)	($19,228)	($19,228)
		($19,771)	($23,707)
Operating costs	($/mth)	($96,183)	($95,425)
Total monthly expenses	($/mth)	($115,954)	($119,133)
Total monthly revenue	($/mth)	$122,778	$122,778
Facility net yearly income	($/yr)	$81,893	$43,746
Cost/ton to compost all materials	($/ton)	($11.66)	($11.98)

9. LETTERS OF INTENT

Letters of intent were acquired from foodwaste generating companies that expressed interest in participating in the project and agreed to submit such a letter. Compost product buyers would not agree to buying any compost or compost product without being able to see it first, thus letters were not acquired from these companies. Letters of intent can be found in Appendix G.

10. CONCLUSIONS

The establishment of a large-scale commercial foodwaste composting operation, given the parameters used in this study, in the south metro Atlanta region is an economically viable alternative in waste management and solid waste reduction for specific industries in this area of the state. Of the foodwaste generating industries surveyed, nearly all expressed interest in participating in such a program and thought it was a good idea for the state of Georgia. Eight companies submitted letters of intent to participate in a future composting program. Based on the quantity of waste generated, the number of interested waste generators, the availability of land, the capital and operational costs incurred, and the potential revenue generated by tipping fees and product sales, a commercial composting company has the components needed to start and maintain an economically sustainable operation.

A total of 44,200 tons of foodwaste per year are available as feedstock for a composting operation in the south metro Atlanta area. This includes 18 industrial food processors, 4 hotels, 8 correctional facilities, and public and private schools in 22 metro Atlanta counties. The industrial sector represents 26,775 tons or 60.6% of the total, hotels represent 1,078 tons or 2.4%, schools represent 14,711 tons or 33.3% and prisons 1636 tons or 3.7%.

A closer look at the industrial sector finds 13,989 tons/yr or 52.2% of the foodwaste in that sector is generated at the State Farmers Market. Likewise, 72% of all the foodwaste generated in the schools can be found in Clayton, Cobb, Gwinnett, Fulton, and Dekalb counties. No meat or meat byproducts were included in the study because they are mostly rendered at a cost to the waste generator lower than potential composters could provide.

Georgia currently has 38 compost manufacturers that process over 550,000 tons/yr of organic waste, but only 13 operations handle the 28,206 tons/yr of foodwaste that is being composted. Of the 13 operations, 11 are institutions (8 prisons and 3 schools), and two are private facilities; including an organic farm and a small compost operator. Only one of these foodwaste composting operations markets the finished compost. The other twelve use the compost internally. Of the 38 compost manufacturers in the state, only 18 distribute or market their finished product.

A total of 34 compost product venders were identified as supplying/marketing compost products in the south metro Atlanta area. Eighteen of these vendors buy wholesale from manufacturers in the state for retail sales. The remaining 16 vendors manufacture their compost, however, four of these operations give it away for free. Municipalities run these four operations.

Compost is typically sold in bulk by the cubic yard (about 1000 lbs.) or in 38-50 lb bags (a cubic foot). Bulk prices range from free to $50.00/cu. yd and bags range from $2.35 to $7.95/bag. Prices are influenced by availability, quality, feedstock, and if it was produced by a private or public operation. It should be noted, the operation that receives $50.00/cu. yd is the state’s only commercial foodwaste compost manufacturer.

If the potential commercial composting operation were to handle all of the foodwaste generated in the study area it would require 20 acres. This is based on using the windrow method. This includes 8.4 acres for active composting, 2.1 acres for curing, 0.8 acres for storage and product marketing, and a 1.5 acre pond (Appendix F). Assuming the land is provided at no cost, the operation would require $2,053,611 in capital investment (construction, equipment) or $2,453,611 with land purchase. Operational expenses (equipment, fuel, personnel, contract services) for the potential facility would cost $886,520/yr or $10.29 per processed ton of material (foodwaste and carbon). At full scale, this operation could gross up to $1,252,340/yr (combined tipping fees and product sales) and net $23,958/yr, while providing 6 new jobs in the state of Georgia.

The success of this operation and the amount of revenue it can generate hinges on the tipping and transportation fees as well as the price that can be negotiated for the final product. While no waste generating company would enter into disposal cost negotiations without speaking with the potential composting company, it is recommended that the potential company place greater emphasis on generating revenue from disposal fees rather than product sales. A tipping fee of $20-25/ton is recommended, however this may increase or decrease based on quantity of material, distance to facility, and willingness of the waste generator. It is recommended that the potential operation only enter into bulk sales during the first 1-2 years of operation. Bagged markets require greater product consistency and capital investment, both of which can be difficult in the initial stages of operation. Likewise, no compost vendor or buyer would agree to buy the compost before seeing what the product looked like (e.g. quality). It is recommended that the compost operation sell the compost for not less than $10.00/cu. yd once the product is available.

Two sites have been identified as potential composting venues for the South Atlanta region; Lafarge Aggregate of Lithonia and Fort Gillem military base of the US Department of Defense. At Fort Gillem, total acreage was difficult to interpret because of the amount of site preparation required and density of forest cover. Both locations had sites that could handle the total quantity of foodwaste identified. While both Lafarge Aggregate and Fort Gillem have expressed interest in participating and partnering with a compost company, both required a detailed business plan and presentation from the potential compost company as a next step towards approval. Fort Gillem noted that the potential company must handle all of Fort Gillem's foodwaste in return for land use and they would not supply any capital start up funds. They also noted that there may be legal issues locating any operation, that would generate a profit, on federal property. Lafarge Aggregate noted that the potential company must incorporate their granite pond fines, a byproduct of granite quarrying, in return for land use. Lafarge Aggregate also noted that they might assist in land preparation if the potential composter can handle a large percentage of their granite fines.

A detailed design was created for the two potential composting sites using the amount of available land as the basis for how much foodwaste each site could compost. Lafarge Aggregate has 20 usable acres that would be able to process approximately 44,200 tons of foodwaste. The Fort Gillem site also has about 20 acres that could be used to compost the same amount of foodwaste. Due to the nature of the Lafarge Aggregate site, a collection pond and a liner based composting pad is not needed, thus significantly reducing the initial capital costs for this site. Total capital costs for Lafarge Aggregate and Fort Gillem are $1,702,782 and $2,041,827, respectively. Because Fort Gillem is only four miles away from the State Farmers Market, the largest concentration of foodwaste generators in the study area, it has much lower transportation costs. Although costs for wastewater treatment are higher for Fort Gillem, the operational cost of $1,145,106/yr for this site is slightly lower when compared to the Lafarge Aggregate site at $1,154,198/yr. Revenue generation would be the same for both sites. Although each location has its particular strengths, the Lafarge Aggregate site appears to be the most financially sound of the two sites to start a foodwaste composting operation.

11. RECOMMENDATIONS & FUTURE NEEDS

Based on the interest level from foodwaste generators and the capital and operational cost estimates to run a commercial foodwaste composting operation, such an endeavor appears to be economically feasible and sustainable. Some recommendations that may benefit this potential operation and similar endeavors are outlined below.

1) While quantifying and characterizing foodwaste from the industrial sector is not difficult; it can be extremely difficult in the commercial sector. Detailed foodwaste and/or organic waste audits for the commercial sector may yield more precise information in this area.

2) Source separation is always a critical need for a composting operation. For some food processors this is already being done as a function of their processing. For commercial and institutional establishments, simple training may be all that is required, however each establishment needs to do a cost analysis to see if financial savings in waste disposal fees offsets extra equipment or labor cost.
3) A survey that includes all organic wastes, not just foodwaste, generated around the south metro Atlanta region could prove to be more profitable and feasible for inclusion in a large commercial composting operation. The metro Atlanta area produces large volumes of biosolids, woodwaste, scrap drywall, and animal manure (mostly from horse stables) that could be located, mapped, quantified, and characterized as potential feedstocks for a commercial composting operation. The composting operation may find some of these sources to be easier or more cost effective to include in their program.
4) The potential locations identified to establish a commercial composting operation need a formal business plan from the potential composting company. While there is significant interest from both Fort Gillem and Lafarge Aggregate, both require a formal business plan and presentation by the interested company before they can move further on any proposal to compost foodwaste.
5) While it is currently economically feasible to partner with large food processors in a commercial composting operation, it is not for smaller generators of foodwaste characteristic of the commercial and institutional sectors assuming landfill tipping fees stay constant. It may be more feasible to have central foodwaste or organic waste containers that several commercial and/or institutional establishments can utilize. This would only be feasible if it meant an overall reduction in their waste disposal bill.
6) The acquisition of a foodwaste collection truck through state funds can make collection and transportation costs more economically feasible for small and medium foodwaste generators. A commercial foodwaste composting operation in North Carolina was awarded state funds through the Division of Pollution Prevention and Environmental Assistance to acquire a foodwaste collection truck and has since expanded its operation to three trucks. These small collection trucks make it more feasible and cost effective to move around in the city where there are many small sources of foodwaste. Rendering operations in Atlanta have begun to experiment with this type of collection system as well.

7) If “free” use of land is not an option, then the feasibility of this hypothetical facility is in question as was shown by the negative rate of return on investment. This is because of the high cost of land, its availability in continuous tract for industrial use and the ability to get the tract of land adequately zoned and permitted. It is recommended that a survey be conducted to locate further potential partnerships for the use of land for commercial composting. It was beyond the scope of this study to research real estate prices in the south metro Atlanta region yet doing so may yield new opportunities for a potential facility.
8) Demonstration sites that encourage and provide education on the uses of compost to stimulate market demand are needed. Compost has many uses and benefits that can be demonstrated in an urban area. For example, erosion and sediment control demonstration sites utilizing compost have the potential to create a demand larger than the industry can currently supply. Creating and sustaining a real market demand for compost and compost products is critical for the growth and sustainability of this potential operation and for the industry as a whole.

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13. APPENDIX A: INDUSTRIAL & COMMERCIAL FOODWASTE GENERATORS

Table 13.1 Industrial & commercial sector foodwaste generators

Company Name	Quantity of Wastes (tons/yr)	Size of Dumpster (cu. yd)	Approximate Disposal Costs ($/yr)
Institutional Sector			
5 seasons Brewery	208	8	$7,280
Arden's Garden	520	8	$11,960
Atlanta Egg & Produce*	1,343	30	$47,005
Brito Produce*	729	20	$25,515
Dogwood Brewery	208		$0
Fresh Express	8,000	80	$196,000
Fresh Pac*	260	8	$9,100
General Mills	429	40	$15,015
General Produce*	2,300	30	$80,500
Georgia Tomato Co.*	5,357	12	$187,495
La Chaquita	350	8	$12,250
Los Amigos Tortilla	206	8	$7,210
Masada Bakery	11	6	$385
Portion Pac	223	20	$7,805
Southeast Processing*	2,000	40	$70,000
Tarimura & Antle	2,600	40	$91,000
Taylor Farms*	2,000	60	$70,000
Valentine Enterprises Inc.	31	20	$1,085
Totals	**26,775**		**$839,605**
Commercial Sector			
Crown Plaza Hotel	120	20	$4,200
Four Seasons Hotel	133	20	$4,655
Hilton-Atlanta Towers	225	40	$7,875
Swiss Hotel	600		$18,000
Totals	**1,078**		**$34,730**
Institutional Sector			
Schools	14,711		
Prisons	1,636		
Totals	**16,347**		**$57,260**
All Category Total	**44,200**		**$931,595**

* Represents Industries located at State Farmers Market

14. APPENDIX B: SCHOOL FOODWASTE GENERATED BY COUNTY

Table 14.1 School foodwaste generated by county

County	Number of Students	Foodwaste* (tons/yr)

(1999-2000)		
Public Schools		
Barrow	8,042	181
Butts	3,202	72
Cherokee	24,737	557
Clayton	44,622	1004
Cobb	93,169	2096
Coweta	15,777	355
Dekalb	92,951	2091
Douglas	16,703	376
Fayette	19,012	428
Forsyth	15,644	352
Fulton	65,602	1476
Gwinnett	104,203	2345
Henry	21,748	489
Jasper	1,905	43
Lamar	2,595	58
Morgan	2,914	66
Newton	10,523	237
Paulding	15,059	339
Pike	2,557	58
Rockdale	13,412	302
Spalding	10,314	232
Walton	9,042	203
	593,733	13,359
Private Schools	60,089**	1,352
	653,822	**14,711**

* Each student produces 0.25 pounds of foodwaste per day
** Assumes 70% of statewide enrollment of private school students

15. APPENDIX C: FOODWASTE GENERATED BY PRISONS

Table 15.1 Foodwaste generated by prisons

Prison	Inmates	Tons/yr foodwaste*
Atlanta Transitional Ctr(M)	242	91
Clayton County Prison	221	83
Gwinnett County Prison	450	169
Metro State Prison	683	256
Metro Transitional Ctr(F)	120	45
Philips State Prison	1,044	392
West Central State Prison	181	68
Spalding County Prison	1,417	532
Totals	4,358	1,636
Average per prison	545	204

* Avg foodwaste per inmate 0.37 tons/year

16. APPENDIX D: GEORGIA COMPOST BUYERS AND SUPPLIERS

Table 16.1 Georgia compost buyers and suppliers

				Price of compost				
				Bought		Sold		
Name	Type	City	Quantity (cu. yd)	cu. yd	cu. ft	cu. yd	cu. ft	Composted Material
AAA Topsoil & Landscape Material	Landscaper	Doraville	600	$8.00				
Bailey, Harold E. Landscape	Landscaper	Atlanta	1000	$10.00				Biosolids
Atlanta Landscape Materials	Landscape Supply	Doraville	600	Prop.*		$26.00		Biosolids
Georgia Ground Cover Inc.	Landscape Supply	Bogart	2000	Prop.*		$17.00		Manure
Home Depot	Landscape Supply	Marietta	780		Prop.*		$4.00	Mushroom
Master Nursery Landscape Supply	Landscape Supply	Covington	250	Prop.*		$29.00		
McGinnis Farms	Landscape Supply	Alpharetta	333				$4.25	Mushroom
Bannister Creek Nursery	Nursery	Duluth			$3.75		$5.00	
Green Brothers Earth Works	Nursery	Alpharetta		$18.00		$21.00		
Green Plant Market	Nursery	Senoia			Prop.*			Manure
Habersham Gardens	Nursery	Atlanta			Prop.*		$7.95	Manure
Land Arts	Nursery	Monroe			Prop.*		$7.00	Forest Byproducts
Lost Mountain Nursery	Nursery	Dallas			Prop.*		$2.75	Forest Byproducts
Saul Nursery	Nursery	Atlanta			Prop.*		$5.00	Poultry Litter
Seven Nursery Products Inc.	Nursery	Barnesville	150	$18.00		$32.00		Biosolids
Southern Gardens Nursery	Nursery	Alma	25	Prop.*		$40.00	$3.99	Manure
Transplant Nursery	Nursery	Livonia	1925	$11.00				Pine Bark
Walker Nursery Farms	Nursery	Jonesboro			Prop.*		$3.25	Yardwaste
City of Athens/Clarke County	Municipal Composter	Athens				$10.00		Biosolids
City of Brunswick	Municipal Composter	Brunswick				$1.00		Biosolids
City of Douglas	Municipal Composter	Douglas				Free		Biosolids
Crisp County	Municipal Composter	Cordele				Free		Tobacco waste
Cobb Co. MSW Compost	Municipal Composter	Marietta				$4.00		MSW
Appalachian Organics	Private Composter	Ball Ground				$24.00	$3.00	Poultry Litter
Bricko Organic Farm	Private Composter	Augusta				$35.00		Cow Manure
Creative Earth	Private Composter	Athens				$50.00		Foodwaste
Consolidated Resource Recover	Private Composter	College Park				$10.00		Yardwaste
Hutchins Farm	Private Composter	Summerville				$20.00		Cotton Gin Trash
Erth Food Products	Private Composter	Plains				$18.00	$2.35	Biosolids
Lula Farms	Private Composter	Lula				$25.00		Poultry litter
Poultry Gold	Private Composter	Lula				$25.00		Hen manure
OMI	Private Composter	Hinesville				Free		Yardwaste
			Average	**$13.00**	**$3.75**	**$21.90**	**$4.41**	

Prop* Represents proprietary information

17. APPENDIX E: INTERNAL USE OF COMPOST PRODUCTS

Table 17.1 Compost manufacturers in Georgia that use their products internally within their operations

Georgia Composting Operations	Feedstock Type	City	Contact	Phone
Institutional				
Dooly State Prisons	Foodwaste	Unadilla	Officer Greene	(478) 627-2000
GA Diagnostic Prison	Foodwaste	Jackson	Glenn Suggs	(770) 504-2162
Lee State Prison	Foodwaste	Leesburg	Officer Lane	(229) 759-6453
Phillips State Prison	Foodwaste	Buford	Ginger Alley	(770) 932-4706
Rogers State Prison	Foodwaste	Reidsville	Kelly Murray	(912) 557-7771
Telfair Prison	Foodwaste	Helena	Mark Ferris	(229) 868-3248
Walker State Prison	Foodwaste	Rock Springs	Dale Herndon	(706) 764-3600
Washington State Prison	Foodwaste	Davisboro	Debbie Molton	(478) 348-2246
Schools				
Piedmont Academy	Foodwaste	Monticello	Jean Walters	(706) 468-6479
University of Georgia	Yardwaste	Athens	Brett Fowler	(706) 542-7546
Washington Park Alt. School	Foodwaste	Monticello	Jean Walters	(706) 468-6479
Washington Park Middle School	Foodwaste	Monticello	Jean Walters	(706) 468-6479
Municipal				
City of Manchester	Biosolids	Manchester	Ralph Pierson	(706) 846-8701
City of Griffin	Yardwaste	Griffin	Robby Dean	(770) 228-0430
City of Pelham	Yardwaste	Pelham	Marty Taylor	(229) 294-6015
Private				
Gromor Organics	Ag Waste	Cool Springs	Peter Germishuizen	(229) 392-1191
Chastain Horse Park	Manure	Atlanta	Amy Lance	(404) 252-4244
East Lake Farm	Foodwaste	Decatur	Ryan Cohen	(404) 819-2122
Rayonier	Industrial	Jesup	Gerald DeWitt	(912) 427-5280
TaylorOrganics Farm	Yardwaste	Ellenwood	Neil Taylor	(770) 981-0827

18. APPENDIX F: DESIGN OF PROPOSED COMPOSTING OPERATION

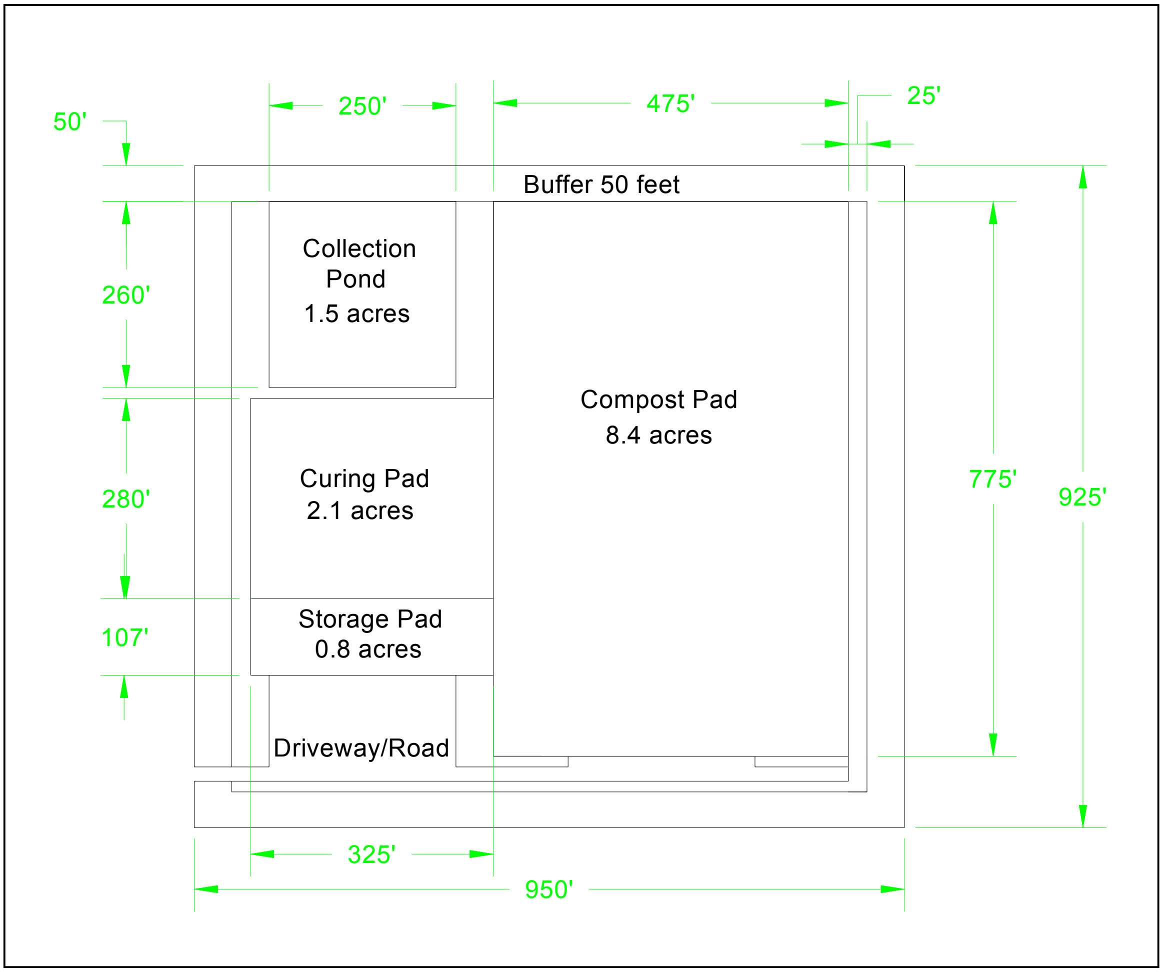

Figure 18.1 Design of proposed composting operation to compost 44,200 tons of foodwaste quantified by study.

19. APPENDIX G: LETTERS OF INTENT

BRITO PRODUCE

BRITO PRODUCE INC.
State Farmers Market
16 Forest Parkway Building C 11-19
Forest Park, GA 30297
Phone: (404) 366-8459
Fax: (404) 361-0732
WWW.ENESPANOL.COM/BRITO.PRODUCE

May 10, 2002

University of Georgia
Attn.: Mr. Javier Sayago
DRIFTMIER Engineering Center
Athens, GA 30602

Ref.: Waste Project

We want to state the University of Georgia was visiting us through Mr. Sayago about a project on food waste.

Should this project represent some saving to our company, we are willing to participate.

Cordially,

Humberto Soza
Admin. Manager

DOGWOOD
BREWING CO.

University of Georgia
Driftmier Engineering Center
Athens, GA 30302

Dear Sir or Madam,

Recently we had a meeting with Javier Sayago, Britt Faucette, and Bryan Graffagnini. In this meeting they offered interesting options for Dogwood Brewing Company to efficiently and conscientiously handle our brewing by-products. If this project moves forward we would be interested in pursuing this option.

Sincerely,

Crawford Moran
President

1222 Logan Circle, N.W. Atlanta, GA 30318 ph:(404) 367-0500 fax:(404) 367-0505

GENERAL MILLS OPERATIONS, INC.
Covington Facility
15200 Industrial Park Blvd. NE
Covington, GA 30014

Mr. Javier Sayago
University of Georgia
Driftmier Engineering Center
Athens, GA
30602

Dear Mr Sayago;

General Mills is pleased to be considered in your program for waste minimization and reclamation. As a manufacturer of dry, ready-to-eat breakfast and snack food products in Covington, we are always looking for economical and environmentally responsible methods of managing our production-derived waste materials. Your program of centralizing a food waste composting plant is very appealing to us here. We are anticipating more details about the facility so that we can identify our materials that are appropriate for your project.

Please continue to communicate the plans and details of this significant project. You may reach me at (770) 784-2554,or by FAX (770) 784-2563. My e-mail address is sam.mason@genmills.com.

Thanks,
Sam Mason
Sam Mason
Environmental Engineer

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Los Amigos
Tortilla Mfg., Inc.

www.LOSAMIGOS.com

251 Armour Drive, N.E.
Atlanta, Georgia 30324
U.S.A.

Phone (404) 876-8153
1-800-969-TACO (8226)
Fax (404) 876-8102

05-13-02

University of Georgia
Engineering Outreach Service
Athens, GA 30602
Attn: Javier Sayago

Javier:

It was a pleasure meeting your associates and discussing your future composting project. Our company would certainly be interested in such a project, should you decide to go forth. We believe that the potential savings in waste removal fees, along with the good that this will do for the environment, certainly warrants such a project.

Please keep us advised as to how the project is moving along.

Best regards,

Tom Gibb
Operations Manager

May 29, 2002

Dan Garner
Plant Manager
Masada Bakery
252 Rio Circle
Decatur, GA 30030

Javier Sayago

Mr. Sayago,

We at Masada would be interested in a program that would allow us to dispose of our food waste at a reduced cost. I appreciate your taking the time to talk to us. Please let me know when you have more information.

Sincerely,

Dan Garner

Suzanna's Kitchen, Inc.

4025 BUFORD HIGHWAY • DULUTH, GEORGIA 30096
770/476-9900 • 1-800-241-2455
FAX 770-476-8899

Engineering Outreach Service
University of Georgia
Driftmier Engineering Center
Athens, GA 30602-4435

April 16, 2002

Javier Sayago,

I would like to thank you and the others from the University of Georgia who visited our facility recently and discussed the viability of a compost project. We are a small business and for us it would mean a considerable saving. We now pay to have our products picked up and hauled to land fills or to Alabama for land application because there is no place here in Georgia to do this. We would be very interested in participating in a project that would be a win win situation. It saves our company money and is better for the environment. We would appreciate and be willing to help and support anyway you think we could. Good luck on you project, and keep me posted on its status.

Sincerely,

J. A. Adams

Judith Adams
Operations Manager

Something tasty is always cooking at Suzanna's.

TANIMURA & ANTLE SOUTHEAST
Riverview Business Park • 148 Riverview Park
Jackson, GA 30233
(770) 504-7100 • FAX (770) 504-7101

April 16, 2002

Mr. Javier Sayago
Outreach Chemist
University of Georgia
Driftmier Engineering Center
Athens, GA 30602-4435

Dear Javier:

Thank you for taking your time to visit our facility and to review the Composting Project you and your team are working on.

The purpose of this letter is to confirm our support of composting in general, and, if the project produces a cost reduction in the disposal of our vegetable waste, that we certainly would be most interested in participating in this project.

Please keep me advised as to the progress of the project.

Sincerely,

Bart Good

Barton E. Good
General Manager

VALENTINE
ENTERPRISES, INC.

To Whom It May Concern:

On March 25, 2002, The University of Georgia visited Valentine Enterprises, Inc. in reference to food waste. Javier Sayago, Bryan Graffagnini and L. Britt Faucette met with Lisa Jones to discuss the possibility of VEI supplying some of its product food waste to be used for agricultural purposes. Supplied with this letter is a sample of material taken from line production. This sample is a composite of all waste on the production line for one week.

Thank you very much for taking the time to meet with us here at Valentine Enterprises, Inc.

Sincerely,

Casey Duffield
Quality Control Manager

940 Collins Hill Road / Lawrenceville, Georgia 30043 / (770) 995-0661 / FAX: (770) 995-0725