

**PINELLAS COUNTY, FLORIDA
INNOVATIVE GRANT PROJECT REPORT**



AN ADVANCED WASTE COMPOSITION MODEL

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WasteCalc: AN ADVANCED WASTE COMPOSITION MODEL

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SECTION 1.0 INTRODUCTION

1.1 Background

Pinellas County (Pinellas) conducted this project to develop an advanced waste composition model capable of characterizing Florida's county municipal solid waste (MSW) streams, including the 18 material categories identified by the Florida Department of Environmental Protection (DEP). The project was funded by DEP's 1999-2000 Innovative Recycling Grant Program.

To complete the project, Pinellas assembled a team of experts in the field of waste composition methodology. The Pinellas Project Team included Franklin Associates and Kessler Consulting, Inc., (KCI). Franklin Associates, which developed the model, has spearheaded the development of material flow methodology for the past two decades to characterize national, state, and municipal waste streams. The staff at KCI, which conducted field sampling studies and helped manage the project, has extensive experience with conducting waste composition studies, having conducted more than 22 studies in Florida. In addition, the Project Team enlisted the participation of Highlands, Indian River, and Levy Counties to serve as waste sorting sites and to partially fund waste composition studies for the project.

1.2 Purpose

Pinellas conducted this project to develop a user-friendly, computer-based model that would enable Florida's counties to efficiently update MSW composition data annually. The model would supplement periodic field sampling studies or reduce the necessary frequency of such studies. *WasteCalc*, the resulting model, has accomplished the project's purpose and should produce substantial public benefits.

Accurate and up-to-date MSW composition data is essential for sound solid waste management planning, including recycling program development. A county cannot effectively plan its recycling program or accurately track its recovery rates without understanding the quantities of recyclable materials generated. Therefore, DEP requires each county to report its percent composition of collected (generated) MSW each year.

WasteCalc is intended to assist counties in estimating these generation rates and in preparing their annual solid waste report to the state. Waste composition sampling studies are costly, especially when numerous material categories, various generator types, and multi-season sorts are included. Therefore, it is only feasible for counties to conduct such studies periodically. *WasteCalc* provides a cost-effective way to estimate MSW composition when sampling studies are not feasible, and also allows counties to compare sampling study results with the model's estimates. To use the model, Florida's county solid waste managers and planners need only enter county-specific information into the model's interactive format.

1.3 Innovation

This project is innovative because of its use of advanced technology, simplicity of technology transfer, regional benefits, and cost-effectiveness. The project is one of the "Targeted Projects" specified by DEP in the criteria for the 1999-2000 Innovative Recycling Grants Program. As requested by DEP, the project is designed to develop "...a waste composition model that would be useable by all Florida counties . . . to characterize their waste stream without conducting costly individual waste composition studies."

In addition, the results of this project should facilitate greater recovery of not only materials targeted by the 1999-2000 Innovative Recycling Grants Program, but also every material targeted for recycling by DEP in the state's MSW and C&D waste streams. That is, *WasteCalc* was designed to characterize county waste streams according to the 18 material categories DEP requires for the Solid Waste Recycling and Education Grant reports. The model will allow planners to identify unrecovered materials by type, adjust recovery objectives accordingly, and maximize the effectiveness of recycling and waste reduction programs.

Despite the well-documented need for accurate waste composition data, budget constraints often limit counties' access to current, reliable information. A survey conducted by DEP prior to initiation of this project indicated that all but 8 of Florida's 67 counties were operating with MSW composition data that is four or more years old. While national waste composition data and waste characterization work in other states are widely available, their applicability to Florida's waste stream is limited by several important factors. For example, Florida's long growing season produces larger quantities of yard waste than other areas of the country, and its mild climate lends itself to a longer construction season and therefore greater quantities of construction materials. Florida's rapid population growth, tourist industry, and seasonal population also affect the content and quantity of the state's waste stream.

For decades, solid waste planners and managers have searched for a mechanism to estimate MSW composition when sampling studies are not feasible. One of the most promising developments has been pioneering work with computer-based econometric models that can provide reasonably accurate characterization of local waste streams without the expense of sampling studies. In general terms, these models relate information about a community's significant demographic and economic features to waste generation characteristics. To develop the model for this project, the Project Team utilized a methodology, initially formulated by Franklin Associates, and adapted it for use by Florida's 67 counties.

WasteCalc relies on the most advanced technology available, and is more user-friendly than the methodologies that have previously been tested in other states and local jurisdictions. The model incorporates the latest MSW research conducted for the U.S. Environmental Protection Agency (EPA) along with the most recent data available in the State of Florida to provide results that can be regularly updated. The model, one of the first of its kind in the country, was not previously available in Florida, which defines it as innovative according to DEP's Innovative Recycling Grant Program criteria.

WasteCalc also represents an ideal prototype for technology transfer. The project developed a model that is applicable to every county in the state. It was adapted using data from Pinellas and eleven other counties with a representative range of demographic, economic, and climatic features. The model has been provided to DEP in a form suitable for publication on DEP's website and will, therefore, be available for use by all Florida counties at no cost. Because of this, the project represents one of the most widely applicable and easily transferred technologies funded through the Innovative Recycling Grants Program.

Another element that contributes to the project's innovativeness is its multi-county participation and focus. Four counties participated by serving as waste sorting sites and partially funding waste composition studies for the project. Other counties contributed results of recently completed waste composition studies. In addition, the project was a cooperative effort between two Innovative Grant projects that generated and shared a common data pool for the benefit of both projects.

1.4 Intended Audience

All Florida counties will have the ability to take advantage of the model developed through this project to characterize their waste streams. *WasteCalc* is being submitted to DEP in the form of a web page suitable for publication on DEP's website that will provide the interactive model format. The user-friendly web page will allow Florida counties to have regular access to the model.

To facilitate technology transfer to the intended audience, Pinellas sent press releases to several Florida and national publications, copies of which are provided in Appendix D. The press releases described the project and indicated where the model could be found and the estimated date the model would be available. Plans are also in development to present the results of the project through a journal article and at an appropriate upcoming forum.

1.5 Acknowledgments

Pinellas County would like to extend thanks to all those who assisted with this project. In particular, Pinellas thanks Highlands County, Indian River County, and Levy County, who participated in and helped fund field sampling studies in their counties. We also thank those counties that contributed recently completed waste composition sampling study data: Alachua, Hendry, Lee, Marion, Monroe, and Sumter Counties. In addition, Charlotte County's project team deserves thanks for its cooperation with developing a common data pool for both project teams. Lastly, Pinellas County would like to especially thank our Project Team, Kessler Consulting, Inc., and Franklin Associates, for their assistance with the waste composition sampling studies and model development.

**SECTION 2.0
IMPLEMENTATION**

2.1 Equipment and Services

To implement the project, collect necessary data, and develop the advanced model, appropriate expertise was required. Therefore, Pinellas developed a Project Team that included KCI and Franklin Associates, as a subcontractor through KCI. Table 2.1, *Purchase and Utilization of Services*, summarizes the services provided by each. Most of these services were funded through the grant; however, Pinellas County budgeted \$30,000 for waste sampling studies and model development. Also, the four participating counties contributed approximately \$90,000 of various in-kind services.

| TABLE 2.1 PURCHASE AND UTILIZATION OF SERVICES | |
|--|--|
| <i>Service</i> | <i>Utilization</i> |
| Kessler Consulting, Inc. - consulting services | Project management and coordination |
| | Performance of waste composition field sampling studies and C&D visual audits |
| | Compilation, review, and analysis of existing waste composition studies |
| | Waste composition data analysis |
| | Web page finalization |
| | Report preparation |
| Franklin Associates, Ltd. - consulting services as subcontractor through KCI | Collection and incorporation of demographic data into model |
| | Assistance with review of existing waste composition studies |
| | Comparison of Florida waste composition data to national data |
| | Incorporation of sampling study and existing waste composition study data into model |
| | Model validation and testing |
| | Assistance with report preparation |

2.2 Cooperative Effort

This project represents an unprecedented cooperative effort between multiple counties. While Pinellas hosted the project and had lead responsibility for coordinating project activities, Highlands, Indian River, and Levy Counties participated by serving as waste sorting sites or partially funding waste composition studies for the project. Six additional counties contributed results of recently completed waste composition studies.

It also represents a cooperative effort between competing Innovative Recycling Grant Projects, both of which were implemented to develop waste composition models. The Pinellas Project Team cooperated with Charlotte County's project team, which also conducted four waste composition studies.

Between the two projects, a total of 14 counties participated either through direct in-kind services regarding waste composition sampling studies or through sharing of data from recently completed waste composition studies. These counties represent a cross-section of Florida counties, with a representation of small, medium, and large counties, as well as counties varying in climate and economics.

In addition, *WasteCalc* was developed for and will be accessible by all Florida counties. The project, therefore, constitutes a statewide effort designed to increase the state's recovery rates and enhance solid waste planning and management activities.

2.3 Project Elements and Timeline

This project consisted of four elements. These elements and the project timeline are discussed in the subsections below.

2.3.1 State and County Demographic Data

This project adapted a methodology developed by Franklin Associates based on the annual waste characterization reports the firm has prepared for EPA since the mid 1970s. Since the national model is based on production data, this methodology was not practical for calculating local MSW generation. At the same time, national rates provide useful benchmarks for local

analyses. For example, if a county appeared to be generating a particular waste category at a much higher or lower rate than the national average, it was useful to investigate the reasons for the difference and to adjust the model appropriately. Building on this observation, the Project Team developed a model that relies on local demographic and sampling data to adjust the national numbers and account for local conditions.

In the initial stages of this project, an extensive survey of available relevant data was conducted using three main criteria: 1) relevance to the accuracy of the model; 2) ease of entry for the Florida counties; and 3) ease of updating background data used in the model. The final model as developed requires entry of only the most basic data by the counties, although many data sources were used in developing the model.

A summary of data used in developing *WasteCalc* and the sources of this data is provided in Table 2.2, *Data Used in Model Development*. The most influential demographic variables used by the model are population and economic factors. The premise that more populous counties typically have a higher level of economic activity and higher than average waste generation rates was demonstrated by Franklin Associates in previous MSW generation analyses.^{1,2} The most important data source was *Florida Statistical Abstract 1999*, published by the University of Florida's Bureau of Economic and Business Research, Warrington College of Business Information.

In addition, sampling data was used to estimate generation of organic materials such as food waste and yard trimmings and to further validate and adjust the results generated by the model. Construction and demolition (C&D) debris waste generation rates were developed using recent C&D studies conducted by the Florida Center for Solid and Hazardous Waste Management, which rely on building and demolition permits in combination with sampling data.

¹ U.S. Environmental Protection Agency, *Characterization of Municipal Solid Waste in the United States: 1994 Update*, EPA 530-R-94-042, November 1994.

² Franklin Associates, Ltd., *Analysis of Trends in Municipal Solid Waste Generation, 1972 to 1987*, January 1992.

TABLE 2.2
DATA USED IN MODEL DEVELOPMENT

| Data | Source |
|---|--|
| Florida County Sampling Studies – 2000 & 2001 | Sampling studies conducted by Kessler Consulting, Inc., and R. W. Beck as part of Innovative Grant projects |
| Other Florida County Sampling Studies | Various consultants and agencies |
| State and County Population | U.S. Census Bureau 2000 Redistricting Data (PL 94-171) Summary File |
| County Land Area | Florida Statistical Abstract 1999, Table 1.77 |
| County Employment by SIC | <i>Florida Statistical Abstract</i> : Total, manufacturing, wholesale trade, retail trade, financial, insurance and real estate services – Table 6.05 |
| | Eating and drinking places – Table 19.73 |
| | Hotels and other lodging – Table 19.76 |
| | Amusement and recreation services – Table 19.78 |
| County Newspaper Circulation | <i>Circulation</i> , published by SRDS® |
| County Newsprint Purchases | <i>Editor & Publisher Year Book</i> , published by Editor & Publisher |
| U.S. MSW Generation Data | <i>Characterization of Municipal Solid Waste in the United States</i> . Draft updated data for 2000 by Franklin Associates, Ltd. for the U.S. Environmental Protection Agency, 2001. |
| Construction & Demolition Debris in Florida | <i>C&D Debris Recycling Study</i> : Final Report by the Florida Center for Solid and Hazardous Waste Management, State University System of Florida |

| | |
|---|---|
| County Reports of MSW Collection and Recycling, by Material | <i>Solid Waste Management in Florida.</i> Published by Florida Department of Environmental Protection, 1997 - 2000 |
|---|---|

The Project Team attempted to find data that would permit allocating tourism and “snowbird” residents to the counties. Potentially useful sources included vacant seasonal housing units, a University of Florida Bureau of Economic and Business Research snowbird survey by region (1996 data), a Florida Facts survey of visitors by region (1997 data), employees in relevant occupations by county, hotel units by county, and limited information from a few cities’ web sites. Except for employment, none of these data seemed helpful for all counties. County employment in the Standard Industry Code (SIC) categories of Eating and Drinking Places, Hotels and Other Lodging, and Amusement and Recreation Services was used to calculate generation of corrugated boxes, as further explained in Section 2.3.4.2.

Other potentially useful data sources identified and analyzed included motor vehicle data, household data, beverage consumption, and county population by age group. These were found either to have poor correlations with MSW collection data, or to be difficult for county personnel to find and enter.

2.3.2 Existing Florida Waste Composition Data

A 1999 DEP survey of Florida’s 67 counties indicated that eight Florida counties had completed waste composition studies since 1996. Study results from only six of these eight counties could be obtained, the others being either incomplete studies or still to be performed. The Project Team carefully reviewed the methodology and results of the six studies to determine their applicability to the model. Deviations from standard protocols were noted, and studies that did not meet industry standards for validity were eliminated. Four of the six available studies were determined to be valid for use in the model: Lee, Marion, Monroe, and Sumter Counties. Initially, Alachua County’s study was determined to be useful, but a lack of complete commercial/institutional generation data made it of limited use. The statistical validity of Hendry County’s data was questionable since it was based on sorting of only eight samples. Therefore, it was used only for guidance purposes.

Once the four studies were determined to be acceptable, waste composition data from the studies was compiled and prepared for use in model development. In some cases, material categories were realigned and results adjusted to conform to the model's waste categories.

2.3.3 Additional Waste Composition Studies

To generate sufficient reliable data to support the model, four waste composition studies were conducted in connection with this project (in Highlands, Indian River, Levy, and Pinellas Counties). Four studies also were completed by Charlotte County's project team (in Charlotte, Citrus, Okaloosa, and Sarasota Counties). The results of these eight studies comprised a common data pool shared by both projects. To ensure consistent quality for the common data pool, the project teams established uniform sampling protocols for the additional studies, including the following:

- Studies were designed to target at least the 18 material categories required for annual DEP recycling reports.
- Studies included two seasonal sorts.
- Each study sorted 70 to 80 samples, with 30 samples from commercial generators, 20 to 25 samples from single-family residential generators, and 20 to 25 samples from multi-family residential generators (if available).
- Each study included a visual analysis of C&D waste streams delivered to a central disposal facility.

These sampling protocols were consistent with the state-approved waste composition study methodology³ to achieve statistically valid results. Appendix A, *Waste Composition Study Sample Report*, presents the report prepared for the Pinellas County Waste Composition Study. This sample report includes a description of the project methodology and results. All counties serving as sampling study sites received a report of the results of the study for their county.

To supplement the available Florida C&D composition research, C&D visual audits were conducted in Indian River, Highlands, and Levy counties. C&D debris is not segregated at the Pinellas County facility. The results of these studies were shared with Dr. Timothy G.

³ Debra R. Reinhart, Ph.D., and Pamela McCauley-Bell, *Methodology for Conducting Composition Study for Discarded Solid Waste*, Florida Center for Solid and Hazardous Waste Management, 1996.

Townsend, University of Florida, and Dr. Debra R. Reinhart, University of Central Florida, who are developing a standard protocol for C&D waste stream composition studies.

2.3.4 Development of Waste Composition Model

Florida's waste stream is influenced by several unique features that required careful analysis in order to adjust the model to account for Florida conditions. These features include, for example, the climate, which results in year-round generation of yard waste; seasonal fluctuations in resident populations; and influxes of large numbers of tourists in some counties. The model was developed in six interrelated steps, which are listed below and further discussed in the following subsections.

1. Analysis of Florida county sampling data, including new data developed as part of this grant as well as data from previous years.
2. Calculation of newspapers and corrugated boxes tonnage for each county.
3. Development of average per capita data for C&D debris for each Florida county.
4. Development of average per capita data for other MSW materials, using EPA data and sampling data.
5. Development of an Excel[®] spreadsheet model for Florida's 67 counties and 18 MSW materials.
6. Conversion of the Excel[®] spreadsheets into an Active Server Page (ASP) model.

2.3.4.1 Analysis of Florida County Sampling Data

Counties Sampled for This Grant: During the waste composition studies, MSW destined for disposal in the eight counties mentioned in Section 2.3.3 was sampled. The counties also provided recycling data, so that a complete picture of collection by material could be obtained. These sample results were arrayed in an Excel[®] spreadsheet for each county, adding disposal tonnage and recycled tonnage for each material to obtain the total amount generated or collected. Adjustment factors for use in the model were then developed for each material in each county as follows.

1. Generation (collection) of each Florida material category was calculated using U.S. average data.⁴
2. The materials were then adjusted for moisture, using data based on moisture content studies in Monroe and Indian River Counties, which is presented in Table 2.3, *Average Waste Composition Percent Moisture Analyses*. This was necessary because U.S. average “as generated” data was used as a basis, while materials sorted in the sampling studies had been mixed together, transferring moisture.
3. A second adjustment factor was developed that would adjust the U.S. average data for each material to the Florida data for each county. This was combined with the moisture adjustment into a composite adjustment for each material. (As is further explained in Sections 2.3.4.2 and 2.3.4.3, adjustment factors were not used for every material; some were calculated separately.)

Previous Sampling Studies: Existing sampling data for the counties mentioned in Section 2.3.2 was analyzed in the same manner. While these sampling studies were older and, in some cases, less complete, they were considered when developing the model.

⁴ See a Section 2.3.4.3 for a detailed description of how the 40+ U.S. EPA materials categories were combined into 18 Florida categories.

| TABLE 2.3 AVERAGE WASTE COMPOSITION PERCENT MOISTURE ANALYSES | | | |
|--|---|---|--------------------------------------|
| DEP Materials | Monroe County⁵ (% moisture) | Indian River County⁶ (% moisture) | Average Used (% moisture) |
| Newspapers | 34.6 | 21.1 | 27.85 |
| Corrugated paper | 25.6 | 22.5 | 24.05 |
| Office paper | 18.4 | 8.4 | 13.4 |
| Other paper | 26.4 | 24.5 | 25.45 |
| Glass | 3.2 | | 3.2 |
| Aluminum cans | 12.9 | | 12.9 |
| Non-ferrous metal | 16.9 | | 16.9 |
| Steel cans | 5.8 | | 5.8 |
| Ferrous metal | 5.4 | | 5.4 |
| Plastic bottles | 4.8 | | 4.8 |
| Other plastics | 11.7 | | 11.7 |
| Textiles | 17.2 | 16.8 | 17.0 |
| Food waste | 53.6 | 65.9 | 59.75 |
| Yard waste | 49.9 | 51.3 | 50.6 |
| C&D debris | 8.9 | | 8.9 |
| Miscellaneous | 28.6 | 34.0 | 31.3 |
| White goods | | | |
| Tires | | | |

2.3.4.2 Calculation of Newspaper and Corrugated in Florida Counties

The methodologies for calculating generation of newspapers and corrugated boxes at the county level were based on county-specific statistics. (These two materials represented nearly 19% of the materials, excluding C&D debris, reported as collected in Florida in 1998.) These methodologies have been used for decades in waste composition projects for local and state agencies as well as paper companies seeking supplies of recovered paper for their mills. The

⁵ Sampling by Kessler Consulting, Inc.

⁶ Sampling by University of Central Florida for Florida Center for Solid and Hazardous Waste Management.

newspaper methodology has, in fact, been reviewed for use previously by DEP.^{7,8} Both methodologies have been updated from time to time as better data becomes available.

Newspaper Calculations: The methodology for calculating newspaper generation in each county is as follows:

1. An average weight per issue was calculated for each daily newspaper, including foreign language papers, circulated in the state using purchases of newsprint for each publication from *Editor & Publisher Year Book*. Newsprint purchases were adjusted by adding a weight factor for ink and deducting a factor for pressroom scrap. Then the newspaper weight was increased to account for inserts (e.g., advertising, comics) printed on newsprint or groundwood. In addition to newspapers published in Florida, weights were calculated for *USA Today*, the *Wall Street Journal*, and out-of-state papers like the *Chicago Tribune*.
2. Circulation of newspapers in each Florida county was obtained from *Circulation*, an annual publication. The circulation in the county was multiplied by the average weights to obtain the weight of newspapers in the county. Circulation included not only papers published in the county, but other Florida and out-of-state newspapers that have circulation in the county. Newspaper weight was increased by 5 percent to allow for weekly papers, religious papers, etc., circulated in the county.

The calculated newspaper data for each county in 2000 was entered in a spreadsheet for use in the model. To make the calculations comparable to the sampled numbers, the calculated numbers were adjusted for moisture.

Corrugated Box Calculations: It has been determined by Franklin Associates and others that generation of corrugated boxes is closely related to economic activity, and hence employment, in states and counties. Corrugated generation in each county was calculated using employment data and generation factors for each employment category. Employment in

⁷ Franklin Associates, Ltd., *Generation and Recovery of Old Newspapers in Florida*, 1992.

each Florida county was obtained from *Florida Statistical Abstract* in the following categories:

- Manufacturing
- Wholesale trade
- Retail trade
- Financial, insurance and real estate services
- Eating and drinking places
- Hotels and other lodging
- Amusement and recreation services
- All others

These categories were chosen to reflect economic activity in Florida. The most recent data available were for 1998; however, these can be updated when newer data are available. Nationally, corrugated box generation did not change much between 1998 and 2000, which may also be the case in Florida. The generation factors for each employment category were obtained from sampling studies specific to corrugated generation.

The calculated corrugated data for each county in 1998 (as a surrogate for 2000) was entered in a spreadsheet for use in the model. To make the calculations comparable to the sampled numbers, the calculated numbers were adjusted for moisture.

2.3.4.3 Development of Florida Construction & Demolition Debris Factors

Generation of C&D debris, as reported by Florida counties, tends to vary from year to year, reflecting fluctuations in construction activity. In order to reflect normal fluctuations, the following approach was used to model this material:

1. C&D debris in each county from 1995 to 1998, as reported by DEP, was entered into a spreadsheet. These numbers were totaled for each county.

⁸ Franklin Associates, Ltd., *Evaluation of Florida Newspaper Generation and Recovery, October 1992 to September 1993*, developed for the Florida Press Association, 1994.

2. These totals were used to allocate to individual counties the 1998 total Florida C&D debris generation reported by the Florida Center for Solid and Hazardous Waste Management (5.9 million tons).⁹
3. Population changes were used to extrapolate the 1998 generation figures to 2000 for each county. Some county tonnage factors were adjusted downward based on population decline in those counties.

If better data is obtained for C&D debris generation in Florida counties, the model can be updated at a later time.

2.3.4.4 Development of Material Adjustment Factors for Florida Counties

An annual report prepared by Franklin Associates for EPA is widely used as a baseline for MSW generation. While the data in this report cannot be taken as representative for any particular community, it is comprehensive and, because it represents 40 years of data and is updated annually, it provides useful data on the changing nature of the waste stream. The methodology for using this report to develop the Florida model is as follows:

1. The 40+ categories in the EPA report were rearranged into Florida's 18 categories, as shown in Table 2.4, *Assignment of U.S. EPA MSW Categories to Florida MSW Categories*. (Note that newspapers and corrugated boxes, while shown here, were calculated as explained in Section 2.3.4.2. C&D debris is not characterized in the EPA report referenced here, but was calculated as described in Section 2.3.4.3. The Miscellaneous category was modeled as explained in Section 2.3.4.5.)
2. For each material category (with exceptions noted above), pounds generated per person per year were calculated using the U.S. tonnage.
3. For the recently sampled Florida counties, adjustment factors were developed to convert U.S. materials data to Florida data (see Section 2.3.4.1 above).

⁹ Debra R. Reinhart, Timothy Townsend, and Howell Heck, *Generation and Composition of Construction and Demolition Waste in Florida*, Florida Center for Solid and Hazardous Waste Management, 2002.

TABLE 2.4
**ASSIGNMENT OF U.S. EPA MSW CATEGORIES TO
FLORIDA MSW CATEGORIES**

| Florida Categories | U.S. EPA Categories | Florida Categories | U.S. EPA Categories |
|----------------------------|----------------------------|-------------------------------|---------------------------------|
| Newspaper | Newspaper | Steel cans | Steel cans |
| Corrugated boxes | Corrugated boxes | Other ferrous | Other steel packaging |
| Office paper | Office paper | | Ferrous in misc. durables |
| Other papers | Books | Aluminum cans | Aluminum cans |
| | Magazines | Other nonferrous | Nonferrous in misc. nondurables |
| | Directories | | Aluminum foil & closures |
| | Standard (A) mail | | Nonferrous in misc. durables |
| | Commercial printing | Textiles | Clothing |
| | Tissue paper | | Towels, sheets, & pillowcases |
| | Paper plates | Textiles in misc. nondurables | |
| | Other nonpackaging paper | Yard trash | Yard trimmings |
| | Milk cartons | Food waste | Food waste |
| | Folding cartons | Tires | Tires |
| Other paperboard packaging | White goods | Major appliances | |
| Paper bags and sacks | Other miscellaneous | Small appliances | |
| Other paper packaging | | Furniture & furnishings | |
| Glass packaging | Beer & soft drink bottles | | Carpet & rugs |
| | Wine & liquor bottles | | Lead-acid batteries |
| | Food & other bottles | | Other misc. durables |

| | | |
|--------------------|--|--|
| Plastic containers | PET soft drink bottles Other PET bottles HDPE natural bottles Other HDPE bottles | Disposable diapers Footwear Rubber in misc. nondurables Wood packaging Other misc. packaging Miscellaneous inorganics |
| Other plastics | Other plastic containers Plastic plates & cups Trash bags Plastics in misc. nondurables Plastic bags & sacks Plastic wraps Other plastic packaging Plastics in misc. durables | |

- Factors developed for the sampled Florida counties were used to develop factors for other Florida counties (described in Section 2.3.4.5 below).

2.3.4.5 Development of Spreadsheet Model

An Excel[®] spreadsheet was then developed to incorporate the material calculations described above for each of Florida's 67 counties. To apply the results from the sampling studies to other counties, it was necessary to identify a parameter that would reflect similarity between counties. After consideration of available Florida data, it was determined that population density would be an appropriate parameter for the following reasons:

- The correlation between Florida county population density and county-reported MSW collection in 1998 is about 0.7, which is reasonably good for a heterogeneous material such as MSW.

- High-density counties have the population and industrial/commercial activity to generate larger quantities of wastes on a per capita basis. Their newspapers are larger, there is more construction activity, more corrugated boxes are unpacked at malls and factories, they have large office complexes, and other factors common to densely populated areas.
- In Florida, the high-density counties generally have more ability to attract tourists and seasonal residents, which therefore increases commercial activity. Consumption of products by tourists and seasonal residents is reflected in the per capita generation numbers for beverage containers, paper products, and other components of the waste stream.
- The low-density counties are generally rural, and rural areas are known to have smaller newspapers, fewer wastes generated by commercial activities such as offices and shopping malls, and less concentrated tourist and seasonal residential activity.

The counties were listed in decreasing order of population density and the 18 material categories arrayed across the spreadsheet. Factors and tonnages for materials in the 12 sampled counties were calculated first, as described in Sections 2.3.4.1 through 2.3.4.4. Population density was then used to develop adjustment factors for the remaining Florida counties.

To compare the model results with national averages, the results for all counties were summed and analyzed for each material category. (The 2000 totals used in the model assumed a growth in total Florida generation of about 7 percent above 1998 totals). The average per capita generation for each material was then compared with the national average, as displayed in Table 2.5, *Comparison of U.S. Averages and Florida Model Averages, 2000*.

TABLE 2.5
COMPARISON OF U.S. AVERAGES AND
FLORIDA MODEL AVERAGES, 2000
(pounds per person per year)

| Material | U.S. Average | Florida Model Average | Florida Increase Over U.S. |
|-------------------|---------------------|------------------------------|-----------------------------------|
| Newspaper | 106.6 | 157.4 | 47.7% |
| Glass | 79.5 | 80.0 | 0.6% |
| Aluminum cans | 11.2 | 18.1 | 61.6% |
| Plastic bottles | 25.5 | 41.2 | 61.6% |
| Steel cans | 18.8 | 25.1 | 33.5% |
| Yard trash | 197.1 | 330.4 | 67.6% |
| White goods | 25.9 | 25.9 | 0.0% |
| Tires | 33.2 | 33.2 | 0.0% |
| Other plastics | 131.2 | 160.4 | 22.3% |
| Ferrous metals | 34.5 | 174.0 | 404.3% |
| Nonferrous metals | 9.5 | 34.3 | 261.1% |
| Corrugated boxes | 214.7 | 326.5 | 52.1% |
| Office paper | 53.5 | 68.7 | 28.4% |
| Other paper | 241.1 | 256.9 | 6.6% |
| Food wastes | 184.1 | 197.5 | 7.3% |
| Textiles | 48.7 | 70.8 | 45.4% |
| Miscellaneous | 232.5 | 558.9 | 140.4% |

Excludes C&D debris.

U.S. categories have been recompiled into Florida categories.

U.S. source: Draft report by Franklin Associates, Ltd., for the U.S. EPA.

In making this comparison, it is important to note that the annual EPA MSW characterization study includes a specifically defined group of materials and products that do *not* characterize all materials that are typically disposed in a landfill or waste-to-energy facility.

It is also important to consider factors that make Florida unique. For example, Florida's average annual rainfall is 54 inches as compared with the U.S. average of 27 inches. Table 2.6, *Florida Demographic Factors*, summarizes additional factors that may influence MSW generation.

| TABLE 2.6 FLORIDA DEMOGRAPHIC FACTORS | |
|--|---------------------------|
| Demographic Factor | Florida State Rank |
| | |

| | |
|------------------------------------|------------------|
| Resident population | 4 th |
| Persons per square mile | 9 th |
| Retail sales per household | 8 th |
| Personal income per person, 1996\$ | 18 th |
| Gross State Product, 1996\$ | 5 th |

Data years are the most recent available from the U.S. Census; they vary from 1996 to 2000.

These demographic considerations help to explain why Florida's per capita generation of MSW is well above the national average in nearly all categories. Florida has a large, dense population with a high Gross State Product. Personal income ranks 18th, with retail sales per household even higher. (The latter is probably affected by large numbers of tourists and seasonal residents.) High rainfall, along with a year-round growing season, contributes to high generation of yard trash.

Provided below is a discussion of the model results for material categories:

Newspapers, Corrugated Boxes, Office Paper, and Other Paper: Per capita generation rates for paper categories were 6.6% to 52.1% percent higher than national averages. This reflects the influence of dense population in many areas, as well as the influx of seasonal residents and tourists. It is expected that the economic activity associated with tourism and large populations would result in higher than average generation of corrugated boxes and office paper.

Glass, Aluminum Cans, Plastic (PET and HDPE) Bottles, and Steel Cans: Glass generation was only slightly higher than the national average, reflecting Florida's consistency with the nationwide trend of replacing glass containers with other packaging materials. Generation of other container types, especially in the more populous counties, was considerably higher than the national average (33.5% to 61.6%). This likely reflects both the Florida climate and tourist and seasonal activity. Aluminum cans and plastic bottles, in particular, contain beverages that are popular in warm climates.

C&D Debris: C&D debris is not included in EPA's MSW characterization study. As described in Section 2.3.4.3, per capita factors were developed based on four-year average

generation rates in each county and statewide data from the Florida Center for Solid and Hazardous Waste Management. C&D generation within a given county appears to fluctuate widely depending upon the level of construction activity from year to year. The model is not able to predict these fluctuations, but rather bases generation on an average. Therefore, future significant construction or demolition projects or improvements in the way C&D debris is reported would not be reflected in the model, but could be incorporated in future updates.

Yard Trash: As expected, yard trash is generated at much higher rates (67.6%) than the national average. The more populous counties had higher than average generation, while rural counties were much lower. The model does not include yard waste that is source reduced through backyard composting or “grasscycling.” It should be noted that if a county makes a marked change in how yard waste is managed, the model would not reflect this. It would be possible to incorporate such changes into the model's yard waste factors in future years.

White Goods: Since white goods (major appliances) often are managed outside the normal county waste management system (e.g., they tend to be managed privately), the county sampling studies uniformly showed results much lower than the national average generation. Recycling of ferrous metal contained in these products is likely included in the unusually large ferrous metals recycling numbers reported in many counties. Therefore, for modeling purposes, generation of white goods was based on the national average for all counties.

Tires: Tire generation rates in the counties with sampling studies were also uniformly lower than the national average. As with white goods, this is likely because tires are often handled outside the solid waste management system, e.g., returned to a dealer when new tires are purchased. For this reason, the national average was used for modeling tire generation.

Other Plastics: Generation of other plastics was 22.3% higher than the national average. As with containers, this is likely due to the higher generation rate for plastic containers expected in a densely populated state with a large seasonal population.

Ferrous Metals and Nonferrous Metals: The methodology was slightly altered for these materials since many counties report very high recycling rates (99% or 100% in some instances). A generation factor for the materials disposed was calculated. The model then

adds this factor to the county-reported recycling number on the model input page. While this avoids the possibility of a county reporting greater than 100% recycling, it also results in significantly higher generation rates for ferrous and nonferrous metals than the national averages (404% and 261%, respectively). It is likely that reported recycling data includes products such as shredded metals from automobiles and other scrap metals that are not counted as MSW in the EPA national report. It is recommended that DEP look into this issue to determine if metals recovery rates are being over-reported by inclusion of scrap metal from non-MSW sources.

Food Wastes: Food waste generation was only slightly higher (7.3%) than the national average. While generation in the most populous counties was higher than average, most of the state's counties followed a typical pattern.

Textiles: Textile generation was 45.4% higher than the national average, reflecting the data resulting from the waste composition sampling studies. Florida's high ranking in retail sales and personal income indicate that this high level of generation is not surprising.

Miscellaneous: The miscellaneous category is quite variable, and the sampling studies did not provide consistent guidance. Therefore, the calculated generation tonnages of all other materials were added together, then subtracted from the county-entered figures for total MSW collected (landfilled, combusted, and recycled), to obtain the quantity of materials not accounted for in other material categories. This tonnage was assigned to the miscellaneous category. This methodology resulted in a 140% higher generation rate for this category than the national average. It is likely that, in at least some counties, wastes not counted as MSW by EPA are included in Florida's reported data.

2.3.4.6 Conversion of Spreadsheet Data to a Web Page Model

To develop a model capable of being displayed on a web page, the data from the spreadsheets was converted to tables in a Microsoft Access 97 database. To achieve this, a conversion program was written in Visual FoxPro 6.0. The conversion program directly converted the spreadsheets for newspaper and corrugated and the factors used to adjust the results for each county. The EPA estimates of MSW by Florida category were entered manually.

The web page model was written in Active Server Pages (ASP). The calculations made by the spreadsheets were duplicated within the ASP, which draws on the information contained in the Access database described above. The output produced by the web page model was methodically compared to the results arrived at by the spreadsheet model to insure that the functionality was exactly reproduced. The model was programmed so that later modifications, data updates, or text additions could be done easily by any experienced ASP programmer.

Text was then developed and added to the web page model to provide a brief summary of *WasteCalc* and its purpose, and to provide easy-to-follow instructions for using the model. The output pages include a tabular list of the percent composition by weight of each material category for the specified county, as well as a pie chart depicting these percentages. Appendix B, *Sample WasteCalc Web Pages*, provides a hard copy of the web pages when modeling Pinellas County's MSW composition for 2000.

2.3.4.7 Updates

This model has been developed so that updates can be made, as outlined below, without rewriting the model.

- ***Updating EPA Factors:*** The materials that are characterized by multiplying a Florida county factor times the per capita U.S. average MSW generation have an update sheet built into the model. Detailed instructions for this update are provided in Appendix C, *Instructions for Updating U.S. MSW Generation Data*.
- ***Updating Newspapers and Corrugated Boxes:*** As mentioned previously, calculated county generation of newspapers and/or corrugated boxes can be updated whenever new data is available. In the meantime, the model will update generation of these materials using the EPA methodology described above. In other words, if newspaper or corrugated generation increases or decreases on a national basis, Florida generation will increase or decrease in the same ratio.

- ***Updating C&D Debris:*** Per capita factors for the generation of C&D debris in each county can be updated in the model when better data becomes available, e.g., from more comprehensive Florida sampling studies or improved reporting mechanisms.

2.3.4.8 Model Testing

The web page model was tested by entering 1995 and 1998 materials data for each county as reported in the Florida DEP annual reports. Further testing was conducted using 1999 and 2000 data for Pinellas County, as well as 1999 data for several other counties. The Project Team then looked for negative numbers, which indicated that the model was not working properly in a particular county. The materials factors and model were adjusted, as needed, to ensure non-negative results.

It was necessary to make similar adjustments for some counties that had experienced population declines. Results also were reviewed and, if necessary, adjusted for counties that had unusually high results in the miscellaneous category.

2.3.5 Project Timeline

Table 2.7, *Project Timeline*, presents the schedule of completion of all project elements.

| TABLE 2.7 | | |
|---|------------------------|------------------------|
| PROJECT TIMELINE | | |
| <i>Project Element</i> | Initiation Date | Completion Date |
| State and County Demographic Data | June 2000 | November 2000 |
| Existing Florida Waste Composition Data | June 2000 | April 2001 |
| Additional Waste Composition Studies | June 2000 | September 2001 |
| Development of Waste Composition Model | October 2000 | May 2002 |

2.4 Problem Resolution

Few problems were experienced with the waste composition studies. During the first reporting period of the project (June – August 2000), Union County, which had originally agreed to participate in the project as a field sampling study site, was unable to participate because of its concern about operational problems at its landfill. Pinellas submitted a written request to DEP to substitute Levy County for Union County as a project participant. DEP approved the substitution, and Levy County replaced Union County as a representative small county. Levy County transfers its solid waste to the New River Landfill, located in Union County.

The Project Team originally intended to obtain 15 reliable points of reference from a combination of existing waste composition studies and the sampling studies conducted as part of this and the Charlotte County project. Although DEP identified eight existing studies, only six were available, and of these four were determined to be useful for incorporating into the model. Therefore, 12 reliable points of reference (4 existing studies plus 8 sampling studies) were available, which were determined to be sufficient for developing the model.

The project experienced a four-month delay in receiving the sampling data from Charlotte County's project team. Pinellas requested and received a four-month extension of the project due to these delays.

Challenges addressed when developing the model were discussed in Section 2.3.4. As previously mentioned, the model is programmed to avoid having any material category “go negative.” This can be more of a problem in counties that have small amounts of total waste. If an unusually large quantity of one material category, usually C&D debris, is generated, a negative percentage could result in the miscellaneous category to compensate. The model programming was adjusted to prevent this occurrence. If the changes in solid waste generation or management within a county are significant enough to cause the model to no longer be useful, an error message to that effect will appear to the user.

SECTION 3.0

RESULTS

3.1 Project Accomplishments

This Innovative Grant project resulted in development of *WasteCalc*, an advanced waste composition model for use by Florida counties. This was accomplished through the use of demographic and economic data as well as data from existing waste composition studies from Florida counties and additional waste composition sampling studies conducted by the Pinellas Project Team and Charlotte County's project team. The data was incorporated into the model and the model was tested for accuracy.

The finished model is being submitted to DEP as a web page suitable for publication on DEP's website, where it will be accessible by all counties. Appendix B provides sample web pages of the model and Appendix C contains instructions for DEP to update the model.

By using *WasteCalc*, counties in Florida will be able to estimate MSW percent composition by weight for their specific county. This information is essential for solid waste management planning purposes, and especially for developing and maintaining an effective waste reduction and recycling program.

3.2 Advanced Technologies

An advanced waste composition model such as *WasteCalc* was not previously available for Florida counties and is one of the first of its kind in the country. The model was based on a national waste composition methodology that was adapted for Florida counties using the most recent demographic, economic, and sampling study data available. *WasteCalc* combines the features of being a technologically advanced computer-based model, while also being user-friendly. It also features the ability of being updated as more current and accurate information becomes available.

3.3 Increased Material Recovery

WasteCalc should assist Florida counties in more accurately and effectively managing waste reduction and recycling programs. All of DEP's 18 material categories are represented in the

model. By evaluating generation data and comparing it with recycling data, counties will be able to identify opportunities for program expansion and improvements. Such efficient management should lead to increased diversion of materials from disposal.

3.4 Technology Transfer

The technology developed through this project will be readily transferable since *WasteCalc* will be published on DEP's website, where it will be available for use by all Florida counties. The model was designed to be interactive and user-friendly so all program managers can run the model properly. In addition to using the model to improve waste reduction and recycling programs, *WasteCalc* will be useful in preparing annual county recycling reports for DEP.

Other states and local governments will also be able to learn from the model. To facilitate technology transfer, press releases regarding the model, which are included in Appendix D, were sent to state and national publications. The opportunity to present the project results at an appropriate upcoming forum or through a journal article also will be pursued.

3.5 Improved Program Cost-Effectiveness and Efficiency

WasteCalc represents a substantial advancement in waste composition analysis in Florida and has the potential to greatly improve solid waste program cost-effectiveness and efficiency. Waste composition studies can cost between \$40,000 and \$100,000 to conduct. DEP suggests counties conduct a new study every five years to keep track of changing waste generation and composition.

WasteCalc may reduce the necessary frequency of sampling studies, but more importantly, it provides a means to check sampling study results with county-specific figures based on production data. It also provides a means for counties to estimate MSW generation between sampling events. Periodic sampling studies are still recommended, especially if significant changes have been made in waste generation patterns (e.g., initiation of a major construction or demolition project) or unusual events have occurred (e.g., natural or man-made disasters) that would cause the model assumptions for a county to be inaccurate.

Table 3.1, *Costs by Project Element*, summarizes the costs of the project, including in-kind and budgeted contributions to the project from the participating counties. The primary objective of developing *WasteCalc* was to provide Florida counties with a cost-effective means of estimating MSW composition, and this objective has been achieved. Counties will benefit from the use of the model free-of-charge, with no additional county expenditures required. The model only requires counties to input county-specific population and solid waste management data, which should be readily available.

TABLE 3.1
COSTS BY PROJECT ELEMENT

| <i>Project Element</i> | In-Kind Contribution | Budgeted Contribution | Grant Funds Contribution |
|---|-----------------------------|------------------------------|---------------------------------|
| State and County Demographic Data | | | \$18,000 |
| Existing Florida Waste Composition Data | | | \$12,000 |
| Additional Waste Composition Studies | \$50,000 | \$20,000 | \$90,000 |
| Development of Waste Composition Model | | \$10,000 | \$93,000 |
| Report Preparation | | | \$12,000 |
| Project Management/Coordination | | | \$15,000 |
| Project Administration | \$40,000 | | |
| TOTALS | \$90,000 | \$30,000 | \$240,000 |

To estimate the cost-effectiveness of *WasteCalc*, a value must be placed on development of annual MSW composition data for state reporting and county planning purposes. Assuming a conservative estimate of \$3,000 per county, *WasteCalc* would have a payback period of less than 1.5 years if all 67 Florida counties make use of the model:

$$\$3,000 \text{ (value of developing MSW composition data annually)} \times 67 \text{ counties} \times 1.34 \text{ years} = \$270,000$$

Since *WasteCalc* offers the potential to reduce the necessary frequency of sampling studies, counties will also benefit from the avoided costs for these studies. Assuming a waste composition study typically costs from \$40,000 to \$100,000, an average cost would be \$70,000. If the necessary frequency of sampling studies were extended from five years to seven, the average annual cost savings per county would be \$4,000 (\$70,000 distributed over 7 years = \$10,000/year versus \$70,000 distributed over 5 years = \$14,000/year). Should all 67 counties use the model, the payback period based on avoided sampling study costs would be approximately one year:

\$4,000 (annual cost savings of reduced sampling frequency) x 67 counties x 1.01= \$270,000

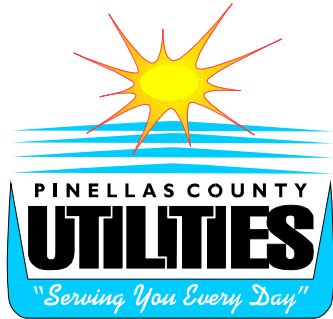
In addition to cost savings, **WasteCalc** is intended to assist counties with improving their waste reduction and recycling programs. Improvements in these programs may increase material recovery and associated revenues, and also avoid tipping fees.

3.6 Nontraditional Materials

It is hoped that the results of this project will lead to greater recovery of traditionally recycled materials as well as nontraditional materials in Florida's MSW and C&D waste streams. **WasteCalc** was designed to characterize county waste streams according to the 18 material categories that DEP requires for the Solid Waste Recycling and Education Grant reports. Using **WasteCalc** will allow planners to identify unrecovered materials by type, adjust recovery objectives, and maximize the effectiveness of recycling and waste reduction programs for traditional and nontraditional materials.

APPENDIX A

**WASTE COMPOSITION STUDY
SAMPLE REPORT**



Kessler Consulting, Inc.

**PINELLAS COUNTY,
FLORIDA**

Waste Composition Study

Final Report

Prepared for:

**Pinellas County Utilities
Department of Solid Waste Operations
3095 114th Avenue N
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Submitted by:

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Printed on recycled paper

April 2001

PINELLAS COUNTY, FLORIDA
WASTE COMPOSITION STUDY
Final Report

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APPENDICES

Appendix A Material Categories Lists

Appendix B Data Recording Form

Appendix C Site Safety Plan

EXECUTIVE SUMMARY

This waste composition study (WCS) was conducted as part of Pinellas County's 2000 Innovative Recycling Grant Project, *Advanced Waste Composition Model*, funded by the Florida Department of Environmental Protection (DEP) to develop an advanced waste composition computer model for Florida. Pinellas County (County) contracted Kessler Consulting, Inc.'s (**KCI**) services to conduct a two-season WCS to estimate the composition of municipal solid waste (MSW) being incinerated in the Pinellas County Waste-to-Energy Facility or disposed of in the Pinellas County Bridgeway Acres Landfill. In addition, the County wished to gain an understanding of the amount of recyclable material being incinerated or disposed. A two-season approach was used to study the effects of seasonal impacts, such as agricultural activities and social activities. The results of this WCS will be used to develop a waste composition model for Florida and may be used by Pinellas County for planning and monitoring recycling programs, evaluating material handling options, and preparing the County's annual solid waste report to the DEP.

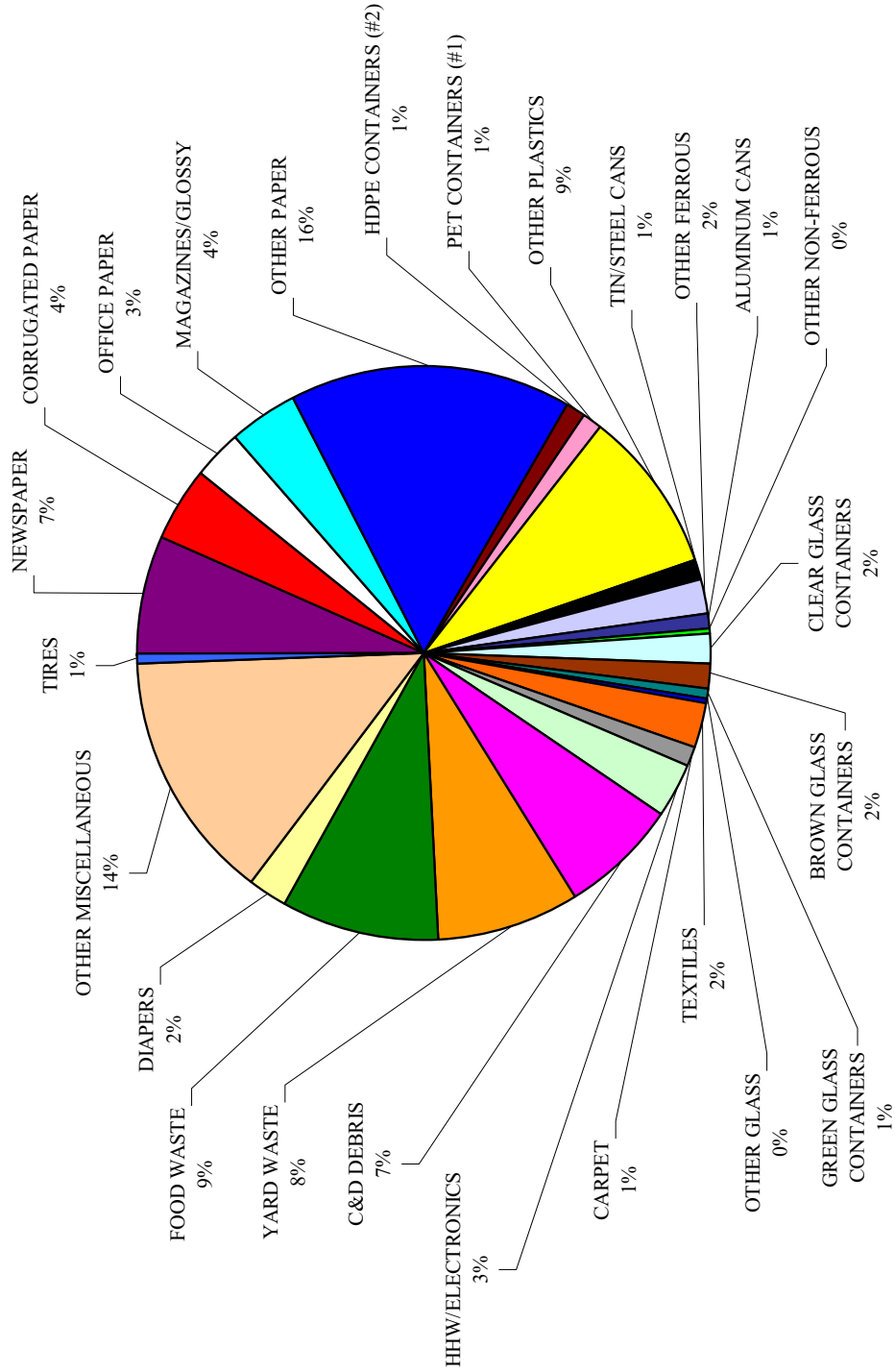
KCI conducted the two one-week sorting events, one in summer and one in winter, to account for seasonal changes in the waste stream. During the events, single family residential, multi-family residential, and commercial solid waste was sampled and sorted manually into pre-determined material categories. The containers into which the materials were sorted were weighed and the weight was recorded. The resulting data was analyzed and the statistical validity was assessed. Section 2.0, *Methodology*, explains the study methodology in detail.

In Sections 3.0, 4.0, 5.0, and 6.0, **KCI** presents the results of each sorting event by generator and compares the events to identify any seasonal differences in the County's waste

composition. **KCI** also combines the results of both sorting events to report the annual composition of waste by generator and the total annual composition of incinerated and landfilled waste. The data in this report do not include waste that is not delivered to the Pinellas County Solid Waste Facility. In addition, **KCI** compared the results of this study to the results from the County's 1989 Waste Composition Study, which was prepared by HDR.

Figure ES-1, *Percent Composition of Total Waste Landfilled or Incinerated – Summer and Winter Events*, shows the percent composition by weight of the total waste landfilled or incinerated at the Pinellas County facility during the summer and winter sorting events. The composition also includes annual tire disposal. Other Miscellaneous, Other Paper, Other

Figure ES-1 Percent Composition of Total Waste Landfilled or Incinerated - Summer and Winter Events



Plastics, C&D Debris, Food Waste, Yard Waste, Newspaper, Magazines/Glossy Paper, Corrugated Paper, and Office Paper comprised relatively large percentages of the waste stream incinerated or landfilled annually. Over 25 percent of materials found in the landfilled or incinerated waste stream are material types that are collected as part of the County's drop-off recycling, yard waste recycling, and office paper recycling programs. Other recyclable materials are also present in the waste stream. In fact, almost 50 percent of landfilled or incinerated materials sorted during this study are recyclable. This number does not include the C&D Debris category, which often contains recyclable or reusable materials.

Among the three generators targeted in this study, Pinellas County's commercial waste stream had the largest difference in waste composition between the seasons. Most notably, Other Paper decreased from summer to winter and Other Miscellaneous and C&D Debris increased. For total waste composition, Other Paper decreased from summer to winter and Other Miscellaneous increased. Other Miscellaneous contains bulky items, such as furniture, and Other Paper contains residential mixed paper.

KCI compared this study to the County's 1989 waste composition study and highlighted a number of changes in the waste stream over the 12 year period. Corrugated paper in the waste stream decreased since 1989 while Office Paper increased. In addition, plastics in the waste stream have increased over the 12-year period. Glass has also increased, as well as electronics, food waste, diapers, tin/steel cans, and aluminum cans. Yard waste made a relatively large decline from 22 percent to 7.8 percent over time, a change of over 14 percent. In general, most materials that are currently recycled in Pinellas County represent larger amounts of the waste stream in 2001 than they represented in 1989. Certain materials may have increased due to general trends in packaging and consumer goods. In particular, packaging material contains more plastic in 2001 than it did in 1989. Electronics may have increased in the waste stream due to the rapidly changing electronics industry, where many items become obsolete quickly. In addition, Pinellas County's average age is decreasing, which may account for some waste composition changes, such as the increase in diapers in the waste stream. Pinellas County should consider this comparison as a general consideration only, since differing methodologies and material categories make a direct comparison difficult.

KCI recommends targeting Yard Waste, Newspaper, Corrugated Paper, Magazines/Glossy Paper, Other Paper, Food Waste, C&D Debris, and Textiles for additional diversion from disposal. In particular, **KCI** developed the following recommended action plan for increasing participation in the County's recycling program and increasing material recovery:

- Expand public education to encourage participation in existing recycling programs, including drop-off recycling centers, the yard waste recycling program, and available curbside recycling. This should involve cooperation with municipalities and waste haulers.
- Continue to educate and encourage residents and businesses through the County’s public relations program to donate usable items and edible food discards to the numerous charities in the County. Pinellas County recently met with several of these charities to discuss handling of household hazardous waste and electronics and expanding recycling.
- Continue to educate and encourage residents to implement backyard food and yard waste composting and promote existing programs. Several years ago, the Pinellas County Cooperative Extension began an education program for backyard composting and provided backyard composting systems to residents. The County should consider revitalizing this program, if necessary.
- Continue to provide and increase incentives to businesses and waste haulers to reduce waste and recycle. In addition to the County’s yearly awards program for businesses, **KCI** recommends enhancing the program by providing recycling “certification” to businesses that recycle, which they can advertise to their customers to show their commitment to a sustainable environment.
- Expand the drop-off recycling program by adding additional centers in the unincorporated areas of the County. Already, the County is planning to provide two new centers in fiscal year 2001-2002, and additional centers should be considered for future years. The County also has plans to provide a model recycling center at its solid waste facility and an area where Class III recyclable material will be accepted. These new centers are a positive step toward increasing material recovery and participation in the recycling program. In addition, cities in the County should consider expanding their drop-off recycling programs. Increasing the number of drop-off centers available will increase the convenience to residents, which should improve participation and increase recovery.
- Expand the drop-off recycling program by adding materials that can be dropped off. The County recently added aluminum cans to 6 of its 10 drop-off sites and residential

mixed paper to 4 sites, which should increase recovery. In addition, corrugated paper was added to 4 sites. If collecting residential mixed paper at the current sites proves to be successful in terms of increased participation, recovery, and revenue generation, the County should consider adding residential mixed paper to all of its centers. Textiles should also be added, and the County should consider collecting tin/steel cans, which will provide more revenue when collected at these centers than when recovered after incineration. The availability of markets should always be considered when adding new materials.

- Continue to promote increasing curbside recycling in the unincorporated County and municipalities. Counties that have extensive curbside recycling programs tend to have higher recovery rates. The County could work with waste haulers serving the unincorporated county to encourage them to expand curbside recycling. In addition, cities in the County that currently do not offer curbside recycling may wish to consider implementing a curbside program.
- Consider implementing a commercial recycling pilot program in the unincorporated areas of the County in which the County would provide free waste audits to interested businesses and provide them with a plan for optimizing recycling and reducing disposal costs.
- Investigate the feasibility of implementing a food waste composting program.

The County may also wish to consider sharing the above information and recommendations with other County or citizen committees or groups.

SECTION 1.0 INTRODUCTION

1.1 Purpose and Scope

This waste composition study (WCS) was conducted as part of Pinellas County's 2000 Innovative Recycling Grant Project, *Advanced Waste Composition Model*, funded by the Florida Department of Environmental Protection (DEP) to develop an advanced waste composition computer model for Florida. Pinellas County (County) contracted Kessler Consulting, Inc.'s (KCI) services to conduct a two-season WCS to estimate the composition of municipal solid waste (MSW) being incinerated in the Pinellas County Waste-to-Energy Facility or disposed of in the Pinellas County Bridgeway Acres Landfill. In addition, the County wished to gain an understanding of the amount of recyclable material being incinerated or disposed. A two-season approach was used to study the effects of seasonal impacts, such as agricultural activities and social activities. The results of this WCS will be used to develop a waste composition model for Florida and may be used by Pinellas County for planning and monitoring recycling programs, evaluating material handling options, and preparing the County's annual solid waste report to the DEP.

1.2 Background

Pinellas County, located on Florida's west coast, had a Year 2000 population of approximately 905,000 and is Florida's most densely populated county. Pinellas County is surrounded by water on three sides and has a large population of retirees and seasonal residents. In addition, Pinellas County is one of the top ten most visited counties in Florida. Pinellas County's main industries are electronics, publishing, computers, and communication. All of these factors have the potential to influence the composition of the County's waste stream.

In addition, Pinellas County's recycling program will influence the composition of the waste stream. The County operates drop-off recycling centers in unincorporated areas of the County and a yard waste recycling program. As of the dates of this study, the County's drop-off recycling centers accept the following materials: newspaper, corrugated paper, mixed paper, plastic bottles, and clear glass bottles. County offices also participate in an office paper

recycling program. Some municipalities in the County operate or contract for curbside pickup of recyclables. Pinellas County's solid waste collection in the unincorporated areas of the County operates under a free market system, and some waste haulers provide their customers with curbside recycling. MSW generated in Pinellas County is incinerated in the Pinellas County Waste to Energy Facility or disposed of at the Pinellas County Bridgeway Acres Landfill. The County also operates a household chemical and electronics collection program and a white goods recycling program.

1.3 Organization of Report

This document is organized into seven sections. Each section addresses a particular aspect of the WCS. Section 1.0, *Introduction*, provides a brief overview of the project's purpose and scope, a description of the study area, a description of the report's organization, and acknowledgments of the individuals that participated in planning and executing the WCS.

Section 2.0, *Methodology*, provides an overview of the WCS procedures. This section also provides a general discussion of considerations used to target loads for statistical validity and factors that may influence the results.

Section 3.0, *Results of Summer Waste Sorting Event*, outlines the findings of the summer waste composition sorting event. This includes a discussion of statistical validity of the findings and composition by generator.

Section 4.0, *Results of Winter Waste Sorting Event*, presents the results of the winter waste composition sorting event. This includes a discussion of statistical validity of the findings and composition by generator.

Section 5.0, *Comparison of Summer and Winter Sorting Events*, will compare the two seasonal sorting events and discuss differences identified during the WCS.

Section 6.0, *Results of Two-Season Waste Composition Study*, summarizes the findings of the WCS by generator and for the total waste stream. Statistical validity of the findings is also discussed.

Section 7.0, *Conclusions, Recommendations, and Next Steps*, provides guidance regarding the use of the data obtained from the WCS. Seasonality trends are discussed, as well as target

materials for additional diversion, materials handling options, effects of moisture, market trends, and recycling and waste reduction goals.

The *Appendices* follow Section 7.0 and include a description of material categories, a copy of the data recording form, and the site safety plan.

1.4 Acknowledgments

KCI extends special thanks to the individuals that participated in the planning and execution of the WCS: Warren Smith, Solid Waste Director; Deb Bush, Solid Waste Program Supervisor; Superior Waste Services staff; and the County's Utilities Customer Service. **KCI** would also like to thank the inmates from the Pinellas County Jail, whose invaluable cooperation and conscientious assistance helped provide efficient and quality sorting of each load sampled, and Eric Braithwaite for supervising the inmates and assisting with sampling. Special thanks are also extended to the participating private and municipal haulers in Pinellas County for their cooperation.

SECTION 2.0 METHODOLOGY

2.1 General Considerations

When reviewing the results of this waste composition study, statistical validity and moisture content should be considered. The study was designed so that the results would be useful for decision makers yet study parameters would remain within time and budget requirements. Therefore, the study relied on statistical sampling, and statistical validity of the results was analyzed. The study was designed to achieve statistically valid results with a 90 percent confidence level. Confidence intervals are reported.

Another important consideration is the role of moisture content in a waste composition study. Some materials in the waste stream tend to absorb liquids, which may bias the results of a waste composition study. However, laboratory methods for estimating moisture content are usually expensive and may overestimate moisture by removing naturally occurring moisture. Moisture content analysis was not included in the scope of this study; however, **KCI** recommends the County consider how moisture absorbed by certain materials, such as paper, may affect the percent composition by weight of the waste stream.

2.2 Generator Types

Three generator types were targeted for sampling in this study: single family residential, multi-family residential, and commercial. Sampling was stratified by generator types. The number of samples chosen for each generator type was proportionate to the relative contribution of the generator type to the solid waste stream entering the Pinellas County Solid Waste Facility. Table 2.1, *Number of Samples Per Generator Type*, shows the number of samples sorted for each generator type and the percentage of the total number of samples. In order to achieve desired statistical accuracy, the number of samples from the multi-family residential waste stream was increased and, therefore, comprised a larger percentage of the samples than it represents in the total waste stream. According to Pinellas County's 2000-2001 Recycling and Education Grant Application, single family residential generators represented 39 percent of the waste stream, multi-family residential generators represented 10 percent, and commercial generators represented 51 percent.

| TABLE 2.1 NUMBER OF SAMPLES PER GENERATOR TYPE | | |
|---|--------------------------|---------------------|
| <i>Generator Type</i> | Number of Samples | % of Samples |
| Single Family Residential | 30 | 41 |
| Multi-Family Residential | 11 | 15 |
| Commercial | 32 | 44 |
| Total | 73 | 100 |

2.3 Material Categories

KCI worked with Pinellas County to develop a list of material categories into which solid waste would be sorted. The categories correspond to the Florida Department of Environmental Protection’s (DEP) annual solid waste reporting requirements for counties, which also serves as part of the Recycling and Education Grant Application. The DEP’s list was expanded to include additional recyclables in which the County was interested. In addition, after the summer sorting event, the list was modified based on the results of the first sorting event. Because the Other Plastics category represented a large percentage of the waste stream during the summer sorting event, Film Plastics were sorted separately during the winter sorting event. Similarly, the Household Hazardous Waste/Electronics/Fluorescent Bulbs category was larger than anticipated during the summer sorting event; therefore, Electronics were sorted separately during the winter event. Appendix A, *Material Categories Lists*, shows the lists of material categories and their descriptions for the summer and winter sorting events.

2.4 Sampling, Sorting, and Analysis Procedures

The summer sorting event for the Pinellas County WCS was conducted by **KCI** August 25 through September 1, 2000. The winter sorting event was conducted by **KCI** January 22 through January 26, 2001. Prior to each sorting event, **KCI** called all waste haulers serving Pinellas County residents and businesses to inform them of the upcoming study and to answer questions.

The sampling and sorting areas were located at the Pinellas County Bridgeway Acres Landfill. Figure 2.1, *Waste Sorting Area*, shows the waste sorting area, including the sorting table and sorting containers. Pinellas County provided a front-end loader with operator and arranged for an inmate work crew from the Pinellas County jail to assist with sorting. Throughout both events, **KCI** staff were responsible for supervising the operations and instructing the sorters regarding sampling and safety procedures.



Figure 2.1 Waste Sorting Area

Randomly-selected vehicles were routed to the sampling area by scalehouse personnel. The sampling supervisor briefly interviewed each driver to determine the type of load (i.e., single family residential, multi-family residential, or commercial) and to describe the route(s) serviced, and then the hauler was directed to tip the load. Figure 2.2, *Typical Load of Solid Waste Being Emptied*, shows a garbage truck tipping its load at the landfill for sampling. If the load was mixed (e.g. commercial and multi-family residential material were collected by the same truck), the driver was asked to estimate the percentage of each type of waste in the load. For analysis, the load was evaluated as the generator type that represented the majority

of the load. The front-end loader operator mixed the load to eliminate waste stratification that



often occurs in trucks. After mixing, a representative sample of the load was taken and transported to the sorting area. The remaining waste was compacted and covered by the end of each day.

The sample was sorted into containers representing each of the material categories and were visually inspected by the sorting supervisor throughout the sorting event to ensure quality control. Figure 2.3, *Sorting Activities*, shows the sorters sorting a waste sample. Once the **Figure 2.2 Typical Load of Solid Waste Being Emptied**

were subtracted from the weights of the containers

after sorting to obtain the net weight of each material category.

After each sorting event, **KCI** calculated the weighted averages of each material category by generator type for all samples and determined the statistical validity of the data. Generator type data was then combined to determine the total composition of landfilled and incinerated waste for each event. For annual waste composition, **KCI** combined the sample data from each season to calculate weighted averages by generator, determine statistical validity of the annual data, and calculate weighted averages for total annual composition of landfilled and incinerated waste.



Figure 2.3 Sorting Activities

2.5 Site Safety

A site safety plan was developed for this study and used during each waste sorting event. Appendix C, *Site Safety Plan*, presents this plan. The plan addressed potential worker hazards, safe sorting procedures, worker back safety, fire safety, emergency plan, and a smoking, drinking and eating policy. Prior to conducting each sorting event, sorters were given thorough safety instructions. No injuries or emergencies occurred at the site during the sorting events.

SECTION 3.0 RESULTS OF SUMMER WASTE SORTING EVENT

3.1 Statistical Validity

A 90% confidence level is generally chosen when conducting a solid waste sampling study because the results are considered reliable and a higher level of confidence would require a larger number of samples, which would not be cost effective. This WCS was designed to achieve statistically accurate results with a 90% confidence level for all generators.

3.1.1 Single Family Residential Loads

Table 3.1, *Statistical Validity of Single Family Residential Loads – Summer Event*, presents a summary of the weighted averages of percent by weight for each of the material categories in single-family loads sampled during the Pinellas County WCS summer sorting event and lists the lower and upper bounds of the 90% confidence interval. A relatively high level of statistical accuracy was achieved for most categories. Carpet, Household Hazardous Waste/Electronics/Fluorescent Bulbs, Other Ferrous, and Green Glass Containers achieved a lower degree of accuracy for single-family residential loads. This is typical for components of the waste stream such as these that are found in small amounts and are not disposed of regularly.

3.1.2 Multi-Family Residential Loads

Table 3.2, *Statistical Validity of Multi-Family Residential Loads – Summer Event*, shows a summary of the weighted averages of percent by weight for each of the material categories in multi-family residential loads sampled during the Pinellas County WCS summer sorting event and lists the lower and upper bounds of the 90% confidence interval. Most material categories achieved a relatively high degree of statistical accuracy for multi-family residential loads. However, Carpet, Household Hazardous Waste/Electronics/Fluorescent Bulbs, Other Ferrous, Other Non-Ferrous, Brown Glass Containers, Green Glass Containers, and Other Glass, and C&D Debris had lower degrees of accuracy, which is typically due to the small quantity of these materials in the waste stream and because these materials are not generally disposed of on a regular basis or by typical multi-family residential households. Food Waste also had a relatively low degree of accuracy, which may be due to some mixing of multi-

TABLE 3.1
STATISTICAL VALIDITY OF SINGLE FAMILY
RESIDENTIAL LOADS – SUMMER EVENT

| MATERIAL CATEGORIES | WEIGHTED AVERAGE | 90% CONFIDENCE LEVEL | |
|--------------------------------|-------------------------|-----------------------------|--------------|
| | | Lower | Upper |
| 1 NEWSPAPER | 9.9% | 7.8% | 12.0% |
| 2 CORRUGATED PAPER | 2.8% | 1.8% | 3.8% |
| 3 OFFICE PAPER | 4.2% | 2.1% | 6.3% |
| 4 MAGAZINES/GLOSSY | 4.2% | 3.0% | 5.4% |
| 5 OTHER PAPER | 16.7% | 13.3% | 20.2% |
| 6 HDPE CONTAINERS (#2) | 1.6% | 1.2% | 2.0% |
| 7 PET CONTAINERS (#1) | 0.9% | 0.7% | 1.1% |
| 8 OTHER PLASTICS | 8.3% | 7.3% | 9.4% |
| 9 TIN/STEEL CANS | 1.8% | 1.5% | 2.2% |
| 10 OTHER FERROUS | 0.6% | 0.2% | 1.0% |
| 11 ALUMINUM CANS | 1.1% | 0.7% | 1.5% |
| 12 OTHER NON-FERROUS | 0.4% | 0.3% | 0.5% |
| 13 CLEAR GLASS CONTAINERS | 1.3% | 0.9% | 1.7% |
| 14 BROWN GLASS CONTAINERS | 0.8% | 0.5% | 1.1% |
| 15 GREEN GLASS CONTAINERS | 0.5% | 0.1% | 0.9% |
| 16 OTHER GLASS | 0.2% | 0.1% | 0.2% |
| 17 TEXTILES | 3.2% | 2.3% | 4.1% |
| 18 CARPET | 2.0% | 0.8% | 3.2% |
| 19 HHW/ELECTRONICS/FLUORESCENT | 1.5% | 0.4% | 2.6% |
| 20 C&D DEBRIS | 3.2% | 1.9% | 4.5% |
| 21 YARD WASTE | 16.2% | 10.5% | 22.0% |
| 22 FOOD WASTE | 6.4% | 5.0% | 7.8% |
| 23 DIAPERS | 2.7% | 1.7% | 3.6% |
| 24 OTHER MISCELLANEOUS | 9.4% | 6.8% | 12.0% |
| TOTALS | 100.0% | | |

TABLE 3.2
STATISTICAL VALIDITY OF MULTI-FAMILY
RESIDENTIAL LOADS – SUMMER EVENT

| MATERIAL CATEGORIES | WEIGHTED AVERAGE | 90% CONFIDENCE LEVEL | |
|--------------------------------|------------------|----------------------|-------|
| | | Lower | Upper |
| 1 NEWSPAPER | 14.7% | 9.4% | 20.0% |
| 2 CORRUGATED PAPER | 3.4% | 2.6% | 4.2% |
| 3 OFFICE PAPER | 0.4% | 0.2% | 0.7% |
| 4 MAGAZINES/GLOSSY | 2.8% | 1.7% | 3.9% |
| 5 OTHER PAPER | 18.7% | 16.1% | 21.4% |
| 6 HDPE CONTAINERS (#2) | 1.4% | 0.8% | 1.9% |
| 7 PET CONTAINERS (#1) | 1.2% | 0.9% | 1.5% |
| 8 OTHER PLASTICS | 17.9% | 13.6% | 22.2% |
| 9 TIN/STEEL CANS | 1.3% | 1.0% | 1.6% |
| 10 OTHER FERROUS | 0.8% | 0.0% | 1.9% |
| 11 ALUMINUM CANS | 1.1% | 0.6% | 1.6% |
| 12 OTHER NON-FERROUS | 0.5% | 0.1% | 0.8% |
| 13 CLEAR GLASS CONTAINERS | 2.4% | 1.5% | 3.4% |
| 14 BROWN GLASS CONTAINERS | 1.3% | 0.2% | 2.5% |
| 15 GREEN GLASS CONTAINERS | 0.6% | 0.2% | 1.1% |
| 16 OTHER GLASS | 0.1% | 0.0% | 0.1% |
| 17 TEXTILES | 4.9% | 3.1% | 6.6% |
| 18 CARPET | 0.4% | 0.0% | 0.8% |
| 19 HHW/ELECTRONICS/FLUORESCENT | 0.8% | 0.4% | 1.3% |
| 20 C&D DEBRIS | 1.5% | 0.5% | 2.5% |
| 21 YARD WASTE | 1.0% | 0.7% | 1.3% |
| 22 FOOD WASTE | 7.5% | 1.4% | 13.7% |
| 23 DIAPERS | 1.2% | 0.6% | 1.8% |
| 24 OTHER MISCELLANEOUS | 14.1% | 8.2% | 20.0% |
| TOTALS | 100.0% | | |

family residential material with commercial waste because, according to waste haulers in Pinellas County, these two generators are often collected in the same trucks.

3.1.3 Commercial Loads

Table 3.3, *Statistical Validity of Commercial Loads – Summer Event*, shows the weighted average of the percent by weight for material categories in commercial loads sampled during the Pinellas County WCS summer sorting event. The table lists the lower and upper bounds of the 90% confidence interval. Most material categories achieved a relatively high degree of accuracy. However, Carpet, Household Hazardous Waste/Electronics/Fluorescent Bulbs, Yard Waste, and Other Ferrous achieved lower degrees of accuracy, which is typically due to the small quantity of these materials in the commercial waste stream and because these materials may not be disposed of by commercial entities on a regular basis.

3.2 Summer Waste Composition Results

This section summarizes the results of the summer waste composition sorting event. Results are presented by generator and for total summer composition of landfilled or incinerated waste.

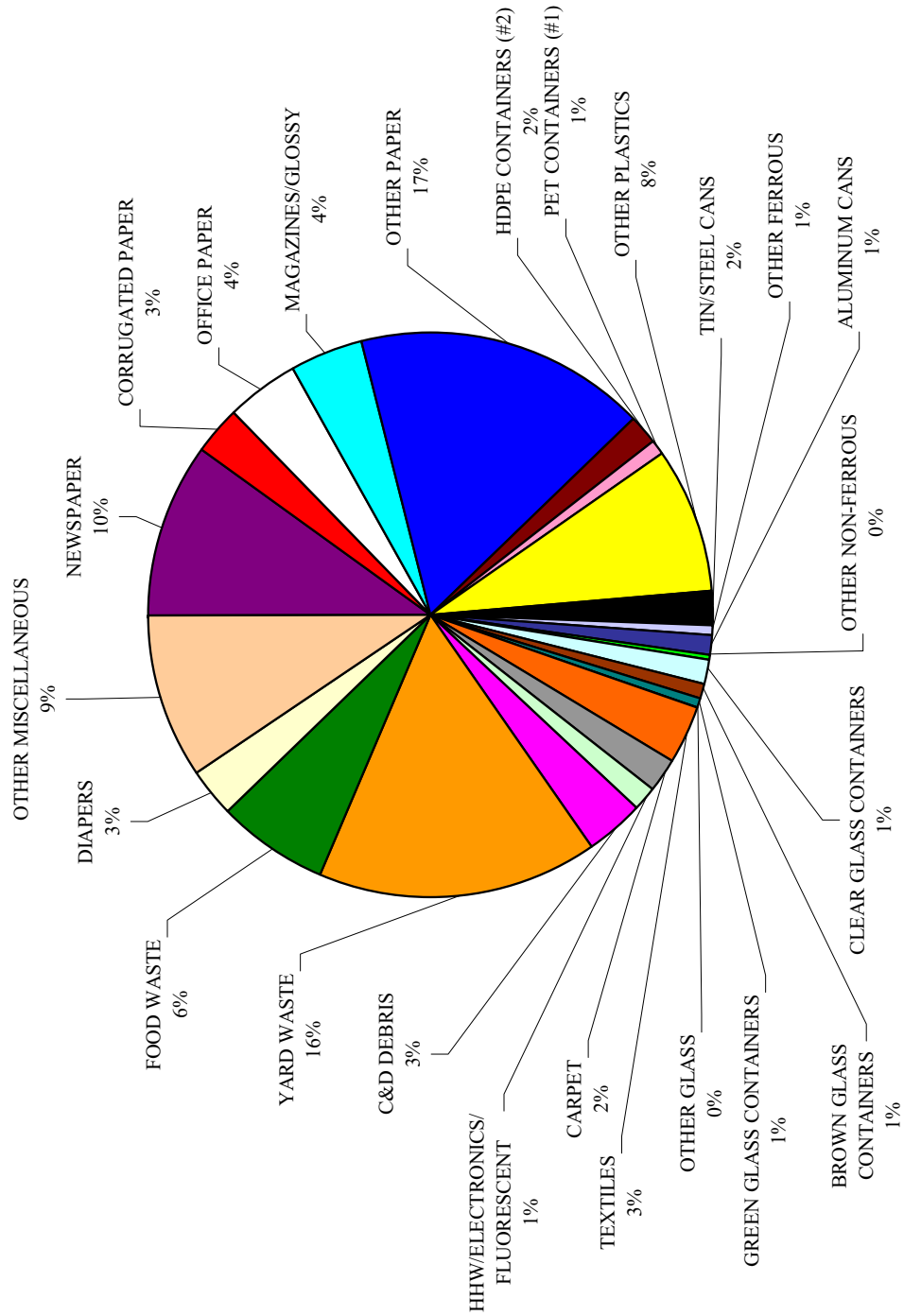
3.2.1 Single Family Residential Generators

Figure 3.1, *Percent Composition of Single Family Residential Waste Landfilled or Incinerated – Summer Event*, presents the percent composition by weight of landfilled or incinerated waste generated by single family residences during the summer sorting event. The following categories comprised relatively large portions of the single family residential waste stream during the summer:

- Other Paper 16.7 percent
- Yard Waste 16.2 percent
- Newspaper 9.9 percent
- Other Miscellaneous 9.4 percent
- Other Plastics 8.3 percent
- Food Waste 6.4 percent
- Office Paper 4.2 percent
- Magazines/Glossy Paper 4.2 percent

| TABLE 3.3 | | | |
|--|-------------------------|-----------------------------|--------------|
| STATISTICAL VALIDITY OF COMMERCIAL LOADS – SUMMER EVENT | | | |
| MATERIAL CATEGORIES | WEIGHTED AVERAGE | 90% CONFIDENCE LEVEL | |
| | | Lower | Upper |
| 1 NEWSPAPER | 5.5% | 4.2% | 6.9% |
| 2 CORRUGATED PAPER | 5.3% | 4.0% | 6.6% |
| 3 OFFICE PAPER | 2.6% | 1.8% | 3.3% |
| 4 MAGAZINES/GLOSSY | 5.8% | 3.5% | 8.0% |
| 5 OTHER PAPER | 21.8% | 19.4% | 24.3% |
| 6 HDPE CONTAINERS (#2) | 1.5% | 1.0% | 2.1% |
| 7 PET CONTAINERS (#1) | 1.4% | 1.1% | 1.8% |
| 8 OTHER PLASTICS | 12.4% | 11.2% | 13.6% |
| 9 TIN/STEEL CANS | 1.1% | 0.9% | 1.3% |
| 10 OTHER FERROUS | 2.0% | 0.6% | 3.4% |
| 11 ALUMINUM CANS | 0.8% | 0.6% | 1.0% |
| 12 OTHER NON-FERROUS | 0.5% | 0.3% | 0.7% |
| 13 CLEAR GLASS CONTAINERS | 2.5% | 1.9% | 3.1% |
| 14 BROWN GLASS CONTAINERS | 2.9% | 1.5% | 4.3% |
| 15 GREEN GLASS CONTAINERS | 0.7% | 0.4% | 1.0% |
| 16 OTHER GLASS | 0.4% | 0.2% | 0.5% |
| 17 | 2.1% | 1.5% | 2.6% |
| 18 CARPET | 0.4% | 0.1% | 0.7% |
| 19 HHW/ELECTRONICS/FLUORESCENT | 2.5% | 0.9% | 4.0% |
| 20 C&D DEBRIS | 5.9% | 3.1% | 8.6% |
| 21 YARD WASTE | 2.1% | 0.4% | 3.8% |
| 22 FOOD WASTE | 9.2% | 7.1% | 11.2% |
| 23 DIAPERS | 1.9% | 0.9% | 2.8% |
| 24 OTHER MISCELLANEOUS | 8.7% | 7.4% | 10.0% |
| TOTALS | 103.5% | | |

Figure 3.1 Percent Composition of Single Family Residential Waste Landfilled or Incinerated - Summer Event



- C&D Debris 3.2 percent
- Textiles 3.2 percent

3.2.2 Multi-Family Residential Generators

Figure 3.2, *Percent Composition of Multi-Family Residential Waste Landfilled or Incinerated – Summer Event*, shows the percent composition by weight of multi-family residential waste landfilled or incinerated during the summer sorting event. The following categories comprised relatively large portions of the multi-family residential waste stream during the summer:

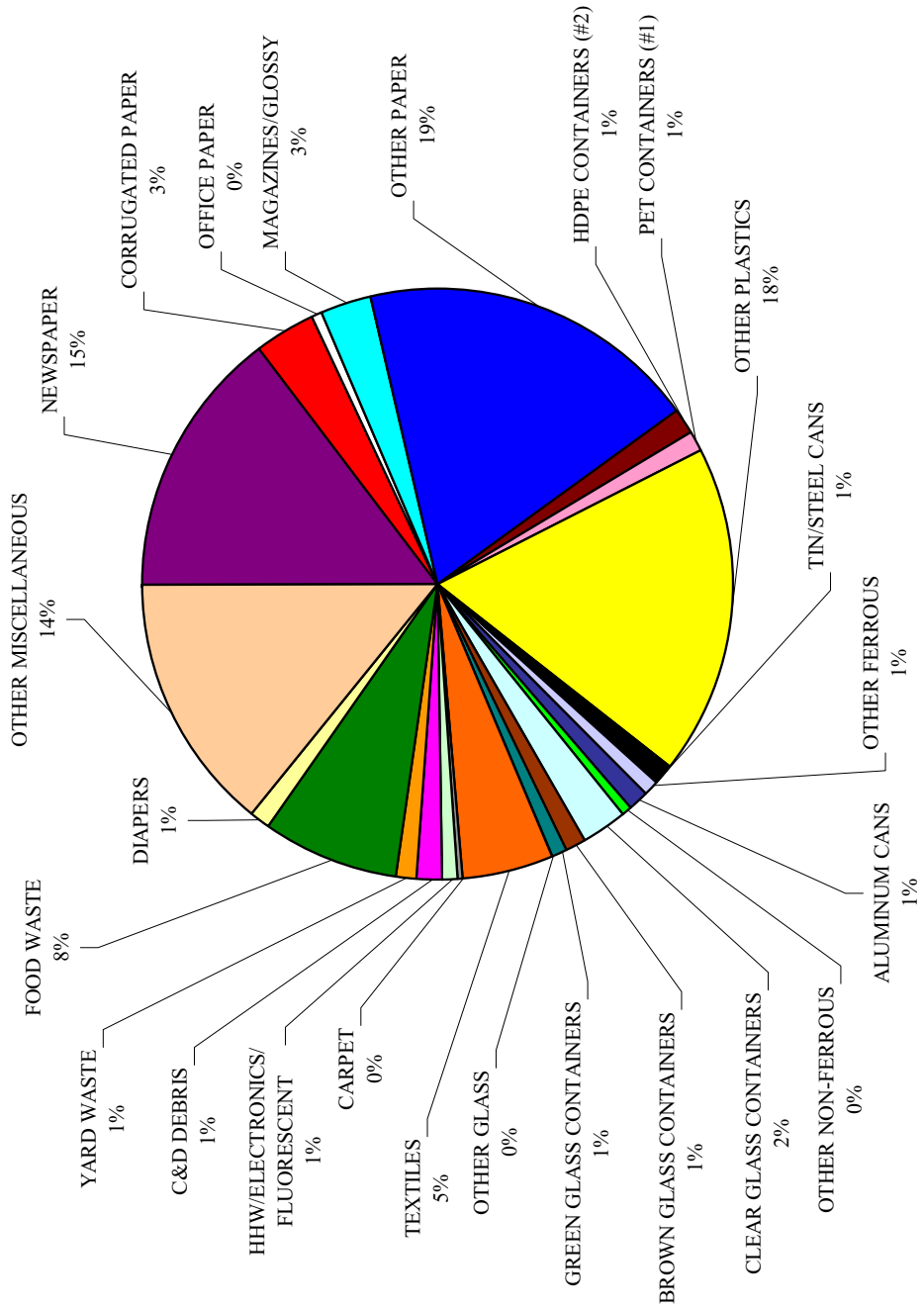
- Other Paper 18.7 percent
- Other Plastics 17.9 percent
- Newspaper 14.7 percent
- Other Miscellaneous 14.1 percent
- Food Waste 7.5 percent
- Textiles 4.9 percent
- Corrugated Paper 3.4 percent

3.2.3 Commercial Generators

Figure 3.3, *Percent Composition of Commercial Waste Landfilled or Incinerated – Summer Event*, presents the percent composition by weight of commercially-generated waste landfilled or incinerated during the summer sorting event. The following categories comprised relatively large portions of the commercial waste stream during the summer:

- Other Paper 21.8 percent
- Other Plastics 12.4 percent
- Food Waste 9.2 percent
- Other Miscellaneous 8.7 percent
- C&D Debris 5.9 percent
- Magazines/Glossy Paper 5.8 percent
- Newspaper 5.5 percent
- Corrugated Paper 5.3 percent

Figure 3.2 Percent Composition of Multi-Family Residential Waste Landfilled or Incinerated - Summer Event



According to observations by the sorting supervisor, the HHW/Electronics/Fluorescent category usually consisted of electronic devices, such as hairdryers and computer equipment.

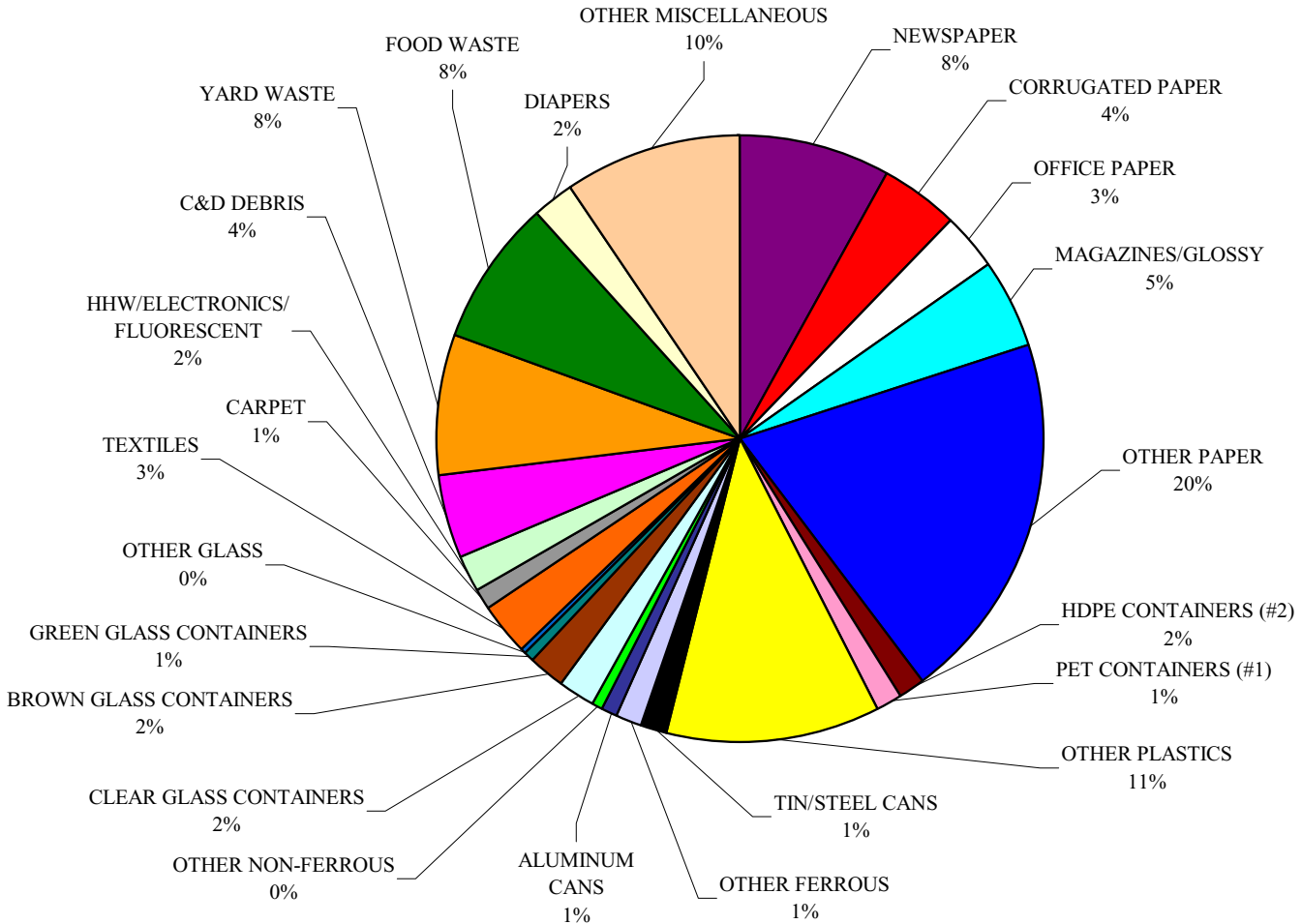
3.2.4 Composition of Total Waste Landfilled or Incinerated – Summer Event

Figure 3.4, *Percent Composition of Total Landfilled or Incinerated Waste – Summer Event*, shows the percent composition by weight of waste landfilled or incinerated during the summer, including single family residential, multi-family residential, and commercial waste. The following categories comprised relatively large portions of the landfilled or incinerated waste stream during the summer:

- Other Paper 19.5 percent
- Other Plastics 11.4 percent
- Other Miscellaneous 9.5 percent
- Newspaper 8.2 percent
- Food Waste 7.9 percent
- Yard Waste 7.5 percent
- Magazines/Glossy Paper 4.8 percent
- C&D Debris 4.4 percent
- Corrugated Paper 4.1 percent
- Office Paper 3.0 percent

Other Paper and Other Plastics together comprised over 30 percent of the waste stream landfilled or incinerated during the summer sorting event. Approximately 28 percent of the summer waste stream was comprised of materials that could have been recycled through the County’s existing recycling programs.

Figure 3.4 Percent Composition of Total Landfilled or Incinerated Waste - Summer Event



SECTION 4.0 RESULTS OF WINTER WASTE SORTING EVENT

4.1 Statistical Validity

KCI used a 90% confidence level as a measure of statistical validity for the results of the winter waste sorting event in Pinellas County. The study was designed to achieve statistically accurate results with a 90% confidence level for all generators.

4.1.1 Single Family Residential Loads

Table 4.1, *Statistical Validity of Single Family Residential Loads – Winter Event*, presents a summary of the weighted averages of percent by weight for each of the material categories in single family loads sampled during the Pinellas County WCS winter sorting event and lists the lower and upper bounds of the 90% confidence interval. A relatively high level of statistical accuracy was achieved for most categories. Carpet, Other Glass, C&D Debris, Electronics, Household Hazardous Waste, Other Ferrous and Other Non-Ferrous achieved lower degrees of accuracy, which is typically due to the small quantity of these materials in the single family residential waste stream and because these materials may not be disposed of by single families on a regular basis. Two residential loads from the hand unload area were considered outliers because of high amounts of office paper, HDPE containers, and C&D Debris. Therefore, they were not used in the final analysis of single family residential loads sampled during the winter event or the total annual waste composition.

4.1.2 Multi-Family Residential Loads

Table 4.2, *Statistical Validity of Multi-Family Residential Loads – Winter Event*, presents a summary of the weighted averages of percent by weight for each of the material categories in multi-family residential loads sampled during the Pinellas County WCS winter sorting event and lists the lower and upper bounds of the 90% confidence interval. Categories that achieved a relatively high degree of accuracy include: Other Paper, PET Containers, Film Plastic, Other Plastics, Tin/Steel Cans, Food Waste, and Other Miscellaneous. Other categories achieved lower degrees of accuracy, most likely because of the small quantity of some materials in the multi-family residential waste stream, because some materials may not be disposed of on a regular basis by families in multi-family housing, and because pure multi-

**TABLE 4.1
STATISTICAL VALIDITY OF SINGLE FAMILY
RESIDENTIAL LOADS – WINTER EVENT**

| MATERIAL CATEGORIES | WEIGHTED AVERAGE | 90% CONFIDENCE LEVEL | |
|------------------------------|------------------|----------------------|-------|
| | | Lower | Upper |
| 1 NEWSPAPER | 7.9% | 5.3% | 10.4% |
| 2 CORRUGATED PAPER | 2.5% | 1.5% | 3.5% |
| 3 OFFICE PAPER | 3.9% | 2.6% | 5.2% |
| 4 MAGAZINES/GLOSSY | 3.1% | 2.0% | 4.2% |
| 5 OTHER PAPER | 14.5% | 12.0% | 17.0% |
| 6 HDPE CONTAINERS (#2) | 0.7% | 0.6% | 0.9% |
| 7 PET CONTAINERS (#1) | 0.9% | 0.7% | 1.1% |
| 8 FILM PLASTIC | 3.1% | 2.7% | 3.6% |
| 9 OTHER PLASTICS | 3.1% | 2.5% | 3.7% |
| 10 TIN/STEEL CANS | 1.2% | 1.0% | 1.4% |
| 11 OTHER FERROUS | 1.6% | 0.7% | 2.6% |
| 12 ALUMINUM CANS | 0.5% | 0.3% | 0.8% |
| 13 OTHER NON-FERROUS | 0.5% | 0.2% | 0.7% |
| 14 CLEAR GLASS CONTAINERS | 1.1% | 0.8% | 1.5% |
| 15 BROWN GLASS CONTAINERS | 1.6% | 0.8% | 2.4% |
| 16 GREEN GLASS CONTAINERS | 0.8% | 0.4% | 1.2% |
| 17 OTHER GLASS | 0.3% | 0.0% | 0.5% |
| 18 TEXTILES | 2.3% | 1.3% | 3.2% |
| 19 CARPET | 1.3% | 0.3% | 2.4% |
| 20 HOUSEHOLD HAZARDOUS WASTE | 0.9% | 0.0% | 1.7% |
| 21 ELECTRONICS | 1.7% | 0.7% | 2.6% |
| 22 C&D DEBRIS | 3.1% | 0.9% | 5.3% |
| 23 YARD WASTE | 13.7% | 8.9% | 18.5% |
| 24 FOOD WASTE | 8.2% | 6.9% | 9.6% |
| 25 DIAPERS | 2.2% | 1.4% | 3.1% |
| 26 OTHER MISCELLANEOUS | 19.4% | 13.0% | 25.7% |
| TOTALS | 100.0% | | |

**TABLE 4.2
STATISTICAL VALIDITY OF MULTI-FAMILY
RESIDENTIAL LOADS – WINTER EVENT**

| MATERIAL CATEGORIES | WEIGHTED AVERAGE | 90% CONFIDENCE LEVEL | |
|------------------------------|------------------|----------------------|-------|
| | | Lower | Upper |
| 1 NEWSPAPER | 5.9% | 0.9% | 10.8% |
| 2 CORRUGATED PAPER | 6.9% | 1.9% | 11.9% |
| 3 OFFICE PAPER | 6.4% | 0.9% | 11.8% |
| 4 MAGAZINES/GLOSSY | 2.6% | 0.4% | 4.8% |
| 5 OTHER PAPER | 20.4% | 15.9% | 24.8% |
| 6 HDPE CONTAINERS (#2) | 1.9% | 0.0% | 4.4% |
| 7 PET CONTAINERS (#1) | 0.7% | 0.5% | 0.9% |
| 8 FILM PLASTIC | 5.2% | 4.0% | 6.4% |
| 9 OTHER PLASTICS | 8.1% | 4.8% | 11.4% |
| 10 TIN/STEEL CANS | 1.9% | 0.9% | 2.9% |
| 11 OTHER FERROUS | 1.7% | 0.0% | 3.6% |
| 12 ALUMINUM CANS | 0.4% | 0.1% | 0.7% |
| 13 OTHER NON-FERROUS | 0.7% | 0.3% | 1.1% |
| 14 CLEAR GLASS CONTAINERS | 2.9% | 0.9% | 4.9% |
| 15 BROWN GLASS CONTAINERS | 1.9% | 0.3% | 3.5% |
| 16 GREEN GLASS CONTAINERS | 0.1% | 0.0% | 0.1% |
| 17 OTHER GLASS | 0.4% | 0.0% | 0.8% |
| 18 TEXTILES | 0.4% | 0.0% | 0.8% |
| 19 CARPET | 0.1% | 0.0% | 0.3% |
| 20 HOUSEHOLD HAZARDOUS WASTE | 0.1% | 0.0% | 0.2% |
| 21 ELECTRONICS | 0.2% | 0.0% | 0.4% |
| 22 C&D DEBRIS | 3.7% | 0.0% | 8.6% |
| 23 YARD WASTE | 2.1% | 0.0% | 5.1% |
| 24 FOOD WASTE | 11.5% | 8.7% | 14.4% |
| 25 DIAPERS | 2.7% | 0.5% | 4.9% |
| 26 OTHER MISCELLANEOUS | 11.3% | 8.5% | 14.0% |
| TOTALS | 100.0% | | |

family residential loads were infrequent and the final sample size was consequently lower than desired.

4.1.3 Commercial Loads

Table 4.3, *Statistical Validity of Commercial Loads – Winter Event*, presents a summary of the weighted averages of percent by weight for each of the material categories in commercial loads sampled during the Pinellas County WCS winter sorting event and lists the lower and upper bounds of the 90% confidence interval. The following categories achieved relatively high degrees of accuracy: Other Paper, Office Paper, HDPE Containers, Film Plastic, Other Plastic, Aluminum Cans, Other Non-Ferrous, C&D Debris, Food Waste, and Other Miscellaneous. Other categories did not achieve a high degree of accuracy. This may be due to a large amount of variability in the waste, which may be seasonal. Some categories likely had a low degree of accuracy because they represent small portions of the commercial waste stream and may not be regularly disposed of by commercial entities.

4.2 Winter Waste Composition Results

This section summarizes the results of the winter waste composition sorting event. Results are presented by generator and for total waste landfilled or incinerated during the winter sorting event.

4.2.1 Single Family Residential Generators

Figure 4.1, *Percent Composition of Single Family Residential Waste Landfilled or Incinerated – Winter Event*, presents the percent composition by weight of landfilled or incinerated waste generated by single family residences during the winter sorting event. The following categories comprised relatively large portions of the single family residential waste stream during the winter:

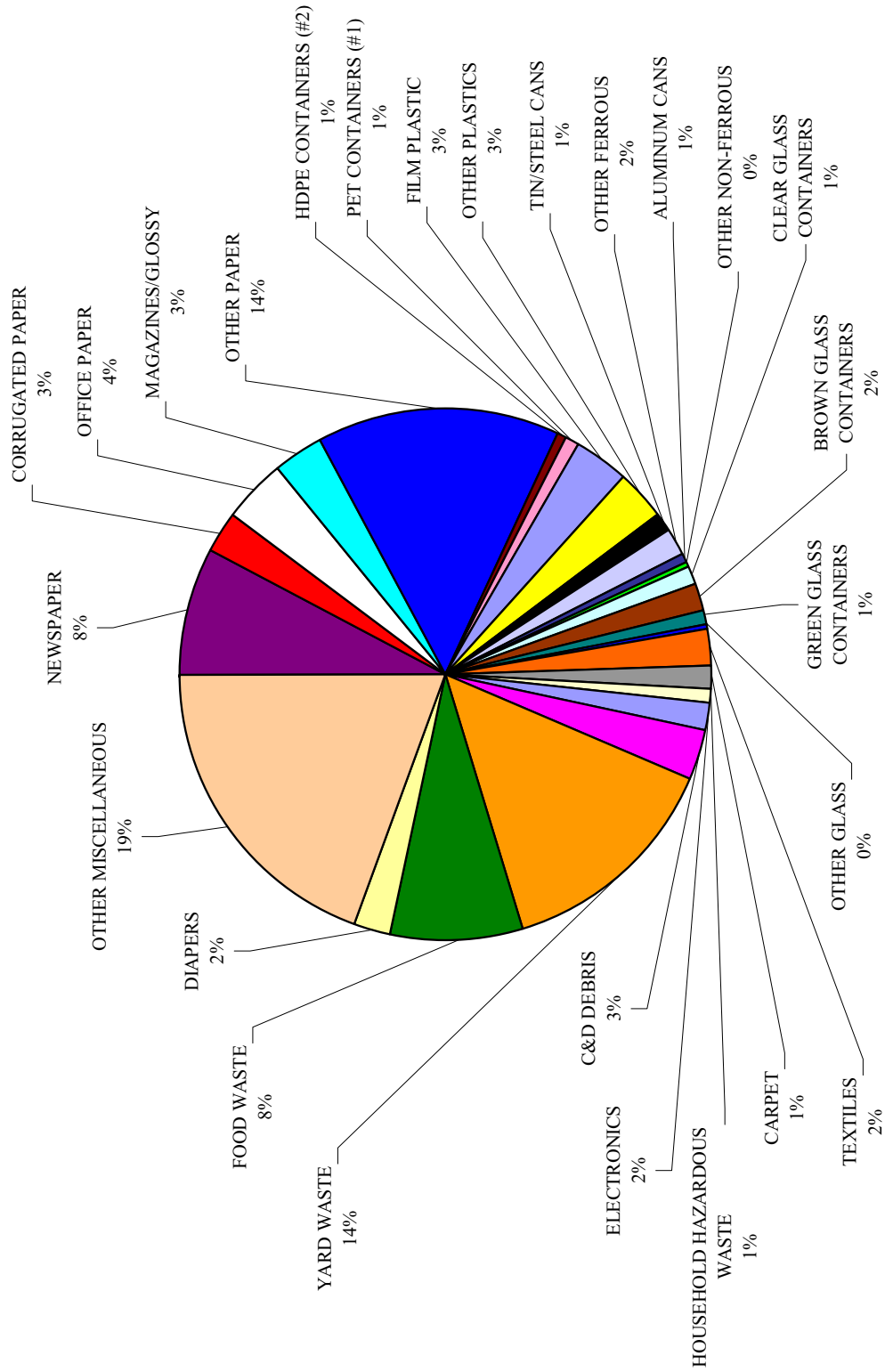
- Other Miscellaneous 19.4 percent
- Other Paper 14.5 percent
- Yard Waste 13.7 percent
- Food Waste 8.2 percent
- Newspaper 7.9 percent
- Office Paper 3.9 percent
- C&D Debris 3.1 percent

**TABLE 4.3
STATISTICAL VALIDITY OF COMMERCIAL LOADS – WINTER EVENT**

| MATERIAL CATEGORIES | WEIGHTED AVERAGE | 90% CONFIDENCE LEVEL | |
|------------------------------|-------------------------|-----------------------------|--------------|
| | | Lower | Upper |
| 1 NEWSPAPER | 3.1% | 0.8% | 5.4% |
| 2 CORRUGATED PAPER | 4.6% | 1.7% | 7.5% |
| 3 OFFICE PAPER | 2.1% | 1.0% | 3.1% |
| 4 MAGAZINES/GLOSSY | 2.8% | 0.5% | 5.1% |
| 5 OTHER PAPER | 9.0% | 6.5% | 11.4% |
| 6 HDPE CONTAINERS (#2) | 0.5% | 0.3% | 0.7% |
| 7 PET CONTAINERS (#1) | 1.0% | 0.5% | 1.6% |
| 8 FILM PLASTIC | 3.1% | 2.2% | 4.1% |
| 9 OTHER PLASTICS | 3.7% | 3.0% | 4.4% |
| 10 TIN/STEEL CANS | 0.6% | 0.3% | 0.9% |
| 11 OTHER FERROUS | 3.2% | 0.4% | 6.1% |
| 12 ALUMINUM CANS | 0.4% | 0.2% | 0.5% |
| 13 OTHER NON-FERROUS | 0.1% | 0.0% | 0.1% |
| 14 CLEAR GLASS CONTAINERS | 0.8% | 0.4% | 1.3% |
| 15 BROWN GLASS CONTAINERS | 0.6% | 0.2% | 1.0% |
| 16 GREEN GLASS CONTAINERS | 0.2% | 0.0% | 0.4% |
| 17 OTHER GLASS | 0.2% | 0.0% | 0.3% |
| 18 TEXTILES | 1.8% | 0.6% | 2.9% |
| 19 CARPET | 2.2% | 0.5% | 3.9% |
| 20 HOUSEHOLD HAZARDOUS WASTE | 1.3% | 0.4% | 2.2% |
| 21 ELECTRONICS | 4.3% | 1.8% | 6.8% |
| 22 C&D DEBRIS | 15.1% | 9.9% | 20.4% |
| 23 YARD WASTE | 6.2% | 2.0% | 10.5% |
| 24 FOOD WASTE | 11.6% | 6.9% | 16.3% |
| 25 DIAPERS | 2.4% | 0.8% | 4.0% |
| 26 OTHER MISCELLANEOUS | 19.0% | 14.1% | 24.0% |
| TOTALS | 100.0% | | |

Section 4.0, Results of Winter Waste Sorting Event

Figure 4.1 Percent Composition of Single Family Residential Waste Landfilled or Incinerated - Winter Event



- Film Plastic 3.1 percent
- Other Plastics 3.1 percent
- Magazines/Glossy Paper 3.1 percent

4.2.2 Multi-Family Residential Generators

Figure 4.2, *Percent Composition of Multi-Family Residential Waste Landfilled or Incinerated – Winter Event*, presents the percent composition by weight of landfilled or incinerated waste generated by multi-family residences during the winter sorting event. The following categories comprised relatively large portions of the multi-family residential waste stream during the winter:

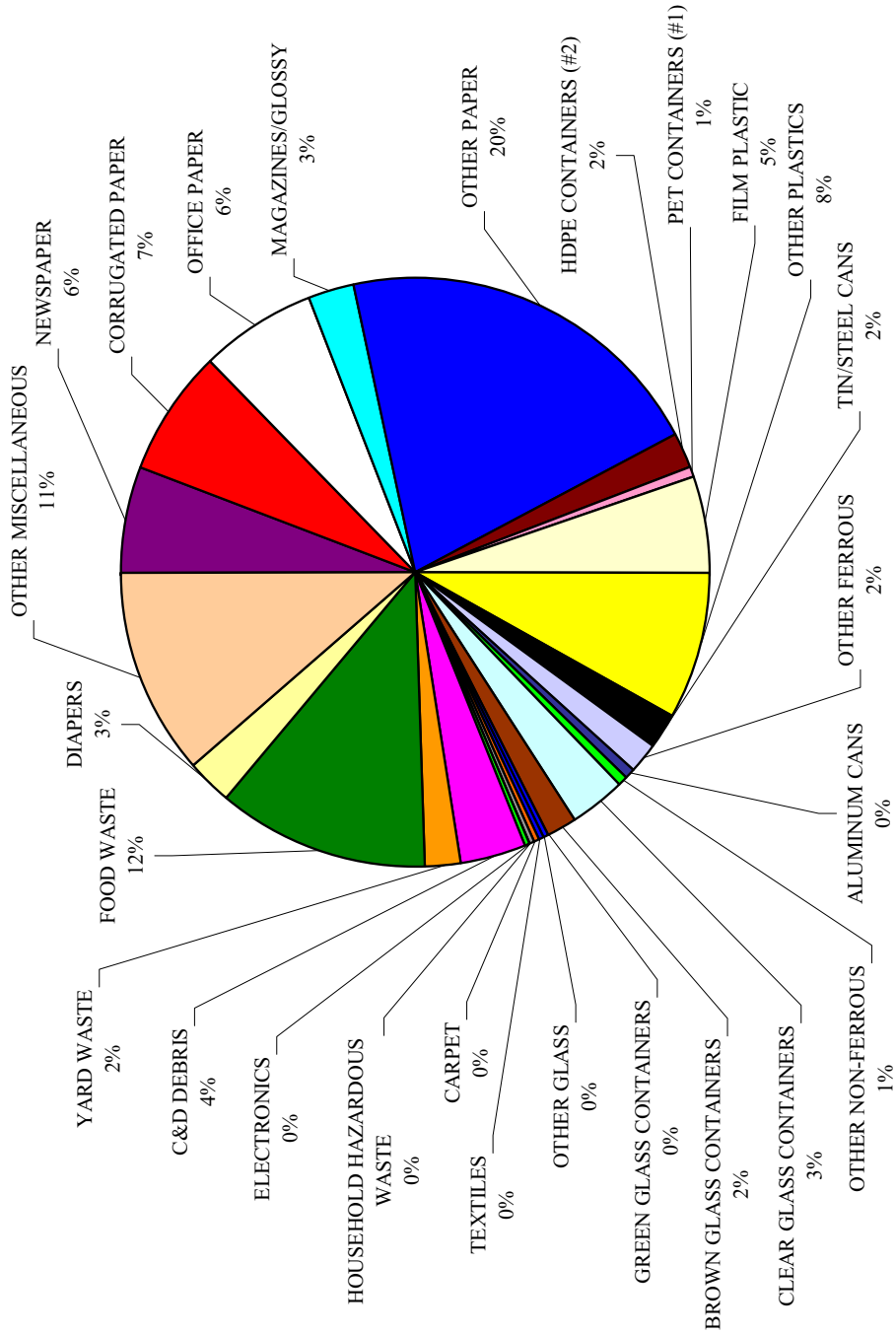
- Other Paper 20.4 percent
- Food Waste 11.5 percent
- Other Miscellaneous 11.3 percent
- Other Plastics 8.1 percent
- Corrugated Paper 6.9 percent
- Office Paper 6.4 percent
- Newspaper 5.9 percent
- Film Plastic 5.2 percent
- C&D Debris 3.7 percent

4.2.3 Commercial Generators

Figure 4.3, *Percent Composition of Commercial Waste Landfilled or Incinerated – Winter Event*, presents the percent composition by weight of landfilled or incinerated waste generated by commercial entities during the winter sorting event. The following categories comprised relatively large portions of the commercial waste stream during the winter:

- Other Miscellaneous 19.0 percent
- C&D Debris 15.1 percent
- Food Waste 11.6 percent
- Other Paper 9.0 percent
- Yard Waste 6.2 percent
- Corrugated Paper 4.6 percent

Figure 4.2 Percent Composition of Multi-Family Residential Waste Landfilled or Incinerated - Winter Event



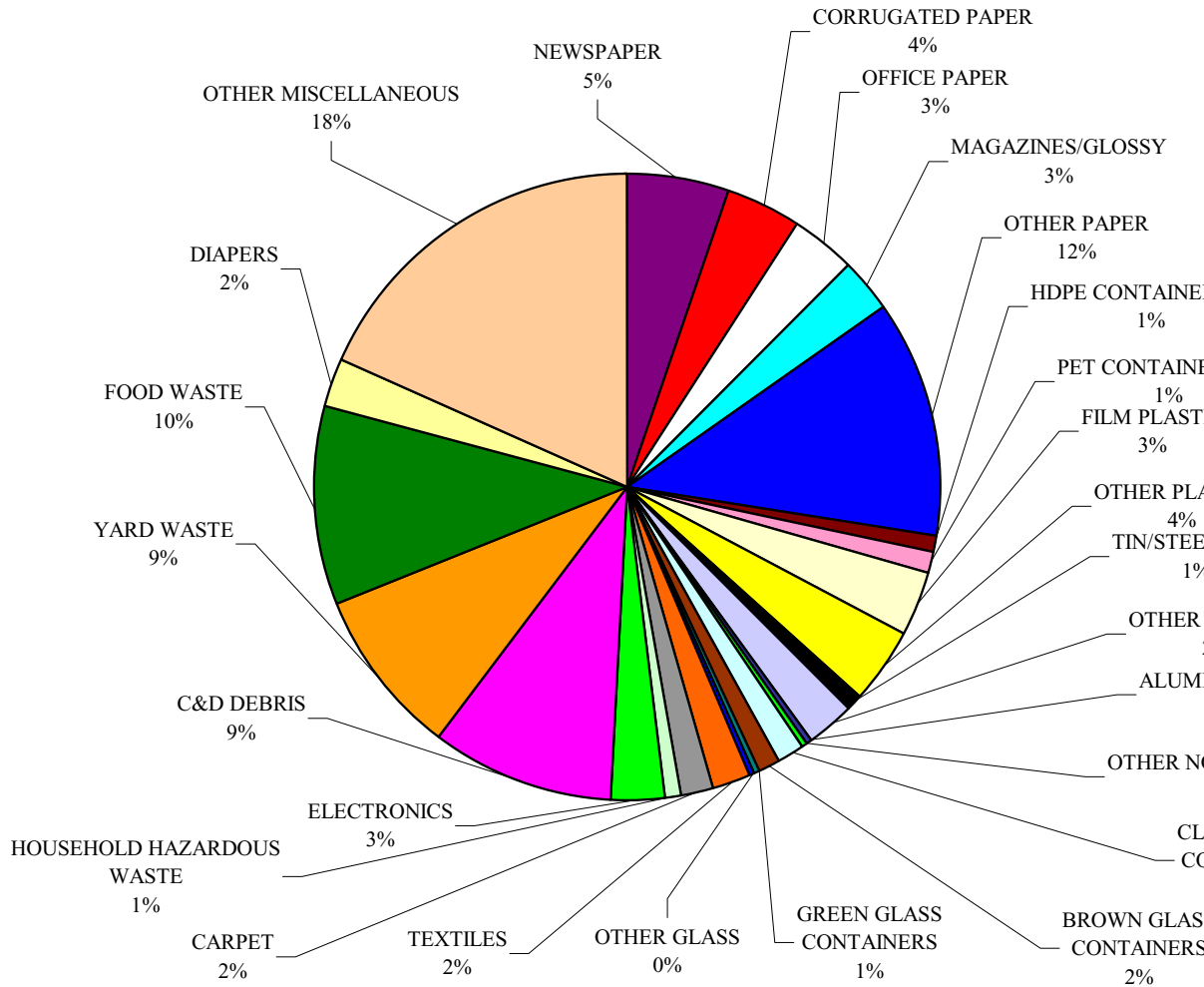
- Electronics 4.3 percent
- Other Plastics 3.7 percent
- Other Ferrous 3.2 percent
- Film Plastic 3.1 percent
- Newspaper 3.1 percent

4.2.4 Composition of Total Waste Landfilled or Incinerated – Winter Event

Figure 4.4, *Percent Composition of Total Waste Landfilled or Incinerated – Winter Event*, shows the percent composition by weight of waste landfilled or incinerated during the winter, including single family residential, multi-family residential, and commercial waste. The following categories comprised relatively large portions of landfilled or incinerated waste during the winter:

- Other Miscellaneous 18.4 percent
- Other Paper 12.3 percent
- Food Waste 10.3 percent
- C&D Debris 9.3 percent
- Yard Waste 8.7 percent
- Newspaper 5.2 percent
- Corrugated Paper 4.0 percent
- Other Plastics 3.9 percent
- Film Plastics 3.3 percent
- Office Paper 3.2 percent

Figure 4.4 Percent Composition of Total Waste Landfilled or Incinerated - Winter Event



5.3 Commercial Generators

The percent composition of the following materials in the commercial waste stream *decreased* significantly from summer to winter by the following percentage points:

- Other Paper 12.8 percent
- Other Plastics 5.6 percent
- Brown Glass Containers 2.3 percent
- Clear Glass Containers 1.7 percent
- HDPE Containers 1.0 percent
- Other Non-Ferrous 0.4 percent
- Aluminum Cans 0.4 percent

The percent composition of the following materials in the commercial waste stream *increased* from summer to winter by the following percentage points:

- Other Miscellaneous 10.3 percent
- C&D Debris 9.2 percent

5.4 Total Waste Landfilled or Incinerated

The percent composition of the following materials in the total waste stream landfilled or incinerated *decreased* from summer to winter by the following percentage points:

- Other Paper 7.1 percent
- Other Plastics 4.2 percent
- Aluminum Cans 0.5 percent

The percent composition of the following materials in the total waste stream entering the County's WTEF *increased* from summer to winter by the following percentage points:

- Other Miscellaneous 8.9 percent

The composition of the commercial waste stream changed most from summer to winter, possibly due to changes in business activity brought on by tourists, seasonal residents, and the

school season. Also, typically, more construction, demolition, and renovation activities occur during the cool winter months. Other seasonal differences, such as an increase in Textiles disposed of in the winter by multi-family residents and an increase in Other Miscellaneous in the commercial waste stream in winter, may be a result of “spring cleaning” activities in the winter months.

SECTION 6.0 RESULTS OF TWO-SEASON WASTE COMPOSITION STUDY

6.1 Statistical Validity

KCI used a 90% confidence level as a measure of statistical validity for the results of the two waste sorting events in Pinellas County. The study was designed to achieve statistically accurate results with a 90% confidence level for all generators.

6.1.1 Single Family Residential Loads

Table 6.1, *Statistical Validity of Single Family Residential Loads – Summer and Winter Events*, presents a summary of the weighted averages of percent by weight for each of the material categories in single family residential loads sampled during the Pinellas County WCS summer and winter sorting events. The table lists the lower and upper bounds of the 90% confidence interval. A relatively high level of statistical accuracy was achieved for all categories except Other Glass. Other Glass had a relatively low degree of accuracy, which is typical, because it represents a very small component of the single family residential waste stream.

6.1.2 Multi-Family Residential Loads

Table 6.2, *Statistical Validity of Multi-Family Residential Loads – Summer and Winter Events*, presents a summary of the weighted averages of percent by weight for each of the material categories in multi-family residential loads sampled during the Pinellas County WCS summer and winter sorting events. The table lists the lower and upper bounds of the 90% confidence interval. A relatively high level of statistical accuracy was achieved for most categories. Office Paper, HDPE Containers, Other Ferrous, Green Glass Containers, Other Glass, Carpet, C&D Debris, and Yard Waste achieved relatively low degrees of accuracy because of their relatively small contributions to the multi-family residential waste stream. Also, mixing of multi-family residential and commercial waste may have occurred, which particularly may have affected the accuracy of the Office Paper category.

**TABLE 6.1
STATISTICAL VALIDITY OF SINGLE FAMILY
RESIDENTIAL LOADS – SUMMER AND WINTER EVENTS**

| MATERIAL CATEGORIES | WEIGHTED AVERAGE | 90% CONFIDENCE LEVEL | |
|---------------------------|------------------|----------------------|-------|
| | | Lower | Upper |
| 1 NEWSPAPER | 8.7% | 7.0% | 10.4% |
| 2 CORRUGATED PAPER | 2.6% | 2.0% | 3.3% |
| 3 OFFICE PAPER | 4.0% | 2.9% | 5.1% |
| 4 MAGAZINES/GLOSSY | 3.5% | 2.7% | 4.3% |
| 5 OTHER PAPER | 15.4% | 13.4% | 17.4% |
| 6 HDPE CONTAINERS (#2) | 1.1% | 0.9% | 1.3% |
| 7 PET CONTAINERS (#1) | 0.9% | 0.8% | 1.1% |
| 8 OTHER PLASTICS | 7.1% | 6.5% | 7.7% |
| 9 TIN/STEEL CANS | 1.4% | 1.2% | 1.7% |
| 10 OTHER FERROUS | 1.2% | 0.6% | 1.8% |
| 11 ALUMINUM CANS | 0.8% | 0.5% | 1.0% |
| 12 OTHER NON-FERROUS | 0.4% | 0.3% | 0.6% |
| 13 CLEAR GLASS CONTAINERS | 1.2% | 0.9% | 1.5% |
| 14 BROWN GLASS CONTAINERS | 1.3% | 0.8% | 1.7% |
| 15 GREEN GLASS CONTAINERS | 0.7% | 0.4% | 1.0% |
| 16 OTHER GLASS | 0.2% | 0.1% | 0.3% |
| 17 TEXTILES | 2.7% | 2.0% | 3.3% |
| 18 CARPET | 1.6% | 0.8% | 2.4% |
| 19 HHW/ELECTRONICS | 2.1% | 1.3% | 2.9% |
| 20 C&D DEBRIS | 3.1% | 1.8% | 4.5% |
| 21 YARD WASTE | 14.8% | 11.3% | 18.3% |
| 22 FOOD WASTE | 7.5% | 6.5% | 8.4% |
| 23 DIAPERS | 2.4% | 1.8% | 3.0% |
| 24 OTHER MISCELLANEOUS | 15.2% | 11.3% | 19.0% |
| TOTALS | 100.0% | | |

**TABLE 6.2
STATISTICAL VALIDITY OF MULTI-FAMILY
RESIDENTIAL LOADS – SUMMER AND WINTER EVENTS**

| MATERIAL CATEGORIES | WEIGHTED AVERAGE | 90% CONFIDENCE LEVEL | |
|---------------------------|------------------|----------------------|-------|
| | | Lower | Upper |
| 1 NEWSPAPER | 11.1% | 7.4% | 14.8% |
| 2 CORRUGATED PAPER | 4.8% | 2.7% | 6.9% |
| 3 OFFICE PAPER | 2.9% | 0.4% | 5.4% |
| 4 MAGAZINES/GLOSSY | 2.7% | 1.7% | 3.7% |
| 5 OTHER PAPER | 19.4% | 17.2% | 21.6% |
| 6 HDPE CONTAINERS (#2) | 1.6% | 0.6% | 2.6% |
| 7 PET CONTAINERS (#1) | 1.0% | 0.8% | 1.2% |
| 8 OTHER PLASTICS | 16.0% | 13.5% | 18.6% |
| 9 TIN/STEEL CANS | 1.6% | 1.1% | 2.0% |
| 10 OTHER FERROUS | 1.1% | 0.2% | 2.0% |
| 11 ALUMINUM CANS | 0.8% | 0.5% | 1.1% |
| 12 OTHER NON-FERROUS | 0.6% | 0.3% | 0.8% |
| 13 CLEAR GLASS CONTAINERS | 2.6% | 1.7% | 3.5% |
| 14 BROWN GLASS CONTAINERS | 1.6% | 0.8% | 2.4% |
| 15 GREEN GLASS CONTAINERS | 0.4% | 0.1% | 0.7% |
| 16 OTHER GLASS | 0.2% | 0.0% | 0.4% |
| 17 TEXTILES | 3.1% | 1.8% | 4.3% |
| 18 CARPET | 0.3% | 0.1% | 0.5% |
| 19 HHW/ELECTRONICS | 0.6% | 0.3% | 0.9% |
| 20 C&D DEBRIS | 2.4% | 0.4% | 4.4% |
| 21 YARD WASTE | 1.4% | 0.2% | 2.7% |
| 22 FOOD WASTE | 9.2% | 6.1% | 12.3% |
| 23 DIAPERS | 1.8% | 0.9% | 2.7% |
| 24 OTHER MISCELLANEOUS | 12.9% | 9.9% | 15.9% |
| TOTALS | 100.0% | | |

6.1.3 Commercial Loads

Table 6.3, *Statistical Validity of Commercial Loads – Summer and Winter Events*, presents a summary of the weighted averages of percent by weight for each of the material categories in commercial loads sampled during the Pinellas County WCS summer and winter sorting events. The table lists the lower and upper bounds of the 90% confidence interval. Most categories achieved a high level of statistical accuracy. Other Ferrous and Carpet achieved a lower degree of accuracy, likely because these materials typically represent a small component of the commercial waste stream that is not regularly disposed of.

6.2 Two-Season Waste Composition Results

This section combines and summarizes the results of the summer and winter waste composition sorting events. Results are presented by generator and for total annual composition of waste landfilled or incinerated.

6.2.1 Single Family Residential Generators

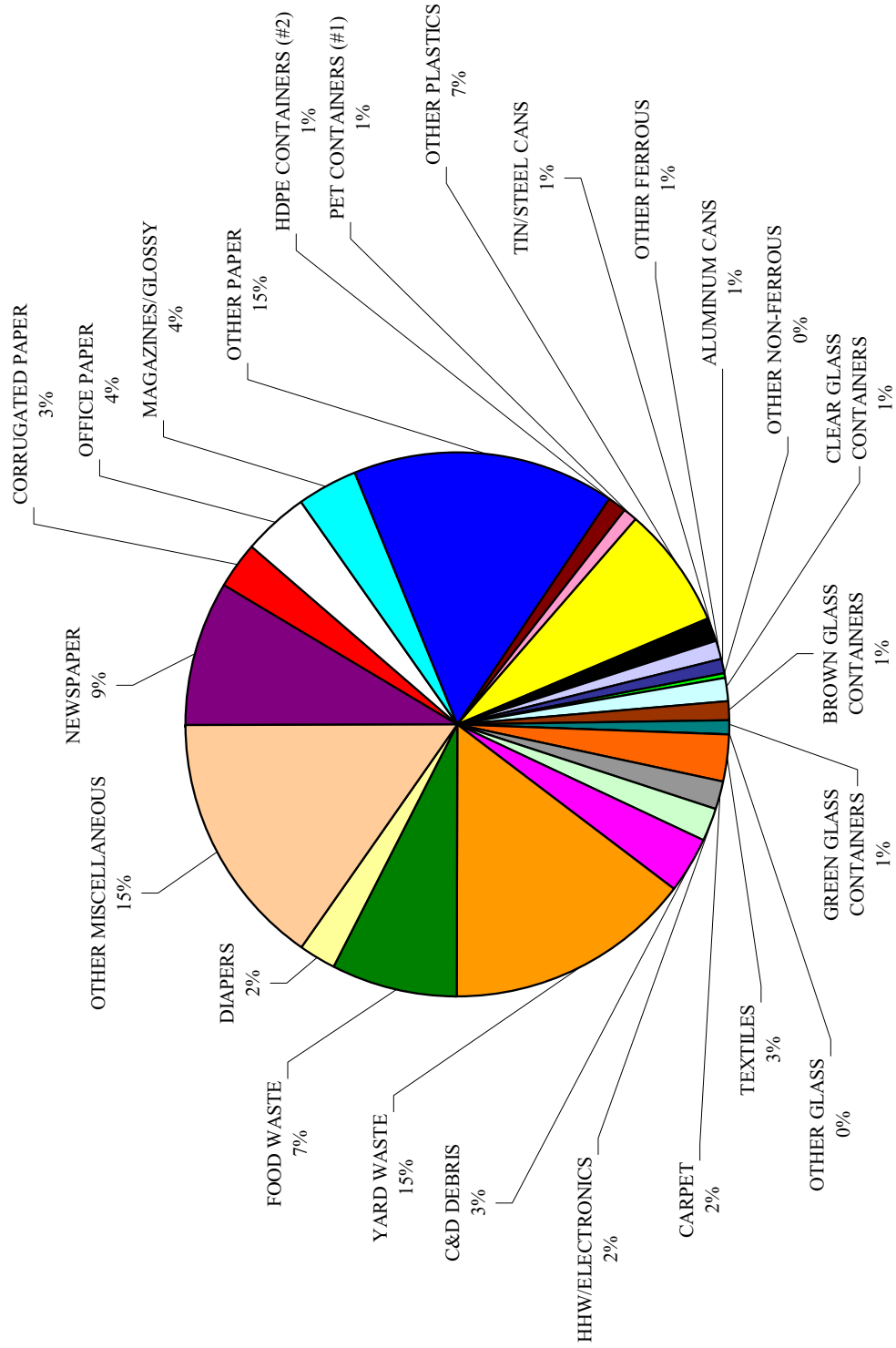
Figure 6.1, *Percent Composition of Single Family Residential Waste Landfilled or Incinerated – Summer and Winter Events*, presents the percent composition by weight of waste generated by single family residences landfilled or incinerated during the summer and winter sorting events. The following categories comprised relatively large portions of the single family residential waste stream:

- Other Paper 15.4 percent
- Other Miscellaneous 15.2 percent
- Yard Waste 14.8 percent
- Newspaper 8.7 percent
- Food Waste 7.5 percent
- Other Plastics 7.1 percent
- Office Paper 4.0 percent
- Magazines/Glossy Paper 3.5 percent
- C&D Debris 3.1 percent

TABLE 6.3
STATISTICAL VALIDITY OF COMMERCIAL LOADS –
SUMMER AND WINTER EVENTS

| MATERIAL CATEGORIES | WEIGHT ED AVERAGES | 90% CONFIDENCE LEVEL | |
|---------------------------|--------------------------|----------------------|-------|
| | | Lower | Upper |
| 1 NEWSPAPER | 4.3% | 3.1% | 5.6% |
| 2 CORRUGATED PAPER | 5.0% | 3.5% | 6.4% |
| 3 OFFICE PAPER | 2.3% | 1.7% | 2.9% |
| 4 MAGAZINES/GLOSSY | 4.3% | 2.7% | 5.9% |
| 5 OTHER PAPER | 15.5% | 13.3% | 17.7% |
| 6 HDPE CONTAINERS (#2) | 1.1% | 0.7% | 1.4% |
| 7 PET CONTAINERS (#1) | 1.2% | 0.9% | 1.5% |
| 8 OTHER PLASTICS | 9.7% | 8.6% | 10.7% |
| 9 TIN/STEEL CANS | 0.8% | 0.7% | 1.0% |
| 10 OTHER FERROUS | 2.6% | 1.1% | 4.1% |
| 11 ALUMINUM CANS | 0.6% | 0.5% | 0.7% |
| 12 OTHER NON-FERROUS | 0.3% | 0.2% | 0.4% |
| 13 CLEAR GLASS CONTAINERS | 1.7% | 1.3% | 2.1% |
| 14 BROWN GLASS CONTAINERS | 1.8% | 1.0% | 2.6% |
| 15 GREEN GLASS CONTAINERS | 0.5% | 0.3% | 0.6% |
| 16 OTHER GLASS | 0.3% | 0.2% | 0.4% |
| 17 TEXTILES | 1.9% | 1.3% | 2.5% |
| 18 CARPET | 1.3% | 0.5% | 2.1% |
| 19 HHW/ELECTRONICS | 4.0% | 2.4% | 5.6% |
| 20 C&D DEBRIS | 10.4% | 7.5% | 13.3% |
| 21 YARD WASTE | 4.1% | 2.0% | 6.3% |
| 22 FOOD WASTE | 10.4% | 8.0% | 12.7% |
| 23 DIAPERS | 2.1% | 1.2% | 3.0% |
| 24 OTHER MISCELLANEOUS | 13.8% | 11.2% | 16.3% |
| TOTALS | 100.0% | | |

Figure 6.1 Percent Composition of Single Family Residential Waste Landfilled or Incinerated - Summer and Winter Events



6.2.2 Multi-Family Residential Generators

Figure 6.2, *Percent Composition of Multi-Family Residential Waste Landfilled or Incinerated – Summer and Winter Events*, presents the percent composition by weight of waste generated by multi-family residences landfilled or incinerated during the summer and winter sorting events. The following categories comprised relatively large portions of the multi-family residential waste stream:

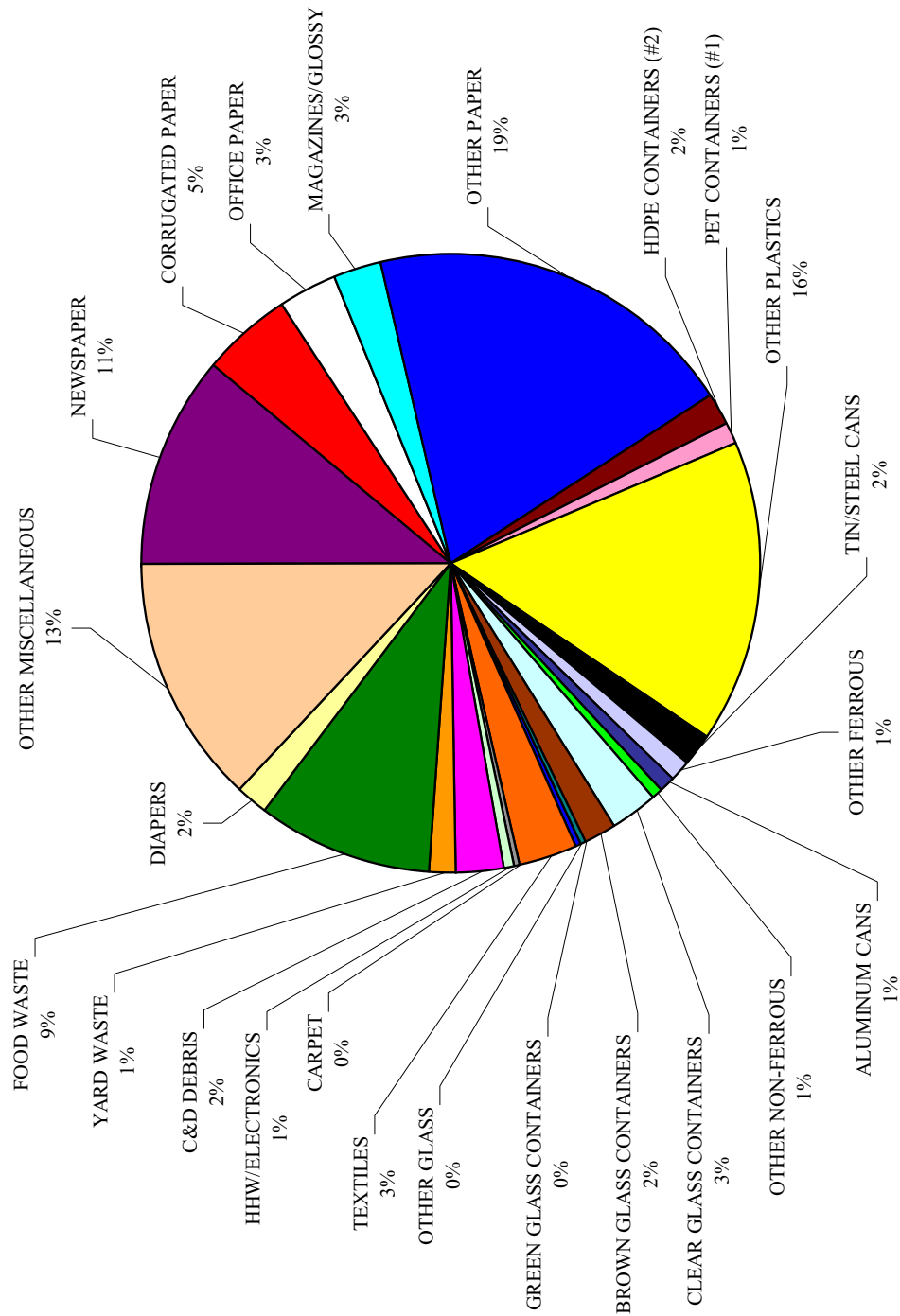
- Other Paper 19.4 percent
- Other Plastics 16.0 percent
- Other Miscellaneous 12.9 percent
- Newspaper 11.1 percent
- Food Waste 9.2 percent
- Corrugated Paper 4.8 percent
- Textiles 3.1 percent

6.2.3 Commercial Generators

Figure 6.3, *Percent Composition of Commercial Waste Landfilled or Incinerated – Summer and Winter Events*, presents the percent composition by weight of waste generated by commercial businesses landfilled or incinerated during the summer and winter sorting events. The following categories comprised relatively large portions of the commercial waste stream:

- Other Paper 15.5 percent
- Other Miscellaneous 13.8 percent
- C&D Debris 10.4 percent
- Food Waste 10.4 percent
- Other Plastics 9.7 percent
- Corrugated Paper 5.0 percent
- Magazines/Glossy Paper 4.3 percent
- Newspaper 4.3 percent
- Yard Waste 4.1 percent
- HHW/Electronics/Fluorescent 4.0 percent

Figure 6.2 Percent Composition of Multi-Family Residential Waste Landfilled or Incinerated - Summer and Winter Events

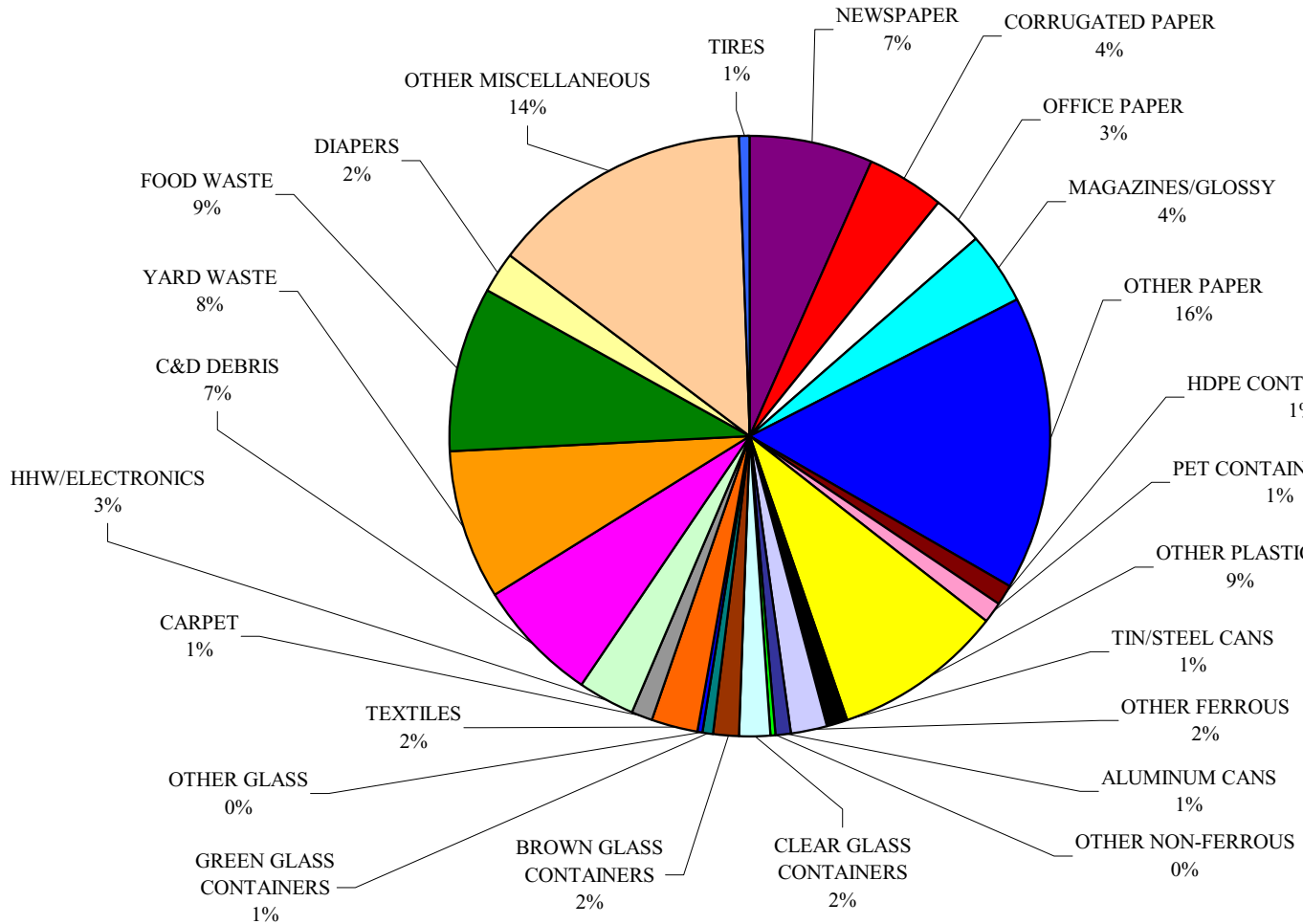


6.2.4 Composition of Total Waste Landfilled or Incinerated

Figure 6.4, *Percent Composition of Total Waste Landfilled or Incinerated – Summer and Winter Events*, presents the percent composition by weight of total waste landfilled or incinerated at the Pinellas County facility during the summer and winter sorting events. The composition also includes annual tire disposal. The following categories comprised relatively large portions of the waste stream:

- Other Paper 15.8 percent
- Other Miscellaneous 14.2 percent
- Other Plastics 9.3 percent
- Food Waste 9.1 percent
- Yard Waste 8.0 percent
- C&D Debris 6.8 percent
- Newspaper 6.7 percent
- Corrugated Paper 4.0 percent
- Magazines/Glossy Paper 3.8 percent
- Office Paper 3.0 percent

Figure 6.4 Percent Composition of Total Waste Landfilled or Incinerated - Summer and Winter E



SECTION 7.0 CONCLUSIONS, RECOMMENDATIONS, AND NEXT STEPS

7.1 Seasonality

Accounting for changes in the composition of waste from season to season is an important component of any WCS. Changes in the waste stream can be caused by seasonal events and activities, such as school sessions and community events, seasonal residents, holidays, and weather changes. Section 5, *Comparison of Summer and Winter Sorting Events*, presents the changes observed between the winter and summer sorting events. Among the three generators targeted in this study, Pinellas County's commercial waste stream had the largest difference in waste composition between the seasons. Most notably, Other Paper decreased from summer to winter and Other Miscellaneous and C&D Debris increased. For total waste composition, Other Paper decreased from summer to winter and Other Miscellaneous increased. Other Miscellaneous contains bulky items, such as furniture and Other Paper contains residential mixed paper.

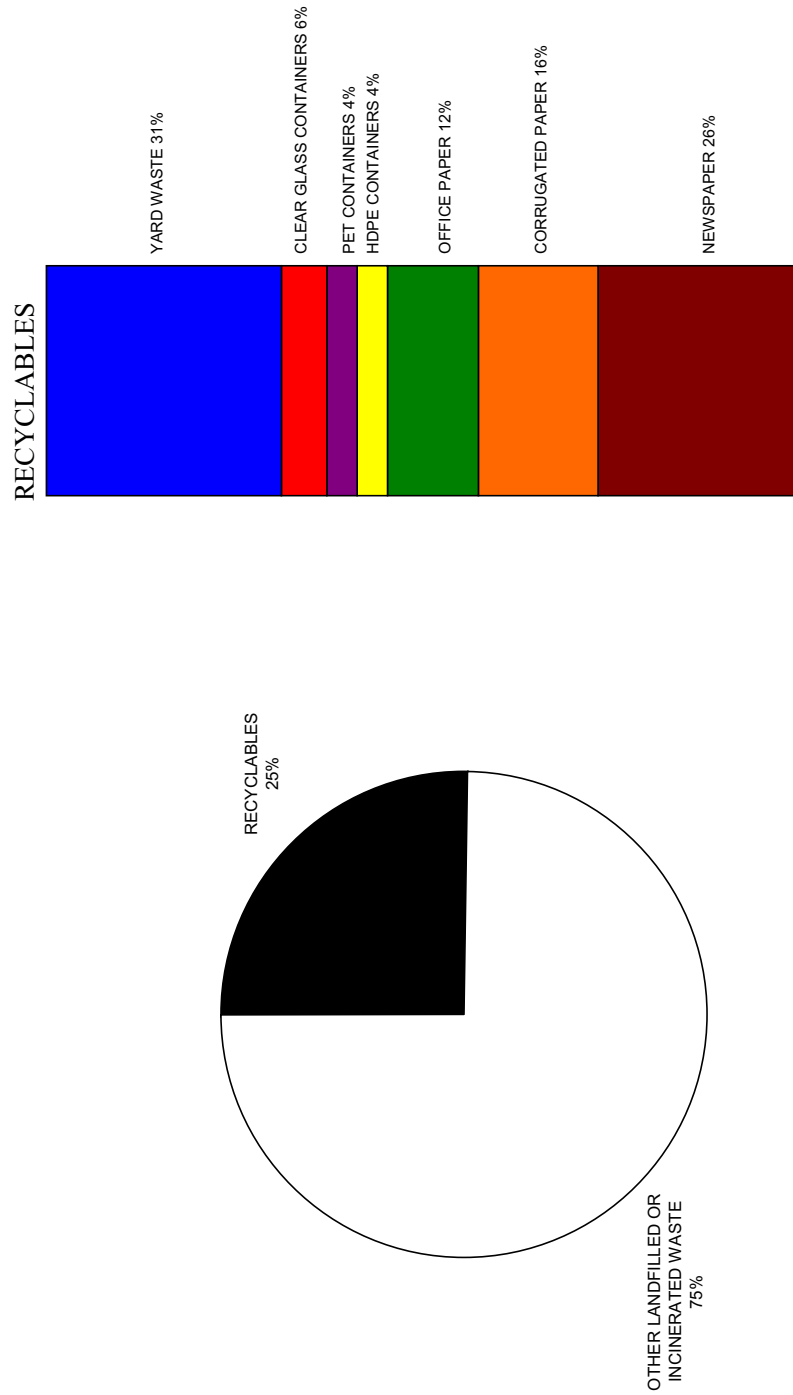
7.2 Recyclable Materials Present in MSW Landfilled or Incinerated

According to the results of this study, materials that could have been recycled through existing recycling programs, including drop-off, curbside, yard waste, and office paper recycling programs, comprised 25.5 percent of the waste stream entering the County's landfill and waste-to-energy facility (WTEF). Those materials are Yard Waste, Newspaper, Corrugated Paper, Office Paper, Clear Glass Containers, HDPE Containers, and PET Containers. Figure 7.1, *Percent of Recyclables Present in Landfilled or Incinerated Waste and Percent Composition of Recyclables Component*, shows the percent of these recyclable materials in the County's waste stream and the percent composition of the recyclable component of landfilled or incinerated waste. The majority of the recyclable component of the waste stream that is being disposed of or incinerated is paper (54 percent). Yard Waste represents 31 percent of recyclable materials that are landfilled or incinerated.

7.2.1 Target Materials for Additional Diversion

Other recyclable materials that represented relatively high percentages of the County's waste stream included: Magazines/Glossy Paper, C&D Debris, Food Waste, Other Paper, and

Figure 7.1 Percent of Recyclables Present in Landfilled or Incinerated Waste and Percent Composition of Recyclables Component



Textiles. The following subsections discuss materials that KCI recommends as targets for additional diversion from disposal.

Yard Waste

Yard Waste was particularly high in the County's single family residential waste stream (14.8 percent) and comprised a relatively large component of the County's total waste stream landfilled and incinerated (8.0 percent). Although the County operates a yard waste recycling program in which 12 cities in the County participate, more can be done to target yard waste for diversion from disposal. Pinellas County's 2000 Solid Waste/Recycling Collection Survey conducted by Research Data Services, Inc. found that 61 percent of respondents dispose of yard waste with their garbage. According to interviews with truck drivers during the waste composition study, loads of waste that contained large amounts of yard waste generally came from residential areas in St. Petersburg, Palm Harbor, and Largo even though both St. Petersburg and Largo have extensive yard waste mulching programs.

Pinellas County may want to target additional yard waste for recycling by encouraging all haulers to participate in its yard waste recycling program and to promote resident participation in curbside yard waste pickup and backyard composting. However, the County has had difficulty finding an end use for the mulched material. Mulch is currently given away to residents, but few are taking it. Pinellas County's Recycling Committee is currently considering alternatives, such as bagging the mulch to make it easier for residents to pick up or, when the current contract for grinding the yard waste expires, considering a contract that includes marketing the finished product.

Newspaper

The percentage of Newspaper in Pinellas County's waste stream is also relatively high (6.7 percent) and maintains a relatively stable market value. According to the *1999 Solid Waste Management in Florida* report published by the Florida Department of Environmental Protection, 5.2 percent of Florida's MSW stream is comprised of newspapers. This number also includes newspapers that are recycled. Nationally, 4.1 percent of discarded MSW consisted of newspapers compared to Pinellas County's 6.7 percent. Increased participation in and possible expansion and promotion of existing curbside recycling and additional drop-

off recycling centers, as well as increased education, may help increase recovery of newspapers. Education can be especially targeted to multi-family residences, which generate the most newspaper. In addition, the County may want to consider implementing newspaper drives at County schools to increase newspaper recovery.

Corrugated Paper

While Corrugated Paper was unusually low in Pinellas County's commercial waste (5.0 percent), it represents four percent of the County's total landfilled or incinerated waste stream. Corrugated Paper is easily collected and recycled and can have a high market value. **KCI** recommends that the County encourage businesses to recycle corrugated paper, which may help reduce their solid waste management costs. In addition, the County should encourage participation in its drop-off recycling program and should consider adding additional drop-off centers to increase the convenience of participating.

Magazines/Glossy Paper

Magazines and Glossy Paper represented over 4 percent of Pinellas County's landfilled or incinerated waste. The County currently collects magazines at half of its drop-off centers. Depending on available markets, **KCI** recommends that Pinellas County consider collecting magazines at more centers. Also, the County may wish to encourage inclusion of this material in existing curbside recycling programs.

Other Paper

Over 33 percent of waste entering the County's landfill and waste-to-energy facilities was paper. More counties in Florida are starting to collect residential mixed paper, such as paperboard, junk mail, and shredded paper. Pinellas County recently added this material to several of its recycling drop-off centers, which may affect the percent composition of landfilled and incinerated waste. Because Other Paper, which includes residential mixed paper, is such a large component of the County's waste (over 14 percent), adding residential mixed paper to all the County's drop-off sites and promoting use of the drop-off centers for residential mixed paper is highly recommended. Also, **KCI** recommends the County encourage cities and waste haulers and processors to include this material in their existing curbside recycling programs.

Food Waste

Pinellas County's landfilled or incinerated waste stream consists of over 9 percent Food Waste. Many programs for food waste reduction, such as food banks, are already in place throughout Florida. These programs save landfill space by reducing food waste while helping the community. In order to reduce food waste entering the waste stream, the County should support these charities through its public relations program by encouraging businesses and institutions to participate.

In addition, food waste composting is increasing nationally and can result in significant recovery of food that is no longer edible. The County may wish to encourage residents to use backyard composting for their fruit and vegetable discards. The County may also wish to consider implementing a food waste composting program. Food waste is often composted with a carbon source, such as paper and yard waste or wood waste, which would provide additional waste diversion. Because starting a food waste composting program would require significant investment of time and resources, **KCI** recommends the County conduct a technology evaluation, feasibility study, and pilot project prior to implementing a full-scale program.

C&D Debris

C&D Debris contains several different types of materials, many of which are recyclable. Some recyclable components of C&D Debris include: corrugated paper, ferrous and non-ferrous metals, asphalt, concrete, wood, plastics, and usable items, such as furniture. Currently, Pinellas County does not collect C&D separately from Class I waste, but is planning to segregate Class III material and set up a Class III recycling area at its landfill. This should result in additional diversion of C&D debris from disposal. Although private facilities in the County are currently collecting and recycling C&D debris, approximately 7 percent of material being landfilled or incinerated at the Pinellas County solid waste facility is C&D debris material.

Textiles

While textiles make up less than 3 percent of Pinellas County's landfilled or incinerated waste, they are easily collected and recycled. For example, All Around Recycling, Inc. of Tampa provides containers and pickup of textiles at many locations around the state. In order to divert more textiles from the County's waste stream, the County may wish to consider adding these containers to its recycling drop-off centers. Recycling textiles may also provide additional revenue for the County.

7.3 Comparison with Pinellas County's 1989 Waste Composition Study

Table 7.1, *Comparison of 1989 and 2001 WCS Averages and Confidence Intervals*, presents a comparison of the results of Pinellas County's 1989 WCS to the WCS findings described in this report. Pinellas County should consider this comparison as a general consideration only, since differing methodologies and material categories make a direct comparison difficult. Table 7.1 reports confidence intervals of the averages for both studies so that the confidence intervals can be compared to determine if the apparent change in the averages from 1989 to 2001 is significant. If the confidence intervals overlap, it is likely that any difference between the two averages is not significant. If the confidence intervals do not overlap, the difference between the averages may be considered significant. According to the table, corrugated paper in the waste stream has decreased since 1989 while office paper has increased. In addition, plastics in the waste stream have increased over the 12-year period. Glass has also increased, as well as electronics, food waste, diapers, tin/steel cans, and aluminum cans. Yard waste made a large decline from 22 percent to 7.8 percent over time, a change of over 14 percent. In general, most materials that are currently recycled in Pinellas County represent larger amounts of the waste stream in 2001 than they represented in 1989. Certain materials may have increased due to general trends in packaging and consumer goods. In particular, over the 12 year period, plastics have increased in use as packaging material. Electronics in the waste stream may have increased due to the rapidly changing electronics industry, where many items become obsolete quickly. In addition, Pinellas County's average age is decreasing, which may account for some waste composition changes, such as the increase in diapers in the waste stream.

7.4 Recommendations and Next Steps

The results of this WCS of landfilled and incinerated waste entering Pinellas County's solid waste facility will be useful as a solid waste management planning tool. Typical uses of waste composition results include sizing and designing solid waste management facilities,

determining generation rates, evaluating and monitoring existing recycling programs and designing program expansion, performing cost-benefit analysis of potential waste diversion or

**TABLE 7.1
COMPARISON OF 1989 AND 2001 WCS AVERAGES
AND CONFIDENCE INTERVALS**

| 1989 Material Categories | 1989 90% Confidence Interval | 1989 Average | 2001 Average | 2001 90% Confidence Interval | 2001 Material Categories |
|----------------------------------|-------------------------------------|---------------------|---------------------|-------------------------------------|---------------------------------|
| PAPER | | | | | PAPER |
| Newsprint | 4.7-6.9 | 5.8 | 6.9 | 5.6-8.3 | Newspaper |
| Corrugated Cardboard | 8.0-10.1 | 9.0 | 4.1 | 3.1-5.1 | Corrugated Paper |
| High Grade Paper | 0.6-0.7 | 0.6 | 3.0 | 2.2-3.8 | Office Paper |
| Other Paper | 11.7-15.8 | 13.7 | 3.8 | 2.8-4.8 | Magazines/Glossy Paper |
| | | | 16.0 | 14.3-17.7 | Other Paper |
| | <i>11.7-15.8</i> | <i>13.7</i> | <i>19.8</i> | <i>17.1-22.5</i> | |
| <i>Total Paper</i> | <i>25.0-33.5</i> | <i>29.1</i> | <i>33.8</i> | <i>28.0-39.7</i> | |
| PLASTIC | | | | | PLASTIC |
| PET & HDPE Plastic Containers | 0.4-0.5 | 0.4 | 1.1 | 0.9-1.4 | HDPE Containers |
| | | | 1.1 | 0.9-1.3 | PET Containers |
| | <i>0.4-0.5</i> | <i>0.4</i> | <i>2.2</i> | <i>1.8-2.7</i> | |
| Other Plastic | 6.5-8.6 | 7.6 | 9.5 | 8.6-10.5 | Other Plastics |
| <i>Total Plastic</i> | <i>6.9-9.1</i> | <i>8.4</i> | <i>11.7</i> | <i>10.4-13.2</i> | |
| METALS | | | | | METALS |
| Ferrous Cans | 0.6-0.8 | 0.7 | 1.2 | 1.0-1.3 | Tin/Steel Cans |
| Other Ferrous Metals | 1.8-2.6 | 2.2 | 1.9 | 1.0-2.8 | Other Ferrous |
| Aluminum Cans | 0.3-0.4 | 0.3 | 0.7 | 0.5-0.8 | Aluminum Cans |
| Other Aluminum Nonferrous Metals | 0.4-0.7 | 0.6 | 0.4 | 0.3-0.5 | Other Non-Ferrous |
| | | | 0.0 | | |
| | <i>0.4-0.8</i> | <i>0.6</i> | <i>0.4</i> | <i>0.3-0.5</i> | |
| <i>Total Metals</i> | <i>3.1-4.6</i> | <i>3.8</i> | <i>4.2</i> | <i>2.8-5.4</i> | |

Note: Differing methodologies and material categories between the 1989 WCS and the 2001 WCS make a direct comparison difficult. Therefore, this table should be used as a general consideration only.

**TABLE 7.1
COMPARISON OF 1989 AND 2001 WCS AVERAGES
AND CONFIDENCE INTERVALS (continued)**

| 1989 Material Categories | 1989 90% Confidence Interval | 1989 Average | 2001 Average | 2001 90% Confidence Interval | 2001 Material Categories |
|---------------------------|------------------------------|--------------|--------------|------------------------------|-----------------------------|
| GLASS | | | | | GLASS |
| Glass Containers | 1.8-2.6 | 2.2 | 1.6 | 1.3-1.9 | Clear Glass Containers |
| | | | 1.6 | 1.0-2.1 | Brown Glass Containers |
| | | | 0.5 | 0.4-0.7 | Green Glass Containers |
| | <i>1.8-2.6</i> | <i>2.2</i> | <i>3.7</i> | <i>2.7-4.7</i> | |
| Other Glass | 0.2-0.2 | 0.2 | 0.2 | 0.1-0.3 | Other Glass |
| <i>Total Glass</i> | <i>2.0-2.8</i> | <i>4.6</i> | <i>3.9</i> | <i>2.8-5.0</i> | |
| Textiles/Leather/Rubber | 3.7-5.2 | 4.4 | 2.4 | 1.8-2.9 | Textiles |
| | | | 1.3 | 0.7-1.9 | Carpet |
| Household Hazardous Waste | 0.4-0.6 | 0.5 | 2.8 | 1.8-3.8 | HHW/Electronics/Fluorescent |
| Household Batteries | 0.1-0.1 | 0.1 | | | |
| Electronic Devices | 0.2-0.2 | 0.2 | | | |
| | <i>0.7-0.9</i> | <i>0.8</i> | <i>2.8</i> | <i>1.8-3.8</i> | |
| Wood Waste | 7.4-9.5 | 8.4 | 6.6 | 4.7-8.5 | C&D Debris |
| Yard Waste | 19.4-24.6 | 22 | 7.8 | 5.5-10.2 | Yard Waste |
| Food Waste | 3.5-5.0 | 4.3 | 9.1 | 7.6-10.6 | Food Waste |
| Disposable Diapers | 0.7-1.0 | 0.8 | 2.2 | 1.6-2.8 | Diapers |
| Other Combustibles | 1.0-1.4 | 1.2 | 14.2 | 11.7-16.6 | Other Miscellaneous |
| Misc. Noncombustibles | 3.6-5.4 | 4.5 | | | |
| White Goods | 0.2-0.7 | 0.4 | | | |
| Tires | 0.3-0.7 | 0.5 | 0.5 | | |
| Furniture | 1.0-2.3 | 1.7 | | | |
| Ceramic and Fines | 6.3-8.5 | | | | |
| | <i>12.4-19.0</i> | <i>8.3</i> | <i>14.2</i> | <i>11.7-16.6</i> | |

Note: Differing methodologies and material categories between the 1989 WCS and the 2001 WCS make a direct comparison difficult. Therefore, this table should be used as a general consideration only.

recycling programs, and satisfying DEP's requirements for preparation of the Recycling and Education Grant Applications.

Two surveys of Pinellas County residents were recently conducted in Pinellas County. The 2000 Recycling Survey, conducted annually for the County, showed that 44 percent of respondents recycle at least monthly (23 percent participate in curbside recycling and 21 percent participate in drop-off recycling). The 2000 Solid Waste/Recycling Collection Survey, which was conducted to provide information to the Pinellas County Collection Task Force, showed that 45 percent of respondents recycle (28 percent at drop-off sites and 18 percent through curbside recycling). However, 21 percent of respondents said they would like to have curbside recycling service and 54 percent felt that the availability of curbside recycling was an important component of their collection service. This information, combined with the results of the WCS, indicates that opportunities exist to improve the County's existing recycling program and improvements would be welcomed by a majority of residents. Therefore, **KCI** recommends that the County consider implementing or further evaluating the options presented in the following action plan for improving its recycling program:

- Expand public education to encourage participation in existing recycling programs, including drop-off recycling centers, the yard waste recycling program, and available curbside recycling. This should involve cooperation with municipalities and waste haulers.
- Continue to educate and encourage residents and businesses through the County's public relations program to donate usable items and edible food discards to the numerous charities in the County. Already, Pinellas County recently met with several of these charities to discuss handling of household hazardous waste and electronics and expanding recycling.
- Continue to educate and encourage residents to implement backyard food and yard waste composting and promote existing programs. Several years ago, the Pinellas County Cooperative Extension began an education program for backyard composting

and provided backyard composting systems to residents. The County should consider revitalizing this program, if necessary.

- Continue to provide and increase incentives to businesses and waste haulers to reduce waste and recycle. In addition to the County's yearly awards program for businesses, **KCI** recommends enhancing the program by providing recycling "certification" to businesses that recycle, which they can advertise to their customers to show their commitment to a sustainable environment.
- Expand the drop-off recycling program by adding additional centers in the unincorporated areas of the County. Already, the County is planning to provide two new centers in fiscal year 2001-2002, and additional centers should be considered for future years. The County also has plans to provide a model recycling center at its solid waste facility and an area where Class III recyclable material will be accepted. These new centers are a positive step toward increasing material recovery and participation in the recycling program. In addition, cities in the County should consider expanding their drop-off recycling programs. Increasing the number of drop-off centers available will increase the convenience to residents, which should improve participation and increase recovery.
- Expand the drop-off recycling program by adding materials that can be dropped off. The County recently added aluminum cans to 6 of its 10 drop-off sites and residential mixed paper to 4 sites, which should increase recovery. In addition, corrugated paper was added to 4 sites. If collecting these materials at the current sites proves to be successful in terms of increased participation, recovery, and revenue generation, the County should consider adding them to all of its centers. Textiles should also be added, and the County should consider collecting tin/steel cans, which will provide more revenue when collected at these centers than when recovered after incineration. The availability of markets should always be considered when adding new materials.
- Continue to promote increasing curbside recycling within the unincorporated County and municipalities. Counties and municipalities that have extensive curbside recycling programs tend to have higher recovery rates. The County could work with waste haulers serving the unincorporated county to encourage them to expand curbside recycling. In addition, cities in the County that currently do not offer curbside recycling should consider implementing a curbside program.

- Consider implementing a commercial recycling pilot program in the unincorporated areas of the County in which the County would provide free waste audits to interested businesses and provide them with a plan for optimizing recycling and reducing disposal costs.
- Investigate the feasibility of implementing a food waste composting program to increase food waste recovery.

The County may also wish to consider sharing the above information and recommendations with other County or citizen committees or groups.

APPENDIX A

MATERIALS CATEGORIES LIST

**PINELLAS COUNTY WASTE COMPOSITION STUDY
MATERIAL CATEGORIES DESCRIPTION – SUMMER EVENT**

| # | Material Categories | Description of Categories |
|----|------------------------|---|
| 1 | Newspaper | Newspaper (tied or shredded) including other paper normally distributed inside newspaper such as ads, flyers, etc. |
| 2 | Corrugated Paper (OCC) | Uncontaminated, uncoated brown "cardboard" boxes with a wavy core (no plastic liners) |
| 3 | Office Paper | Computer paper, white or colored paper, and envelopes without plastic windows. |
| 4 | Magazines/Glossy Paper | All magazines, catalogs, and other printed material on glossy paper. |
| 5 | Other Paper | All remaining paper not categorized in other paper categories including paperboard, gable top containers, waxed cardboard and contaminated paper (i.e. napkins, paper towels, etc.) |
| 6 | HDPE Containers | Clear/natural and pigmented bottles or containers coded HDPE #2 such as milk jugs, detergent bottles, etc. |
| 7 | PET Containers | Clear and colored bottles or containers coded PET #1 such as soda bottles, water bottles, etc. |
| 8 | Other Plastics | All other plastic containers coded all numbers other than 1 and 2, and non-container plastics or film plastics coded 1 through 7. Examples include food containers, plastic toys, styrofoam coffee cups, plastic utensils, etc. |
| 9 | Tin/Steel Cans | Tin-plated steel cans, usually food containers, and aerosol cans. |
| 10 | Other Ferrous | Steel, clothes hangers, sheet metal products, pipes, miscellaneous metal scraps, and other magnetic metal items. |
| 11 | Aluminum Cans | Aluminum soft drink, beer, and some food cans. |
| 12 | Other Non-Ferrous | Scrap aluminum, aluminum foil, and other non- |

| | | magnetic metal, copper wiring and tubing, brass fixtures. |
|---|-----------------------------------|--|
| PINELLAS COUNTY WASTE COMPOSITION STUDY MATERIAL CATEGORIES DESCRIPTION – SUMMER EVENT(Continued) | | |
| # | Material Categories | Description of Categories |
| 13 | Clear Glass Containers | Clear glass bottles and containers. |
| 14 | Brown Glass Containers | Brown glass bottles and containers. |
| 15 | Green Glass Containers | Green glass bottles and containers. |
| 16 | Other Glass | Window panes, mirrors, ceramics, and drinking glasses. |
| 17 | Textiles | Clothing apparel, rags, blankets, curtains, shoes, wallets, purses, belts, scrap leather. |
| 18 | Carpet | Carpet scraps and padding. |
| 19 | HHW/Electronics/Fluorescent Bulbs | Electronic devices such as hairdryers, televisions, toasters, etc.; household hazardous waste; and fluorescent light bulbs. |
| 20 | C&D Debris | Construction and demolition debris that includes concrete, drywall, furniture, insulation, and treated and untreated lumber, including pallets. |
| 21 | Yard Waste | Shrub and brush prunings, household bedding plants, weeds, leaves, grass clippings, and other landscaping and gardening wastes. |
| 22 | Food Waste | Meat and vegetable waste (includes coffee grinds and tea bags). |
| 23 | Diapers | Diapers and feminine products. |
| 24 | Other Miscellaneous | Products that contain combinations of materials such as frozen juice cans, binders, etc.; and indistinguishable items less than 1-inch square that are organic or inorganic including kitty litter, sweepings, and hair. |

| PINELLAS COUNTY WASTE COMPOSITION STUDY MATERIAL CATEGORIES DESCRIPTION – WINTER EVENT | | |
|---|------------------------|--|
| # | Material Categories | Description of Categories |
| 1 | Newspaper | Newspaper (tied or shredded) including other paper normally distributed inside newspaper such as ads, flyers, etc. |
| 2 | Corrugated Paper (OCC) | Uncontaminated, uncoated brown "cardboard" boxes with a wavy core (no plastic liners) |
| 3 | Office Paper | Computer paper, white or colored paper, and envelopes without plastic windows. |
| 4 | Magazines/Glossy Paper | All magazines, catalogs, and other printed material on glossy paper. |
| 5 | Other Paper | All remaining paper not categorized in other paper categories including paperboard, gable top containers, waxed cardboard and contaminated paper (i.e. napkins, paper towels, etc.) |
| 6 | HDPE Containers | Clear/natural and pigmented bottles or containers coded HDPE #2 such as milk jugs, detergent bottles, etc. |
| 7 | PET Containers | Clear and colored bottles or containers coded PET #1 such as soda bottles, water bottles, etc. |
| 8 | Film Plastic | Plastic bags and plastic film or food wrap. |
| 9 | Other Plastics | All other plastic containers coded all numbers other than 1 and 2, and non-container plastics coded 1 through 7. Examples include food containers, plastic toys, styrofoam coffee cups, plastic utensils, etc. |
| 10 | Tin/Steel Cans | Tin-plated steel cans, usually food containers, and aerosol cans. |
| 11 | Other Ferrous | Steel, clothes hangers, sheet metal products, pipes, miscellaneous metal scraps, and other magnetic metal items. |
| 12 | Aluminum Cans | Aluminum soft drink, beer, and some food cans. |
| 13 | Other Non-Ferrous | Scrap aluminum, aluminum foil, and other non-magnetic metal, copper wiring and tubing, brass |

| | | fixtures. |
|--|---------------------------|--|
| PINELLAS COUNTY WASTE COMPOSITION STUDY MATERIAL CATEGORIES DESCRIPTION – WINTER EVENT(Continued) | | |
| # | Material Categories | Description of Categories |
| 14 | Clear Glass Containers | Clear glass bottles and containers. |
| 15 | Brown Glass Containers | Brown glass bottles and containers. |
| 16 | Green Glass Containers | Green glass bottles and containers. |
| 17 | Other Glass | Window panes, mirrors, ceramics, and drinking glasses. |
| 18 | Textiles | Clothing apparel, rags, blankets, curtains, shoes, wallets, purses, belts, scrap leather. |
| 19 | Carpet | Carpet scraps and padding. |
| 20 | Household Hazardous Waste | Cleaners, etc. that are considered household hazardous waste. |
| 21 | Electronics | Electronic devices such as hairdryers, televisions, toasters, etc.; and fluorescent light bulbs. |
| 22 | C&D Debris | Construction and demolition debris that includes concrete, drywall, furniture, insulation, and treated and untreated lumber, including pallets. |
| 23 | Yard Waste | Shrub and brush prunings, household bedding plants, weeds, leaves, grass clippings, and other landscaping and gardening wastes. |
| 24 | Food Waste | Meat and vegetable waste (includes coffee grinds and tea bags). |
| 25 | Diapers | Diapers and feminine products. |
| 26 | Other Miscellaneous | Products that contain combinations of materials such as frozen juice cans, binders, etc.; and indistinguishable items less than 1-inch square that are organic or inorganic including kitty litter, sweepings, and hair. |

APPENDIX B

DATA RECORDING FORM

**PINELLAS COUNTY, FLORIDA
WCS SORTING DATA FORM**

Recorder _____ Date _____ Time _____ Sample # _____

Hauler _____ Truck # _____ Truck Weight _____
(Net Weight)

| Waste Source: | Check | Percent |
|----------------|-------|---------|
| SF Residential | | |
| MF Residential | | |
| Commercial | | |

Source of Materials _____

| MATERIAL CATEGORIES | CONTAINERS | | | | | | | | TOTAL WT. |
|--------------------------------|------------|----------|---------|----------|---------|----------|---------|----------|-----------|
| | 1 TR.WT | 1 GR.WT. | 2 TR.WT | 2 GR.WT. | 3 TR.WT | 3 GR.WT. | 4 TR.WT | 4 GR.WT. | |
| 1 NEWSPAPER | | | | | | | | | |
| 2 CORRUGATED CARDBOARD | | | | | | | | | |
| 3 OFFICE PAPER | | | | | | | | | |
| 4 MAGAZINES/GLOSSY | | | | | | | | | |
| 5 OTHER PAPER | | | | | | | | | |
| 6 #2 PLASTIC CONTAINERS (HDPE) | | | | | | | | | |
| 7 #1 PLASTIC CONTAINERS (PET) | | | | | | | | | |
| 8 FILM PLASTIC | | | | | | | | | |
| 9 OTHER PLASTICS | | | | | | | | | |
| 10 TIN/STEEL CANS | | | | | | | | | |
| 11 OTHER MAGNETIC METALS | | | | | | | | | |
| 12 ALUMINUM CANS | | | | | | | | | |
| 13 OTHER NON-MAGNETIC METALS | | | | | | | | | |
| 14 CLEAR GLASS BOTTLES | | | | | | | | | |
| 15 BROWN GLASS BOTTLES | | | | | | | | | |
| 16 GREEN GLASS BOTTLES | | | | | | | | | |
| 17 OTHER GLASS & CERAMICS | | | | | | | | | |
| 18 TEXTILES | | | | | | | | | |
| 19 CARPET | | | | | | | | | |
| 20 HOUSEHOLD HAZARDOUS WASTE | | | | | | | | | |
| 21 ELECTRONICS | | | | | | | | | |
| 22 C&D DEBRIS | | | | | | | | | |
| 23 YARD WASTE | | | | | | | | | |
| 24 FOOD WASTE | | | | | | | | | |
| 25 DIAPERS | | | | | | | | | |
| 26 MISCELLANEOUS | | | | | | | | | |
| 27 GRIT | | | | | | | | | |
| TOTALS | | | | | | | | | |

Visual Observations: _____

APPENDIX C

**INSTRUCTIONS FOR UPDATING
U.S. MSW GENERATION DATA**

INSTRUCTIONS FOR UPDATING U.S. MSW GENERATION DATA

The “Model Maintenance” page of the web site includes a section for updating data from the U.S. Environmental Protection Agency’s Characterization of Municipal Solid Waste annual report. This part of the model is designed to provide an easy, inexpensive update of trends on a national level that affect MSW generation. Such factors as the effects of recessions or changing consumer habits, e.g., changes in beverage packaging, are reflected. Thus, updates can be made on an interim basis until more time-consuming updates reflecting Florida-specific factors can be made.

By updating this page, the parts of the model that use this information also will be updated. Detailed instructions for the update are given here.

Finding the EPA Report

EPA publishes its annual MSW update report on its web site. The July 2001 report’s web address was <http://www.epa.gov/epaoswer/non-hw/muncpl/msw99.htm>. Later updates should have a similar address, or you can call the EPA Office of Solid Waste.

Finding U.S. Population

You should enter the U.S. resident population that corresponds to the year for which the MSW report is updated. This can be found on the Bureau of the Census web page (<http://www.census.gov>). U.S. population is also shown on the following table of the EPA report: GENERATION, MATERIALS RECOVERY, COMPOSTING, COMBUSTION, AND DISCARDS OF MUNICIPAL SOLID WASTE, 1960 TO 20--. (This was Table 29 in the July 2001 report.)

Finding the EPA Materials/Products Categories

Since the categories in the EPA MSW characterization report do not always match the Florida DEP categories, the table below shows where to find the necessary EPA numbers. (Table references match EPA’s July 2001 report; however, these table numbers could change in the future.) For a few categories, an additional calculation is needed (see Table A-2).

| Table C-1. EPA CATEGORIES AND TABLE NUMBERS | | | | |
|--|---------------------|---|----------------------|----------------------|
| Florida Category | EPA Category | EPA Table Title | EPA Table No. | See Table A-2 |
| White goods | Major Appliances | Products Generated in the Municipal Waste Stream, 1960 to 1999 (With Detail on Durable Goods) | 12 | |
| Miscellaneous | Small Appliances | Same | 12 | |

| | | | | |
|---|-------------------------------------|--|----------------------|----------------------|
| Miscellaneous | Furniture and Furnishings | Same | 12 | |
| | | | EPA Table No. | See Table A-2 |
| Florida Category | EPA Category | EPA Table Title | | |
| Miscellaneous | Carpets and Rugs | Same | 12 | |
| Tires | Rubber Tires | Same | 12 | |
| Miscellaneous | Batteries, Lead Acid | Same | 12 | |
| Other Plastics, Ferrous Metals, Non-Ferrous Metals, Miscellaneous | Miscellaneous Durables | Same | 12 | |
| Newspapers | Newspapers | Products Generated in the Municipal Waste Stream, 1960 to 1999 (With Detail on Nondurable Goods) | 15 | |
| Other Paper | Books | Same | 15 | |
| Other Paper | Magazines | Same | 15 | |
| Office Paper | Office Papers | Same | 15 | |
| Other Paper | Directories | Same | 15 | |
| Other Paper | Standard (A) Mail | Same | 15 | |
| Other Paper | Other Commercial Printing | Same | 15 | |
| Other Paper | Tissue Paper and Towels | Same | 15 | |
| Other Paper | Paper Plates and Cups | Same | 15 | |
| Other Plastic | Plastic Plates and Cups | Same | 15 | |
| Other Plastic | Trash Bags | Same | 15 | |
| Miscellaneous | Disposable Diapers | Same | 15 | |
| Other Paper | Other Nonpackaging Paper | Same | 15 | |
| Textiles | Clothing | Same | 15 | ✓ |
| Miscellaneous | Footwear | Same | 15 | ✓ |
| Textiles | Towels, Sheets and Pillowcases | Same | 15 | |
| Miscellaneous | Other Miscellaneous Nondurables | Same | 15 | |
| Glass | Glass Beer and Soft Drink Bottles | Products Generated in the Municipal Solid Waste Stream, 1960 to 1999 (With Detail on Containers and Packaging) | 18 | |
| Glass | Glass Wine and Liquor Bottles | Same | 18 | |
| Glass | Glass Food and Other Bottles & Jars | Same | 18 | |
| Steel Cans | Steel Food and Other Cans | Same | 18 | |
| Ferrous Metals | Other Steel Packaging | Same | 18 | |
| Aluminum Cans | Aluminum Beer and Soft Drink Cans | Same | 18 | |
| Aluminum Cans | Other Aluminum Cans | Same | 18 | |
| Non-Ferrous Metals | Aluminum Foil and | Same | 18 | |

| | | | | |
|--|----------|--|--|--|
| | Closures | | | |
|--|----------|--|--|--|

| Florida Category | EPA Category | EPA Table Title | EPA Table No. | See Table A-2 |
|-------------------------|--|--|----------------------|----------------------|
| Corrugated Paper | Corrugated Boxes | Same | 18 | |
| Other Paper | Milk Cartons | Same | 18 | |
| Other Paper | Folding Cartons | Same | 18 | |
| Other Paper | Other Paperboard Packaging | Same | 18 | |
| Other Paper | Other Paper Packaging | Same | 18 | |
| Other Paper | Bags and Sacks | Same | 18 | |
| Plastic Bottles | Soft Drink Bottles (PET) | Plastics in Products in MSW, 1999 | 7 or 18 | |
| Plastic Bottles | Other PET Bottles | Same | 7 | |
| Plastic Bottles | Milk and Water Bottles (HDPE or Natural) | Same | 7 or 18 | |
| Plastic Bottles | Other HDPE Bottles | Same | 7 | |
| Other Plastic | Other Plastic Containers | Same | 7 | ✓ |
| Other Plastic | Plastic Bags and Sacks | Products Generated in the Municipal Solid Waste Stream, 1960 to 1999 (With Detail on Containers and Packaging) | 18 | |
| Other Plastic | Plastic Wraps | Same | 18 | |
| Other Plastic | Other Plastics Packaging | Same | 18 | |
| Miscellaneous | Wood Packaging | Same | 18 | |
| Miscellaneous | Other Misc. Packaging | Same | 18 | |
| Food Wastes | Food Wastes | Same | 18* | |
| Yard Trash | Yard Trimmings | Same | 18* | |
| Miscellaneous | Miscellaneous Inorganic Wastes | Same | 18* | |

* These wastes also appear on many other EPA tables.

| Table C-2. CONVERSION FACTORS FOR SELECTED EPA CATEGORIES | | | |
|--|--------------------------|--------------------------|--|
| Florida Category | Model Category | EPA Category | Calculation |
| Textiles | Clothing | Clothing and Footwear | Multiply by 0.916 |
| Miscellaneous | Footwear | Clothing and Footwear | Subtract Clothing (above) from Clothing and Footwear |
| Other Plastic | Other Plastic Containers | Other Plastic Containers | Subtract PET and HDPE from Subtotal Other Containers |

APPENDIX D

PRESS RELEASES

FOR IMMEDIATE RELEASE

Contact: Robin Mitchell, Kessler Consulting, Inc.
813-971-8333
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Pinellas County To Develop Waste Composition Model

Pinellas County, FL, October 12, 2001--Pinellas County has been awarded a grant under the Florida Department of Environmental Protection's Innovative Recycling Grant Program to develop an advanced waste composition model that can be used by all Florida counties to characterize their waste stream. The County, through its Utilities Department of Solid Waste Operations, will be working closely with Kessler Consulting, Inc., a Florida-based firm with extensive experience in conducting waste composition studies, and Franklin Associates, who for the past two decades has spearheaded development of a methodology to characterize national, state, and municipal waste streams. In addition, Pinellas County has enlisted the participation of Highlands, Indian River, and Levy Counties to serve as waste sorting sites for collecting data that will be incorporated into the model. Additional data for the model will come from existing data from recent studies in other Florida counties and sorting events being conducted in Charlotte, Okaloosa, Sarasota, and Citrus Counties.

The Pinellas County project is expected to produce substantial benefits for Florida and also has nationwide implications. While accurate and up-to-date waste composition data is essential for sound solid waste management planning, sampling studies are costly, especially when numerous material categories, various generator types, and multiple-season sorts are included. The Florida Department of Environmental Protection requires that all counties report waste composition information to the department every year and suggests that counties update the information every five years. Pinellas County's project will develop a user-friendly, computer-based model that will enable Florida's solid waste managers and planners to determine local waste stream composition by entering county-specific information into an interactive format. If the model is eventually used by all or most of Florida's counties, the project will result in cost savings of millions of dollars.

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FOR IMMEDIATE RELEASE

Contact: Robin Mitchell, Kessler Consulting, Inc.
813-971-8333
rmitchell@kesconsult.com

Pinellas County, Florida, To Develop Waste Composition Model

Pinellas County, FL, September 27, 2001--Pinellas County, Florida, has been awarded a grant under the Florida Department of Environmental Protection's Innovative Recycling Grant Program to develop an advanced waste composition model that can be used by all Florida counties to characterize their waste stream. The County, through its Utilities Department of Solid Waste Operations, will be working closely with Kessler Consulting, Inc., a Florida-based firm with extensive experience in conducting waste composition studies, and Franklin Associates, who for the past two decades has spearheaded development of a methodology to characterize national, state, and municipal waste streams. In addition, Pinellas County has enlisted the participation of other Florida counties to serve as waste sorting sites for collecting data that will be incorporated into the model. Additional data for the model will come from existing data from recent studies in other Florida counties.

The Pinellas County project is expected to produce substantial benefits for Florida and also has nationwide implications. While accurate and up-to-date waste composition data is essential for sound solid waste management planning, sampling studies are costly, especially when numerous material categories, various generator types, and multiple-season sorts are included. The Florida Department of Environmental Protection requires that all counties report waste composition information to the department every year and suggests that counties update the information every five years. Pinellas County's project will develop a user-friendly, computer-based model that will enable Florida's solid waste managers and planners to determine local waste stream composition by entering county-specific information into an interactive format. If the model is eventually used by all or most of Florida's counties, the project will result in cost savings of millions of dollars.

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