

Final Report

May 2003

Florida Department of Environmental Protection

State-wide Waste Composition Computer Model
1999-2000 Innovative Recycling Grant #IG00-03



Primary Sponsor: Charlotte County

Co-Sponsors: Citrus County
Okaloosa County
Sarasota County



Project Consultant: R. W. Beck, Inc.

Florida Department of Environmental Protection INNOVATIVE RECYCLING GRANT FINAL REPORT

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Section 1 INTRODUCTION

Introduction

Reliable waste composition data is critical to effective recycling program planning and design. Local waste composition studies are expensive to perform, leading many Florida counties to rely on national studies to avoid the expense of preparing their own study. Yet, national data does not reflect the unique nature of Florida's waste stream - its long growing season, heavy tourism, and significant construction activity. Further, the general approach used to develop national data applies to the total amount of waste that has been *generated*, not the composition of waste that has been *disposed*. The national data does not lend itself to accurate development of county-specific composition statistics.

To overcome these challenges, Charlotte County sponsored a multi-county project with Citrus, Okaloosa and Sarasota Counties to develop a web-based interactive computer model that will allow counties across the State to accurately estimate their waste stream composition using Florida-specific data points and appropriate predictive variables. Certain factors -- such as population, employment by SIC code, and building permits -- were used to statistically predict community waste quantities by category.

Project Description

This project included a total of eight tasks, which were required to gather sufficient waste composition data and develop a statistically meaningful model to project waste composition. Tasks are summarized below.

Task 1: Analyze and Compile Existing Florida Waste Composition Data

Prior to this project, several counties across the State were known to have completed waste composition studies. In this task, the Project Team researched and compiled the results from existing waste composition studies for use in development of the computer model.

Appendix A contains the letter report that describes the results of the research process.

Task 2: Select Counties for Supplemental Data Collection

To obtain a sufficient number of data points required to produce a statistically accurate computer model, it was recognized at the outset of the project that additional county-level waste composition studies would need to be performed. The Charlotte County Team selected Citrus, Okaloosa, and Sarasota Counties to co-sponsor this project and host waste composition studies. Each of the co-sponsors, as well as Charlotte County, contributed funds and/or in-kind sort labor to complete their sorts. A summary of these contributions is provided later in this report.

In addition to the four sorts undertaken as part of this grant, the Charlotte County Project Team worked in coordination with another project team from Pinellas County to obtain sort data from four additional counties. The Pinellas County Team, which was also awarded a grant from FDEP, performed sorts in Highlands, Indian River, Levy, and Pinellas Counties. Both project teams shared sort data to maximize the use of FDEP grant funds for development of State-wide waste composition and generation models.

Task 3: Conduct County-level Waste Sorts

Two-seasons waste composition studies were performed at landfills and transfer stations in each of the four host counties. A complete summary of sort results can be found according to the bullets below:

- Charlotte County sort results are contained in Appendix B
- Citrus County sort results are contained in Appendix C
- Okaloosa County sort results are contained in Appendix D
- Sarasota County sort results are contained in Appendix E

In order to maximize the value of the grant, the Charlotte County Project Team also collected over 200 visual samples of construction and demolition (C&D) debris at four C&D disposal facilities across the State. The data from these samples were provided to another State-funded project that involved development of C&D generation and composition estimates. The C&D composition raw data for Charlotte, Citrus, and Okaloosa Counties can be found in Appendices B, C and D, respectively. None of the C&D landfills or recycling facilities in Sarasota County was willing to host a sort, and consequently no C&D data was collected Sarasota County.

Task 4: Document Availability of Predictive Demographic Data

The economics and demographics of a community significantly influence the composition of its waste stream. Communities that are agriculturally oriented will likely have waste streams with proportionately higher quantities of organics and materials such as agricultural films. Manufacturing communities would likely see higher percentages of scrap metals, plastics, and other industrial waste. Conversely, residential suburban communities with existing curbside recycling programs targeting

the Minimum Five recyclables would likely have waste streams with high concentrations of mixed paper and food waste.

As a result, this task allowed for research and compilation of a range of demographic and solid waste system data for all of Florida's 67 counties. The solid waste system data (e.g., existence of recycling, average disposal tip fees, etc.) and demographic data (e.g., employment by SIC code, housing starts) are tested as explanatory variables as part of the statistical analysis described in the next task. Appendix F contains the technical memorandum that summarizes the full set of predictive data that was compiled and integrated into the computer model developed for this project.

Task 5: Develop Statistical Relationships

Based on the waste composition data collected in Tasks 1 and 3, and on the solid waste system and demographic data collected in Task 4, this task allowed for the performance of a statistical analysis to test correlation between the two data sets. The objective of the task was to identify which solid waste system and demographic explanatory variables could be used to project the composition of disposed waste. The results of this analysis form the basis of the waste composition computer model.

Appendix F contains the technical memorandum that summarizes the results of the statistical analysis.

Tasks 6 and 7: Develop Computer Model and Link to Internet

As a final output for this project, all of the raw waste composition data, as well as the results of the statistical analysis, were integrated into a Web-based computer model that projects county-level waste composition for all of Florida's counties. The model can be manipulated to return the following results:

- 1) Display the actual results of the waste composition studies that have been performed in Florida since 1997;
- 2) Select any county and apply statistical coefficients from the statistical analysis to estimate disposed waste composition from waste generated in that county;
- 3) Draw from county-level reported waste disposal and recycling databases to estimate an accurate breakdown of generated, disposed, and recycled waste by material category; and
- 4) Apply results from an independently-conducted, State-funded C&D generation/composition project to project County-level C&D generation and composition.

This program will be made available on FDEP's web site, at <http://www.dep.state.fl.us/waste/Default.htm>. Background to the model and instructions for using the model are included on the website.

Task 8: Technology Transfer

The final project task allows for the Project Team to present the results of the model and describe its use at a Florida solid waste conference. The model was previewed at the Recycle Florida Today conference held in St. Petersburg Beach on June 3, 2003.

Organization of this Report

This report primarily compiles previous deliverables from the multiple phases of the project.

In addition to this Project Overview section, there second section of the report entitled “Results” that discusses the outcome of the grant project, including an evaluation of whether or not project objectives were successfully met. The “Results” section also summarizes the overall cost of the project, including grant funds, and cash contributions/in-kind donations from sponsor counties and third parties.

The remainder of the report consists of appendices that contain interim deliverables that document key findings throughout the waste sorting, statistical analysis, and model development. Specific appendices include:

- **Appendix A**—Technical Memorandum Summarizing Florida Waste Composition Research
- **Appendix B**—Composition of Municipal Solid Waste Disposed in Charlotte County, Final Report
- **Appendix C**—Composition of Municipal Solid Waste Disposed in Citrus County, Final Report
- **Appendix D**—Composition of Municipal Solid Waste Disposed in Okaloosa County, Final Report
- **Appendix E**—Composition of Municipal Solid Waste Disposed in Sarasota County, Final Report
- **Appendix F**—Technical Memorandum Summarizing the Background Research and Resultant Statistical Coefficients of the Web-based Waste Composition Model

Acknowledgements

This project could not have been successful without the assistance of numerous MSW and C&D facilities (both landfills and transfer stations) and local haulers doing business in the four sponsor counties. Specific acknowledgements are included for each host facility and project participant in Appendices B through E. Charlotte County, and R. W. Beck, would like to offer another sincere thanks to these organizations for their assistance.

Section 2 CONCLUSIONS

Results Summary

In hindsight, the Florida State-wide Waste Composition Model was successful in achieving the objectives stated at the outset of the grant. The project's successes are described in the sections below, as well as obstacles that still need to be overcome.

Expanding Florida-Specific Waste Composition Data

Prior to this project, recent (i.e., within the past five years) waste composition data existed for only five of the State's 67 counties. Counties that had not performed their own waste composition study in recent years were left with using national waste generation data—not disposed waste composition data—or relying on the results from one of the five counties or from studies performed in other states.

The four additional studies performed for this project, along with the four studies performed by the Pinellas County project team under a jointly-awarded Innovative Recycling Grant, provided a greater distribution of county-level waste composition data for use by other counties in the State.

Applying Statistical Analysis to Generate Useful County-Level Data

With the development of a sufficient sample of county-level waste composition study data, this project was able to apply statistical correlation analysis of waste composition data against solid waste system and demographic/economic data to estimate waste composition across all counties in the State. Such a methodology has not been used previously in Florida. As a result of the analysis performed for this project, useful disposed waste composition data is available at the county-level for every county in Florida.

Developing a Product that is 100% Transferable to All Florida Counties

Unlike most of the Innovative Grant awards that directly benefit only a single county or region of the State (i.e., for other counties or regions to gain any benefit, they would have to spend money to implement a similar project), this project has resulted in a product that can be used immediately by each and every county in the State. The resulting computer model is available on FDEP's website for immediate use by Florida county solid waste planners.

Impact of Legislative Changes on Project Outcome

It must be noted that the usefulness of the final waste composition model has been impacted both positively and negatively by legislative changes that occurred after award of the grant in the 1999-2000 timeframe. At the time the grant was awarded, all Florida Counties were required to submit detailed solid waste disposal and recycling reports to the FDEP on an annual basis, and FDEP was required to prepare an annual State-wide report documenting county-level and state-level progress towards meeting a state recycling goal. At the time, each county was required to submit annual disposal and recycling quantities, as well as details about recycling and diversion efforts that were underway in the county. FDEP, through its list of certified recyclers across the State, was able to compile and track county-specific recycled material quantities. However, no mechanism existed for counties to estimate the composition of their disposed waste stream and thereby calculate material specific recycling rates (as required by FDEP).

The computer model developed for this project allows users to generate the specific annual summary table (Recycling and Education Grant Table 1) that was to be submitted every year to FDEP. Additionally, the computer model provides a back-up version of this table that illustrates exactly how the table is generated, assuring that both the numerator and denominator of the recycling rate is calculated accurately both in total and by material. With the State Legislature recently reducing the county reporting requirements, it is not clear that counties will continue to have the need to create and submit this table. As a result of these legislative changes, some counties may opt to stop reporting to FDEP in such detail, and may not have incentive to use the model.

In the same breath, it is fair to say that the model could not have come at a better time. If FDEP is willing to keep the model current with county-level recycling data, the model can serve as a tool for counties to easily and conveniently estimate their disposed waste composition, and to calculate their material-specific recycling rate (given that counties are still required to track and report disposed MSW). Waste disposal and recycling data can continue to be tracked on an annual basis for active solid waste planners and recyclers.

Project Cost Summary

The total Grant award for this project totaled \$240,000. Charlotte County retained R. W. Beck, Inc., a professional solid waste consulting firm, to conduct the additional waste sorts and develop the computer model. In addition to the grant award itself, the sponsor counties and R. W. Beck contributed an additional \$54,800 in cash and/or in-kind contributions of labor and general expenses. Table 1 summarizes the cost of this Grant by expense component.

Table 1 Summary of Project Costs by Expense Component

Expense Category	Paid by Grant	Contributed by Sponsors & Third Parties	Total Cost of Project
Administrative Expenses	\$14,300	\$4,800	\$19,100
Equipment Expenses	\$8,000	\$0	\$8,000
Operating Expenses [1]	\$203,700	\$45,200	\$248,900
Advertising Expense	\$0	\$0	\$0
Education Expense	\$0	\$4,800	\$4,800
Other Expense [2]	\$14,000	\$0	\$14,000
Total	\$240,000	\$54,800	\$294,800

[1] Includes \$5,200 of construction & demolition (C&D) data collection for the benefit of a separate DEP-funded project to measure C&D generation and composition.

[2] Includes travel costs for performing waste composition studies across the State.

Table 2 summarizes the total cost of the project, summarized by task.

Table 2 Summary of Project Costs by Task

Task	Paid by Grant	Contributed by Sponsors & Third Parties	Total Cost of Project
Analyze and Compile Existing Data	\$9,900	\$500	\$10,400
Select Counties for Supplemental Data Collection	\$4,600	\$500	\$5,100
Conduct Supplementary Waste Sorts [1]	\$177,600	\$46,500	\$187,100
Document Demographic Data	\$14,700	\$500	\$15,200
Develop Statistical Relationships	\$25,200	\$500	\$25,700
Develop Beta Version of Desktop Computer Model	\$17,100	\$500	\$17,600
Develop Web-based Computer Model	\$27,900	\$500	\$28,400
Technology Transfer & Outreach	\$0	\$5,300	\$5,300
Total	\$240,000	\$54,800	\$294,800

[1] Includes \$5,200 of construction & demolition (C&D) data collection for the benefit of a separate DEP-funded project to measure C&D generation and composition

Cost Benefit Analysis

Due to the nature of this project—which was intended to develop useful solid waste and recycling planning data, but not an actual recycling, diversion or source reduction program—it is not possible to provide a cost-benefit analysis in terms of cost per ton of material diverted or recycled. However, we believe this project, which ultimately provided a resource for use by every county in Florida, was performed at a far lower cost than alternatives to developing reasonable county-specific waste composition estimates.

In the course of this project, it was found that a two-season waste composition study could be performed for most Florida counties for a cost of \$45,000. The cost of performing a study for all 67 counties in Florida would amount to \$3.0 million.

This Grant funded the performance of four of these studies, at a cost of \$187,100, strictly for the waste sorts. By leveraging data from a jointly-awarded grant to Pinellas County, and by researching recently completed waste composition studies, the model developed for this project provides Florida-specific waste composition data for all 67 counties for a total of \$294,800¹. This represents only 10 percent of the total cost of performing actual waste composition studies, or a savings of \$2.7 million. The cost per county to obtain reasonable local waste composition data has been reduced from \$45,000 to \$4,500.

Additionally, the statistical coefficients developed for the model are expected to be relevant for a minimum of five years. Counties will be able to rely on this tool for waste composition estimates for the near future, and the potential exists to update the model every five years with improved waste composition, demographic and solid waste system data.

Conclusion

The Florida State-wide Waste Composition Model provides a template for tracking and maintaining county-specific waste composition data for the next five years. At a minimum, the model should serve as a resource for estimating the composition of disposed MSW and C&D in all of Florida's counties.

With the recent reduction in solid waste and recycling reporting requirements passed by the State Legislature, it is likely that county solid waste and recycling planners will have fewer resources at their disposal for tracking and managing their local solid waste streams. The Web-based model developed as part of this project will remain available as a resource for those counties that are committed to tracking their waste generation, recycling rates, and disposed waste composition.

Additionally, the model represents a tool that could simplify the reporting process and standardize the development of material-specific recycling rates within Florida counties. It is not clear at this time if such reporting will continue, in light of recent legislative changes.

¹ Exclusive of the cost of the Pinellas County grant.

The model developed as part of this project relies on data that changes over time. Waste composition changes in conjunction with changes in local solid waste and recycling programs, the rise and fall of the business cycle, and changes in the concentration of local growth and industry trends. Ideally, the computer model's underlying waste composition data should be updated every five years to assure that the model's ability to project waste composition data remains current.

APPENDIX A

**EVALUATION OF EXISTING FLORIDA WASTE
COMPOSITION DATA**

TECHNICAL MEMORANDUM



To: Barbara Kula, Charlotte County

cc: Chuck McLendon, R. W. Beck
Susan Metcalfe, Citrus County
Jim Reece, Okaloosa County
Jodi John, Sarasota County
Pinellas County Team (c/o Tina Patton, Kessler Consulting)

From: John Culbertson

Subject: **Innovative Recycling Grant—Evaluation of Existing Florida Waste Composition Studies**

Date: April 23, 2001

The purpose of this Technical Memorandum is to present the results of our research into existing waste composition studies to be used as input for the 1999-2000 Innovative Recycling Grant to develop a Florida State-wide Waste Composition computer model.

From the outset of the project, R. W. Beck has been coordinating with the Florida Department of Environmental Protection (FDEP) and the Pinellas County Innovative Recycling Grant Project Team to identify, gather, and evaluate previously conducted waste composition studies in the State of Florida. These existing studies, along with the field studies recently completed in eight additional counties across the State, will be used as input into the predictive computer model that will ultimately be developed under this Innovative Recycling Grant (and also by the Pinellas County Project Team under a similar Grant). The remainder of this technical memorandum summarizes our evaluation of waste composition studies previously conducted in the State to determine which results are valid for use in developing such a statistically predictive model.

The sections that follow discuss:

- Our research and evaluation of existing waste composition studies;
- The waste composition data derived from the studies that met certain selection criteria; and
- A brief discussion of moisture content.

Actual data to be used in computer model development are attached as appendices to this technical memorandum.

EVALUATION OF EXISTING MSW COMPOSITION STUDIES

Changes in community demographics, economic conditions, packaging mix, and waste management programs have all contributed to substantial changes in the discarded waste stream over time. For this reason, it was determined that studies conducted before 1995 should be excluded from consideration as part of this project.

At the outset of the project, FDEP surveyed Florida's counties to ascertain the date of the most recent waste composition study performed for each County. Based on this survey, ten counties were reported to

have conducted some form of an MSW and/or C&D debris composition study subsequent to 1995. R. W. Beck and the Pinellas County Team each followed up with five of the counties to request copies of the most recent waste composition study report.

After receiving responses from all counties that were believed to have conducted a waste composition study, it was found that only six potentially useful studies were available. The following counties were ultimately found to potentially have useful waste composition study data for use in computer model development:

- Alachua County (1997);
- Hendry County (1999);
- Lee County (1997);
- Marion County (1997);
- Monroe County (1997); and
- Sumter County (1998).

In conjunction with the Pinellas County Team, R. W. Beck developed a set of evaluation criteria to determine the usefulness of existing study data. These criteria included:

- Appropriateness of the generating sectors targeted in the study;
- Soundness of the sampling protocols used; and
- Representativeness and accuracy of statistical analyses used to evaluate field study findings.

Further analysis revealed the following limitations for two of the previously completed studies:

- The Lee County project was designed to evaluate only the recyclable materials in the waste stream. As a result, this waste composition study was determined to have limited usefulness for the development of a State-wide waste composition model; and
- The Hendry County study presented aggregate results for the entire County, without differentiating between generating sectors. Additionally, Hendry County sampling was extremely limited.

After excluding the two counties above, the remaining waste composition studies conducted in Florida that met key criteria will be considered in the modeling efforts include:

- Single-family residential waste stream data points: Alachua, Marion, Monroe, and Sumter Counties;
- Multi-family residential waste stream data points: Alachua and Monroe Counties; and
- Industrial, commercial, and institutional (ICI) waste stream data points: Alachua, Marion, Monroe, and Sumter Counties.

WASTE COMPOSITION DATA

Existing waste composition studies were primarily available in hard copy only. R. W. Beck's first step was to compile the actual results as reported in each study. Actual results by generating sector for all four counties are shown in Exhibits A through D, included at the end of this memorandum.

An objective of the computer model will be to report results according to material categories that are consistent with the categories reported to and tracked by FDEP. For annual reporting purposes in the Research and Education (R&E) Grants, FDEP differentiates waste into the following 19 material categories:

- | | | |
|--------------------|-------------------|-------------------|
| 1) Newspaper | 8) Steel Cans | 15) C&D Debris |
| 2) Corrugated | 9) Ferrous | 16) White Goods |
| 3) Office Paper | 10) Aluminum Cans | 17) Tires |
| 4) Other Paper | 11) Non-ferrous | 18) Miscellaneous |
| 5) Plastic Bottles | 12) Food Waste | 19) Rubber |
| 6) Other Plastic | 13) Yard Waste | |
| 7) Glass | 14) Textiles | |

As shown in Exhibits A through D, each County defined their list of material categories differently from the categories reported by FDEP. To develop uniform results consistent with FDEP's R&E Grant reporting requirements, R. W. Beck mapped the material categories identified in Exhibits A through D for each of the existing studies to the appropriate FDEP-defined material category. This process primarily involved aggregating the mean composition and confidence intervals (if available) of one or more material category into the appropriate FDEP-defined category. The mapping of material categories into FDEP-defined categories is shown in the far right column of Exhibits A through D.

Exhibits E through H present the aggregated results from each of the four counties' existing waste composition studies, based on the standardized categories utilized by FDEP for R&E Grant reporting purposes. Separate result sets have been developed for each of the targeted generating sectors.

R. W. Beck will incorporate data from these four counties into the predictive computer model being conducted in this study. Given that R. W. Beck and the Pinellas County Project Team have collectively performed another eight waste composition studies in the past 9 months, there will be a total of 12 data points integrated into the model. Note that these 12 data points are quite representative of the State as a whole. These waste composition studies span a wide range of counties in urban, suburban and rural areas of the state; in north, central and southern regions of the state; with different business and industry profiles; and in both coastal and inland counties. In short, these 12 data points appear to provide a reasonable level of representation of counties across Florida.

MOISTURE CONTENT

Because Florida experiences a rainy season, the moisture content of discarded waste is relevant to understanding the overall characteristics of the waste stream.

Monroe County, one of the existing waste composition studies targeted as part of this project, conducted a moisture analysis as part of their study efforts. In addition, Indian River County completed a moisture content analysis in a study conducted prior to 1995. Because Florida's annual weather patterns are

relatively consistent over time, it was determined that the moisture content data from Indian River County would be valid for incorporating into the computer model.

Exhibits I and J present the moisture content of targeted material categories from Monroe County and Indian River County, respectively. These Exhibits also show the mapping that was used to align material categories with the FDEP-defined material categories. In the case of Monroe County, it was possible to develop a weighted average moisture content based on the proportion of each material in the Monroe County waste stream. In Indian River County, no such weighting factors were available, so a straight average was used to aggregate County-defined material categories into FDEP-defined categories.

Exhibit K compares and averages the two moisture content data sets. It is interesting to note that the results of each study are quite consistent across material categories. Based on these data, R. W. Beck anticipates using an average of the two moisture content result sets in developing the computer model.

Counties participating in the study, as well as other interested parties, are encouraged to review the data attached herein and provide comments to R. W. Beck for consideration in model development. As computer model development is expected to commence in the near future, please provide comments to me at (407) 648-3563 or jculbertson@rwbeck.com no later than May 15. Your attention to this matter is greatly appreciated.

Exhibit A
Alachua County
Waste Composition Study Results
As Reported in 1997 Study

Material Categories	Single Family			Multi - Family			Commercial / Institutional			Rural / Drop Off			Material Category Maps to
	Avg.	Confidence Interval		Avg.	Confidence Interval		Avg.	Confidence Interval		Avg.	Confidence Interval		
		Lower	Upper		Lower	Upper		Lower	Upper		Lower	Upper	
Corrugated	2.1%	1.4%	2.7%	3.4%	2.4%	4.4%	6.6%	4.1%	9.1%	2.0%	1.4%	2.5%	Corrugated
Office Paper	3.3%	2.1%	4.4%	3.0%	1.0%	5.0%	3.3%	1.4%	5.2%	3.6%	1.9%	5.3%	Office Paper
Bulk Mail	2.3%	1.5%	3.1%	2.1%	1.1%	3.2%	0.5%	0.2%	0.9%	2.8%	1.5%	4.1%	Other paper
Newspaper	5.3%	4.1%	6.5%	7.4%	5.8%	9.0%	3.1%	1.3%	4.9%	6.1%	4.5%	7.7%	Newspaper
Other	21.6%	18.5%	24.6%	19.4%	15.9%	23.0%	13.4%	8.5%	18.4%	20.6%	17.6%	23.7%	Other paper
PET Containers	1.3%	1.0%	1.6%	1.9%	1.5%	2.4%	1.3%	0.8%	1.8%	1.4%	1.2%	1.7%	Plastic Bottles
HDPE Containers	1.2%	0.9%	1.4%	2.4%	1.7%	3.0%	0.7%	0.3%	1.0%	2.4%	1.9%	2.9%	Plastic Bottles
Other Containers	1.5%	0.9%	2.0%	1.8%	1.1%	2.4%	0.8%	0.3%	1.3%	1.6%	0.8%	2.4%	Other Plastics
Film	6.0%	5.4%	6.6%	6.0%	5.1%	7.0%	4.2%	2.8%	5.6%	5.4%	4.8%	6.1%	Other Plastics
Other	3.9%	2.8%	4.9%	2.7%	1.9%	3.6%	10.6%	6.7%	14.5%	4.8%	3.6%	6.0%	Other Plastics
Steel/Bimetal Cans	2.9%	2.5%	3.3%	2.9%	2.4%	3.4%	1.2%	0.7%	1.7%	4.2%	3.3%	5.1%	Steel Cans
Aluminum Cans	0.8%	0.5%	1.2%	1.5%	1.1%	1.9%	0.9%	0.4%	1.3%	12.0%	0.8%	1.5%	Aluminum Cans
Other	2.5%	1.3%	3.7%	1.1%	0.4%	1.7%	10.5%	5.3%	15.6%	2.1%	1.3%	2.9%	Ferrous Metals
Containers	4.6%	3.6%	5.7%	7.5%	5.8%	9.2%	2.5%	1.5%	3.5%	5.5%	4.6%	6.4%	Glass
Other	0.4%	0.0%	0.8%	0.3%	0.0%	0.6%	0.7%	0.0%	1.6%	0.4%	0.0%	0.8%	Glass
Disposable Diapers	2.9%	1.7%	4.1%	4.1%	2.8%	5.4%	0.9%	0.3%	1.5%	4.7%	3.1%	6.4%	Miscellaneous
Meat (Food) Waste	3.3%	1.6%	5.1%	2.0%	0.5%	3.6%	0.6%	0.0%	1.2%	1.1%	0.2%	2.1%	Food Waste
Vegetable (Food) Waste	8.4%	6.2%	10.6%	5.2%	3.5%	6.9%	2.8%	1.5%	4.0%	5.2%	3.7%	6.8%	Food Waste
Food-Contaminated Paper	1.9%	0.5%	3.4%	4.2%	1.6%	6.9%	4.0%	0.5%	7.5%	2.1%	0.8%	3.3%	Food Waste
Textiles	4.8%	3.5%	6.2%	2.3%	1.5%	3.1%	2.6%	1.0%	4.3%	4.7%	3.1%	6.4%	Textiles
Rubber	0.4%	0.0%	0.8%	< 0.1%	0.0%	0.1%	< 0.1%	0.0%	0.1%	< 0.1%	0.0%	0.2%	Rubber
Other	6.2%	4.3%	8.2%	6.5%	4.6%	8.4%	12.1%	6.6%	17.5%	5.9%	3.4%	8.5%	Miscellaneous
Batteries	< 0.1%	0.0%	0.2%	< 0.1%	0.0%	0.2%	0.1%	0.0%	0.2%	0.1%	0.0%	0.2%	Miscellaneous
Oil Filters	< 0.1%	0.0%	0.1%	0.1%	0.0%	0.3%	< 0.1%	0.0%	0.0%	0.2%	0.0%	0.5%	Miscellaneous
Other	< 0.1%	0.0%	0.1%	0.1%	0.0%	0.4%	< 0.1%	0.0%	0.1%	< 0.1%	0.0%	0.0%	Miscellaneous
Composite Items	1.8%	0.5%	3.0%	2.6%	1.0%	5.8%	8.1%	1.9%	22.4%	3.8%	1.6%	6.0%	Miscellaneous
Miscellaneous	10.5%	8.0%	13.0%	9.1%	6.4%	9.8%	8.4%	4.8%	13.1%	7.9%	6.0%	9.8%	Miscellaneous
TOTAL	100.0%			100.0%			100.0%			100.0%			

NOTES:

1. Composition is based on 27 single-family samples, 26 multi-family samples, 26 commercial samples, and 26 rural/drop-off samples.
2. Confidence intervals are shown at the 95 percent level.
3. Some numbers may not total exactly due to rounding.
4. Data compiled from Exhibits 3-1 to 3-4 of Final Report

**Exhibit B
Marion County
Waste Composition Study Results
As Reported in 1997 Study**

Material Categories	Single Family			Multi - Family			Commercial			Material Category Maps to
	Avg.	Confidence Interval		Avg.	Confidence Interval		Avg.	Confidence Interval		
		Lower	Upper		Lower	Upper		Lower	Upper	
Newspaper	8.6%						4.2%			Newspaper
Corrugated	5.1%						12.4%			Corrugated
Office Paper	0.5%						3.9%			Office Paper
Magazines	3.0%						1.7%			Other Paper
Telephone Directories	0.3%						0.5%			Other Paper
Other Paper	21.1%						14.6%			Other Paper
#1 Plastic	1.0%						0.5%			Plastic Bottles
#2 Plastic	1.7%						1.2%			Plastic Bottles
Other Plastic	12.0%						13.2%			Other Plastic
Clear Glass	2.4%						1.1%			Glass
Brown Glass	1.4%						1.8%			Glass
Green Glass	0.8%						0.3%			Glass
Other Glass	0.1%						0.5%			Glass
Metal Food Containers	2.8%						1.7%			Steel Cans
Scrap Metal	1.4%						2.0%			Ferrous Metals
Aluminum Cans	0.8%						0.6%			Aluminum Cans
Alum Food Containers	0.1%						0.0%			Aluminum Cans
Other Aluminum	0.2%						0.4%			Non-ferrous Metals
Scrap Aluminum	0.2%						0.3%			Non-ferrous Metals
Misc Food	9.8%						9.1%			Food Waste
Yard Waste	4.9%						2.4%			Yard Waste
Diapers	3.8%						1.2%			Miscellaneous
Wood Crates	0.0%						0.0%			Miscellaneous
Pallets	0.1%						2.0%			Miscellaneous
Other Wood	1.5%						3.5%			Miscellaneous
Misc Rubber	0.7%						0.9%			Rubber
Other Organic	1.1%						1.1%			Miscellaneous
Textiles	4.0%						3.6%			Textiles
Drywall	0.2%						0.6%			C&D Debris
Wood Furniture	0.2%						1.2%			C&D Debris
Concrete	0.8%						1.1%			C&D Debris
Plywood	0.0%						0.3%			C&D Debris
Lumber	0.2%						1.2%			C&D Debris
Other C&D	0.9%						1.6%			C&D Debris
White Goods	1.0%						0.0%			White Goods
Tires	0.0%						0.5%			Tires
Electrical	0.7%						0.7%			Miscellaneous
Batteries	0.1%						0.1%			Miscellaneous
Medical Waste	0.0%						0.2%			Miscellaneous
Other HH Hazardous	0.6%						0.4%			Miscellaneous
Misc	6.4%						7.3%			Miscellaneous
TOTALS	100%						100%			

NOTES:

1. Composition is based on an unknown quantity of samples.
2. Confidence intervals were not available.
3. Some numbers may not total exactly due to rounding.
4. A multi-family composition study was not conducted in Marion County
5. Data compiled from Table 3.5

Exhibit C
Monroe County
Waste Composition Study Results
As Reported in 1997 Study

Material Categories	Single Family			Multi - Family			Commercial			Material Category Maps to
	Avg.	Confidence Interval		Avg.	Confidence Interval		Avg.	Confidence Interval		
		Lower	Upper		Lower	Upper		Lower	Upper	
Newspaper	4.6%	3.8%	5.5%	4.6%	3.7%	5.7%	3.5%	2.9%	4.2%	Newspaper
Magazines	4.6%	3.3%	6.2%	3.9%	3.1%	4.8%	2.5%	1.8%	3.4%	Other Paper
Corrugated Cardboard	4.8%	3.4%	6.4%	5.1%	3.9%	6.5%	6.9%	5.3%	8.7%	Corrugated
High Grade Office Paper	1.3%	0.8%	2.0%	1.1%	0.6%	1.8%	1.2%	0.8%	1.7%	Office Paper
Junk Mail	2.6%	2.0%	3.2%	2.5%	1.8%	3.3%	1.5%	1.1%	2.0%	Other Paper
Mixed Paper	6.0%	5.4%	6.7%	5.5%	4.8%	6.2%	5.4%	4.6%	6.3%	Other Paper
Other Paper	4.6%	4.1%	5.2%	4.9%	4.3%	5.6%	5.2%	4.5%	5.8%	Other Paper
PET Bottles	0.9%	0.7%	1.0%	0.8%	0.6%	1.0%	0.9%	0.7%	1.1%	Plastic Bottles
HDPE Bottles	1.0%	0.8%	1.3%	0.7%	0.6%	0.9%	1.0%	0.8%	1.2%	Plastic Bottles
Other Plastic Bottles	0.6%	0.4%	0.7%	0.7%	0.5%	1.0%	0.6%	0.4%	0.8%	Other Plastic
Other Plastic	8.2%	7.4%	9.0%	9.0%	8.0%	10.2%	9.7%	8.8%	10.7%	Other Plastic
Clear Glass	4.5%	3.7%	5.3%	3.6%	2.9%	4.3%	2.8%	2.3%	3.4%	Glass
Brown Glass	2.4%	1.8%	3.1%	2.1%	1.5%	2.8%	2.8%	2.1%	3.5%	Glass
Green Glass	1.9%	1.3%	2.6%	1.6%	1.1%	2.2%	1.9%	1.4%	2.5%	Glass
Other Glass	1.6%	1.1%	2.3%	2.1%	1.5%	2.9%	3.0%	2.1%	4.0%	Glass
Ferrous Cans	1.5%	1.3%	1.7%	1.6%	1.3%	2.0%	1.5%	1.2%	1.9%	Steel Cans
Aerosol Cans	0.2%	0.1%	0.3%	0.2%	0.1%	0.3%	0.1%	0.1%	0.2%	Ferrous Metals
Other Ferrous Metals	2.1%	1.0%	3.6%	1.4%	0.7%	2.3%	0.7%	0.4%	1.0%	Ferrous Metals
Aluminum Cans	1.1%	0.9%	1.3%	1.2%	1.0%	1.4%	1.1%	0.9%	1.3%	Aluminum Cans
Other Non-Ferrous Metals	1.1%	0.8%	1.4%	0.7%	0.4%	0.9%	0.5%	0.4%	0.6%	Non-ferrous Metal
Food Waste	17.2%	14.9%	19.7%	15.3%	12.9%	18.0%	24.6%	20.4%	29.0%	Food Waste
Yard Waste	6.8%	4.3%	9.8%	9.6%	5.9%	14.0%	3.8%	2.2%	5.9%	Yard Waste
Diapers	2.6%	1.8%	3.6%	2.1%	1.5%	2.8%	1.1%	0.7%	1.7%	Miscellaneous
Other Organics	1.6%	1.2%	2.2%	1.6%	1.0%	2.3%	1.2%	0.7%	1.8%	Miscellaneous
Textiles & Leather	3.8%	2.7%	5.0%	4.5%	3.2%	6.1%	2.9%	2.0%	3.9%	Textiles
C&D Debris	4.4%	3.0%	6.0%	3.9%	2.7%	5.4%	5.4%	3.6%	7.5%	C&D Debris
Consumer Goods	2.7%	1.7%	3.9%	2.3%	1.4%	3.5%	2.2%	1.3%	3.2%	Miscellaneous
Batteries	0.1%	0.0%	0.2%	0.1%	0.1%	0.2%	0.1%	0.0%	0.1%	Miscellaneous
Fluorescent Bulbs	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	Miscellaneous
Hazardous Waste	1.1%	0.7%	1.6%	0.6%	0.3%	1.1%	1.4%	0.7%	2.3%	Miscellaneous
Medical Waste	0.1%	0.0%	0.2%	0.1%	0.0%	0.2%	0.1%	0.0%	0.1%	Miscellaneous
Fines	3.1%	2.5%	3.9%	4.5%	3.8%	5.2%	3.6%	2.9%	4.3%	Miscellaneous
Other Inorganics	0.9%	0.5%	1.4%	1.7%	0.9%	2.8%	0.7%	0.4%	1.1%	Miscellaneous
TOTAL	100.0%			100.0%			100.0%			

NOTES:

1. Composition is based on 28 single family samples, 26 multi-family samples, and 33 commercial samples.
2. Confidence intervals are shown at the 90 percent level.
3. Some numbers may not total exactly due to rounding.
4. Data compiled from Table 8 and Appendices of Final Report

Exhibit D
Sumter County
Waste Composition Study Results
As Reported in 1998 Study

Material Categories	Single Family			Multi - Family			Commercial			Institutional			Material Category Maps to
	Avg.	Confidence Interval		Avg.	Confidence Interval		Avg.	Confidence Interval		Avg.	Confidence Interval		
		Lower	Upper		Lower	Upper		Lower	Upper		Lower	Upper	
Newspaper	10.2%	8.9%	11.6%				2.9%	1.2%	4.5%	4.4%	-3.3%	12.1%	Newspaper
Corrugated Paper	2.4%	1.3%	3.4%				9.9%	6.8%	13.0%	4.4%	-1.7%	10.4%	Corrugated
Office Paper	0.6%	0.5%	0.8%				0.2%	-0.1%	0.5%	6.2%	-9.7%	22.1%	Office
Other Paper	25.0%	23.2%	26.7%				24.9%	20.4%	29.3%	40.2%	28.9%	51.5%	Other Paper
Film Plastic	5.1%	4.7%	5.5%				7.9%	5.9%	9.9%	5.9%	1.8%	9.9%	Other Plastic
HDPE Containers	1.5%	1.4%	1.7%				3.1%	2.2%	4.0%	0.2%	-0.3%	0.8%	Plastic Bottles
PET Containers	1.4%	1.1%	1.7%				1.0%	0.3%	1.7%	0.6%	0.6%	0.7%	Plastic Bottles
Other Plastic Containers	0.8%	0.6%	1.1%				1.0%	0.3%	1.8%	1.7%	-0.4%	3.8%	Other Plastic
Other Plastics	2.6%	2.2%	2.9%				5.4%	3.2%	7.6%	3.7%	1.3%	6.0%	Other Plastic
Tin/Steel Cans	3.8%	3.0%	4.6%				1.7%	0.6%	2.9%	0.5%	-0.5%	1.4%	Steel Cans
Other Ferrous	0.6%	0.3%	0.8%				0.4%	0.0%	0.9%	0.7%	0.6%	0.9%	Ferrous Metal
Aluminum Cans	1.5%	1.1%	1.8%				0.9%	0.8%	1.1%	0.5%	-0.1%	1.0%	Aluminum Cans
Other Non-Ferrous	0.5%	0.3%	0.6%				0.3%	0.2%	0.4%	0.2%	-0.6%	1.1%	Non-ferrous Metal
Glass Containers	9.2%	7.6%	10.8%				4.6%	3.3%	5.8%	0.1%	-0.3%	0.6%	Glass
Other Glass	0.4%	0.2%	0.5%				0.3%	0.0%	0.6%	0.0%	0.0%	0.0%	Glass
Textiles	3.0%	2.3%	3.8%				2.3%	1.0%	3.5%	10.8%	0.7%	20.8%	Textiles
Food Waste	14.6%	12.9%	16.4%				10.6%	2.6%	18.5%	3.7%	-3.3%	10.7%	Food waste
Yard Waste Trash	3.8%	0.9%	6.7%				0.8%	0.1%	1.4%	5.4%	-2.7%	13.6%	Yard waste
Wood	0.3%	0.1%	0.4%				3.4%	0.5%	6.3%	0.1%	-0.2%	0.5%	Miscellaneous
Electronics	0.5%	0.3%	0.6%				0.8%	0.2%	1.4%	0.0%	0.0%	0.0%	Miscellaneous
Household Batteries	0.1%	0.0%	0.1%				0.1%	0.0%	0.2%	0.1%	0.0%	0.3%	Miscellaneous
Hazardous Substances	0.0%	0.0%	0.1%				0.1%	0.0%	0.2%	0.8%	-1.2%	2.8%	Miscellaneous
Diapers	2.1%	1.5%	2.6%				4.6%	1.4%	7.7%	0.5%	-1.1%	2.0%	Miscellaneous
Bulky Waste	1.5%	0.8%	2.2%				2.2%	0.6%	3.7%	0.3%	-0.2%	0.8%	Miscellaneous
Other Miscellaneous	3.1%	1.7%	4.6%				2.4%	1.3%	3.4%	5.1%	-4.7%	14.8%	Miscellaneous
Grit	5.5%	4.5%	6.5%				8.3%	2.7%	13.9%	3.8%	0.4%	7.1%	Miscellaneous
TOTALS	100%						100%			100%			

NOTES:

1. Composition is based on 14 residential samples, 6 commercial samples, and 2 institutional samples.
2. Confidence intervals are shown at the 90 percent level.
3. Some numbers may not total exactly due to rounding.
4. A multi-family composition study was not conducted in Sumter County
5. Data compiled from Tables 2, 3, and 4 of Final Report

Exhibit E
Alachua County
Waste Composition Study Results Mapped into
DEP-Defined Material Categories

Material Categories	Single Family			Multi - Family			Commercial		
	Avg.	Confidence Interval		Avg.	Confidence Interval		Avg.	Confidence Interval	
		Lower	Upper		Lower	Upper		Lower	Upper
Newspaper	5.3%	4.1%	6.5%	7.4%	5.8%	9.0%	3.1%	1.3%	4.9%
Corrugated	2.1%	1.4%	2.7%	3.4%	2.4%	4.4%	6.6%	4.1%	9.1%
Office Paper	3.3%	2.1%	4.4%	3.0%	1.0%	5.0%	3.3%	1.4%	5.2%
Other Paper	23.9%	20.7%	27.0%	21.5%	17.9%	25.3%	13.9%	9.0%	18.9%
Plastic Bottles	2.5%	2.1%	2.9%	4.3%	3.5%	5.1%	2.0%	1.4%	2.6%
Other Plastic	11.4%	10.0%	12.7%	10.5%	9.1%	12.0%	15.6%	11.4%	19.8%
Glass	5.0%	3.9%	6.2%	7.8%	6.1%	9.5%	3.2%	2.0%	4.5%
Steel Cans	2.9%	2.5%	3.3%	2.9%	2.4%	3.4%	1.2%	0.7%	1.7%
Ferrous	2.5%	1.3%	3.7%	1.1%	0.4%	1.7%	10.5%	5.3%	15.6%
Aluminum Cans	0.8%	0.5%	1.2%	1.5%	1.1%	1.9%	0.9%	0.4%	1.3%
Non-ferrous	0.0%			0.0%			0.0%		
Food Waste	13.6%	0.5%	3.4%	11.4%	1.6%	6.9%	7.4%	0.5%	7.5%
Yard Waste	0.0%	3.5%	6.2%	0.0%	1.5%	3.1%	0.0%	1.0%	4.3%
Textiles	4.8%	3.5%	6.2%	2.3%	1.5%	3.1%	2.6%	1.0%	4.3%
C&D	0.0%	0.0%	0.8%	0.0%	0.0%	0.1%	0.0%	0.0%	0.1%
White Goods	0.0%			0.0%			0.0%		
Tires	0.0%			0.0%			0.0%		
Miscellaneous	21.4%	17.8%	25.0%	22.5%	18.6%	26.5%	29.6%	20.5%	45.6%
Rubber	0.4%	0.0%	80.0%	< 0.1%	0.0%	0.1%	< 0.1%	0.0%	20.0%
TOTAL	100%			100%			100%		

NOTES:

1. In order to standardize reporting some non-standard categories were combined with logical major categories for this report.
2. Some DEP-defined material categories were not included in original study.
3. Some numbers may not total exactly due to rounding.

**Exhibit F
Marion County
Waste Composition Study Results Mapped into
DEP-Defined Material Categories**

Material Categories	Single Family			Multi - Family			Commercial		
	Avg.	Confidence Interval		Avg.	Confidence Interval		Avg.	Confidence Interval	
		Lower	Upper		Lower	Upper		Lower	Upper
Newspaper	8.6%						4.2%		
Corrugated	5.1%						12.4%		
Office Paper	0.5%						3.9%		
Other Paper	24.4%						16.8%		
Plastic Bottles	2.7%						1.8%		
Other Plastic	12.0%						13.2%		
Glass	4.7%						3.8%		
Steel Cans	2.8%						1.7%		
Ferrous	1.4%						2.0%		
Aluminum Cans	0.9%						0.6%		
Non-ferrous	0.3%						0.7%		
Food Waste	9.8%						9.1%		
Yard Waste	4.9%						2.4%		
Textiles	4.0%						3.6%		
C&D	2.3%						6.0%		
White Goods	1.0%						0.0%		
Tires	0.0%						0.5%		
Miscellaneous	14.2%						16.5%		
Rubber	0.7%						0.9%		
TOTAL	100%						100%		

NOTES:

1. In order to standardize reporting some non standard categories were combined with logical major categories for this report.
2. Confidence intervals were not reported.
3. Some numbers may not total exactly due to rounding.
4. A multi-family composition study was not conducted in Marion County

Exhibit G
Monroe County
Waste Composition Study Results Mapped into
DEP-Defined Material Categories

Categories	Single Family			Multi Family			Commercial		
	Avg.	Confidence Interval		Avg.	Confidence Interval		Avg.	Confidence Interval	
		Lower	Upper		Lower	Upper		Lower	Upper
Newspaper	4.6%	3.8%	5.5%	4.6%	3.7%	5.7%	3.5%	2.9%	4.2%
Corrugated	4.8%	3.4%	6.4%	5.1%	3.9%	6.5%	6.9%	5.3%	8.7%
Office Paper	1.3%	0.8%	2.0%	1.1%	0.6%	1.8%	1.2%	0.8%	1.7%
Other Paper	17.8%	16.8%	18.9%	16.8%	15.6%	18.1%	14.6%	13.5%	15.8%
Plastic Bottles	1.9%	1.6%	2.2%	1.5%	1.3%	1.8%	1.9%	1.6%	2.2%
Other Plastic	8.8%	8.0%	9.6%	9.7%	8.7%	10.9%	10.3%	9.4%	11.3%
Glass	10.4%	9.1%	11.9%	9.4%	8.2%	10.8%	10.5%	9.2%	12.0%
Steel Cans	1.5%	1.3%	1.7%	1.6%	1.3%	2.0%	1.5%	1.2%	1.9%
Ferrous	2.3%	1.2%	3.8%	1.6%	1.3%	2.0%	0.8%	0.5%	1.1%
Aluminum Cans	1.1%	0.9%	1.3%	1.2%	1.0%	1.4%	1.1%	0.9%	1.3%
Non-ferrous	1.1%	0.8%	1.4%	0.7%	0.4%	0.9%	0.5%	0.4%	0.6%
Food Waste	17.2%	14.9%	19.7%	15.3%	12.9%	18.0%	24.6%	20.4%	29.0%
Yard Waste	6.8%	4.3%	9.8%	9.6%	5.9%	14.0%	3.8%	2.2%	5.9%
Textiles	3.8%	2.7%	5.0%	4.5%	3.2%	6.1%	2.9%	2.0%	3.9%
C&D	4.4%	3.0%	6.0%	3.9%	2.7%	5.4%	5.4%	3.6%	7.5%
White Goods	0.0%			0.0%			0.0%		
Tires	0.0%			0.0%			0.0%		
Miscellaneous	12.2%	10.6%	14.2%	13.0%	11.3%	15.1%	10.4%	8.9%	12.2%
Rubber	0.0%			0.0%			0.0%		
TOTAL	100%			100%			100%		

NOTES:

1. In order to standardize reporting some non standard categories were combined with logical major categories for this report.
2. Some DEP-defined material categories were not included in original study.
3. Some numbers may not total exactly due to rounding.

**Exhibit H
Sumter County
Waste Composition Study Results Mapped into
DEP-Defined Material Categories**

Material Categories	Single Family			Multi Family			Commercial		
	Avg.	Confidence Interval		Avg.	Confidence Interval		Avg.	Confidence Interval	
		Lower	Upper		Lower	Upper		Lower	Upper
Newspaper	10.2%	8.90%	11.60%				2.9%	1.20%	4.50%
Corrugated	2.4%	1.30%	3.40%				9.9%	6.80%	13.00%
Office Paper	0.6%	0.50%	0.80%				0.2%	0.00%	0.50%
Other Paper	25.0%	23.20%	26.70%				24.9%	20.40%	29.30%
Plastic Bottles	2.9%	2.60%	3.30%				4.1%	3.00%	5.20%
Other Plastic	8.5%	7.90%	9.10%				14.3%	11.20%	17.40%
Glass	9.6%	8.00%	11.20%				4.9%	3.60%	6.10%
Steel Cans	3.8%	3.00%	4.60%				1.7%	0.60%	2.90%
Ferrous	0.6%	0.30%	0.80%				0.4%	0.00%	0.90%
Aluminum Cans	1.5%	1.10%	1.80%				0.9%	0.80%	1.10%
Non-ferrous	0.5%	0.30%	0.60%				0.3%	0.20%	0.40%
Food Waste	14.6%	12.90%	16.40%				10.6%	2.60%	18.50%
Yard Waste	3.8%	0.90%	6.70%				0.8%	0.10%	1.40%
Textiles	3.0%	2.30%	3.80%				2.3%	1.00%	3.50%
C&D	0.0%						0.0%		
White Goods	0.0%						0.0%		
Tires	0.0%						0.0%		
Miscellaneous	13.1%	11.10%	15.10%				21.9%	14.50%	29.20%
Rubber	0.0%						0.0%		
TOTAL	100%						100%		

NOTES:

1. In order to standardize reporting some non standard categories were combined with logical major categories for this report.
2. Some DEP-defined material categories were not included in original study.
3. Some numbers may not total exactly due to rounding.
4. A multi-family composition study was not conducted in Sumter County

**Exhibit I
Monroe County Moisture Content Summary**

DEP-Defined Category	Monroe County Data			Weighted Average Moisture Content
	Category	Moisture	Weighting	
Newspaper	Newspaper	34.6%	NA	34.6%
Corrugated	Corrugated	25.6%	NA	25.6%
Office Paper	Office Paper	18.4%	NA	18.4%
Other Paper	Magazines	14.0%	3.4%	29.3%
	Junk Mail	16.7%	2.0%	
	Mixed Paper	28.0%	5.6%	
	Other Paper	46.7%	4.9%	
Plastic Bottles	PET bottles	5.6%	0.9%	4.6%
	HDPE bottles	3.9%	1.0%	
	Other plastic bottles	4.2%	0.6%	
Other Plastic	Other Plastic	1920.0%	NA	19.2%
Glass	Clear glass	1.2%	3.5%	3.0%
	Brown glass	1.2%	2.6%	
	Green glass	1.4%	1.9%	
	Other glass	9.0%	2.4%	
Steel Cans	Ferrous cans	10.1%	1.5%	9.1%
	Aerosol cans	1.5%	0.2%	
Ferrous	Ferrous	5.4%	NA	5.4%
Aluminum Cans	Aluminum Cans	12.9%	NA	12.9%
Non-ferrous	Non-ferrous	16.9%	NA	16.9%
Food Waste	Food Waste	53.6%	NA	53.6%
Yard Waste	Yard Waste	49.9%	NA	49.9%
Textiles	Textiles & Leather	17.2%	NA	17.2%
C&D Debris	C&D Debris	8.9%	NA	8.9%
Miscellaneous	Diapers	59.7%	1.8%	28.5%
	Other Organics	17.9%	1.4%	
	Consumer Goods	1.2%	2.4%	
	Fines	35.4%	3.5%	

Exhibit J			
Indian River County Moisture Content Summary			
DEP-Defined Category	Indian River Data		Avg. Moisture Content*
	Category	Moisture	
Newspaper	Newspaper	21.1%	21.1%
Corrugated	Corrugated	22.5%	22.5%
Office Paper	High Grade Paper	8.4%	8.4%
Other Paper	Mixed Scrap Paper	16.7%	24.5%
	Polycoated Paperboard	21.5%	
	Non-recyclable Paper	35.4%	
Food Waste	Food Waste	65.9%	65.9%
Yard Waste	Yard Waste	51.3%	51.3%
Miscellaneous	Diapers	56.3%	29.7%
	Textiles	16.8%	
	Mixed Materials	17.0%	
	Miscellaneous	28.7%	

*Insufficient data was available to develop weighted averages based on the proportion of each material in the overall Indian River County waste stream. Averages shown for Other Paper and Miscellaneous categories are not weighted.

Exhibit K			
Comparison of Monroe and Indian River County Data and Average Moisture Content of DEP-Defined Material Categories			
Category	Monroe Co.	Indian River Co.	Average
Newspaper	34.6%	21.1%	27.9%
Corrugated	25.6%	22.5%	24.1%
Office Paper	18.4%	8.4%	13.4%
Other Paper	29.3%	24.5%	26.9%
Plastic Bottles	4.6%	NA	4.6%
Other Plastic	19.2%	NA	19.2%
Glass	3.0%	NA	3.0%
Steel Cans	9.1%	NA	9.1%
Ferrous	5.4%	NA	5.4%
Aluminum Cans	12.9%	NA	12.9%
Non-ferrous	16.9%	NA	16.9%
Food Waste	53.6%	65.9%	59.8%
Yard Waste	49.9%	51.3%	50.6%
Textiles	17.2%	NA	17.2%
C&D Debris	8.9%	NA	8.9%
White Goods	NA	NA	NA
Tires	NA	NA	NA
Miscellaneous	28.5%	29.7%	29.1%
Rubber	NA	NA	NA

APPENDIX B

**COMPOSITION OF MUNICIPAL SOLID WASTE
DISPOSED IN CHARLOTTE COUNTY**

Final Report

Composition of Municipal Solid Waste Disposed in Charlotte County, Florida

Florida Department of Environmental Protection
Statewide Waste Composition Computer Model
1999-2000 Innovative Recycling Grant



July 2001

1999-2000 FLORIDA INNOVATIVE RECYCLING GRANT CHARLOTTE COUNTY WASTE COMPOSITION STUDY

INTRODUCTION

In early 2000, Charlotte County was awarded an Innovative Recycling Grant by the Florida Department of Environmental Protection (FDEP) for the purpose of developing a State-wide statistical model to predict the composition of municipal solid waste disposed within each of Florida's counties. As part of the model development process, the Grant provided for Charlotte County and three other partner counties (Citrus, Okaloosa, and Sarasota) to conduct county-wide waste composition studies. The results of these four studies will be used as input in the development of the computer model. A complete overview of the project can be found in Charlotte County's 1999-2000 Innovative Recycling Grant Proposal, found on the Web at <http://www.dep.state.fl.us/dwm/programs/recycling/>.

In 1996, the Florida Center for Solid and Hazardous Waste developed, and FDEP subsequently approved, a methodology for conducting waste characterization analyses in the state of Florida¹ ("Florida Methodology"). An objective of the Innovative Recycling Grant project was to perform all field studies in accordance with the Florida Methodology.

R. W. Beck, Inc., was ultimately retained by Charlotte County to perform the field data collection and subsequently develop a State-wide waste composition computer model. The remainder of this report summarizes the results of the Charlotte County waste composition study, conducted by R. W. Beck (in accordance with the Florida Methodology) over two seasons in August 2000 and March 2001.

SAMPLING SUMMARY

In accordance with the Florida Methodology, sampling and sorting was conducted over two seasons to capture representative samples from both summer (non-tourist) and winter (tourist) seasons. Field sampling and sorting targeted the following three generating sectors:

- Single-family residential waste;
- Multi-family residential waste; and
- Commercial waste (including industrial, institutional, and all other non-residential waste).

Prior to conducting the field sorts, R. W. Beck surveyed all of the haulers (both public and private) that deliver municipal solid waste (MSW) to the Charlotte County Zemel Road landfill. Haulers were asked to provide a list of truck numbers and truck types, and also to specify the origin(s) of waste collected on each truck. Based on these responses, as well as on annual disposal tonnages provided by Charlotte County, R. W. Beck developed a sampling plan for the two-season waste composition study.

Exhibit 1 lists the single-family residential, multi-family residential and commercial trucks from which samples were taken during both seasons of sorting at the Charlotte County landfill. Sampling highlights include:

- Sampling was conducted over two one-week periods. Summer (non-tourist) season sampling was performed from September 18-22, 2000. Winter (tourist) season was performed from March 5-9, 2001;
- Sampling was performed at both the County landfill and the Englewood transfer station to capture representative samples from all geographic areas of the County.
- A total of 78 samples were ultimately sorted, including

¹ "Method for Conducting Composition Study for Discarded Waste," Florida Center for Solid and Hazardous Waste Management, January 1996.

- 26 single-family residential samples,
- 20 multi-family residential samples, and
- 32 commercial samples;
- The samples were divided between the summer and winter seasons, with more samples (42 out of 78) taken during the winter season to reflect the higher waste disposal volumes during this season;
- Samples were targeted at 200 pounds, and were randomly selected from targeted truckloads;
- Over 17,000 pounds of waste were ultimately sorted over the two seasons; and
- Samples averaged 220 pounds by weight, with weights ranging from a low of 132 pounds to a high of 474 pounds.

COMPOSITION SUMMARY BY WASTE STREAM

All field data collected over both seasons was entered into a specially designed spreadsheet for statistical analysis. Field data were analyzed separately for single family residential, multi-family residential, and commercial waste samples. For each generating sector, R. W. Beck calculated the mean composition, standard deviation, and upper and lower confidence intervals at a 95 percent level of confidence for each material type defined in the study.

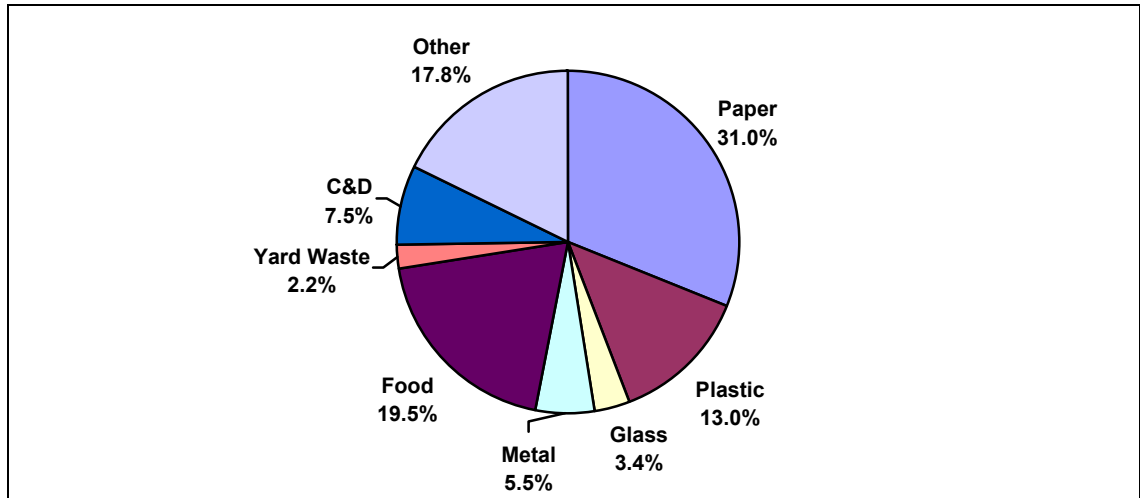
Exhibits 2A, 2B, and 2C summarize the results of the statistical analysis for the single-family residential, multi-family residential, and commercial waste, respectively, disposed² in Charlotte County.

Sampling highlights include:

- *Single-family residential (Exhibit 2A):* Paper (31.0%) and organics (29.5%) were the two largest material groups disposed by single-family households. Food waste was the single largest material category (19.5%). Other prominent categories included other paper (13.8%), mixed paper (7.6%), C&D debris (7.5%), and film plastic (7.4%). A pie chart of major material groups is shown in Figure 1.

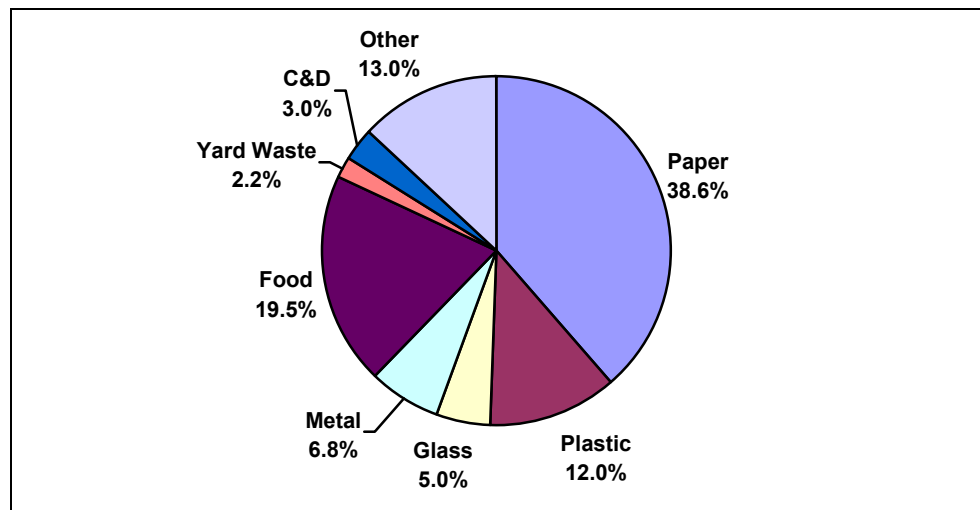
² Note that the study attempted to characterize only the waste being disposed in the County's landfill. No attempt was made to include recyclables, yard waste, tires, or other wastes handled by the County but not disposed in the landfill.

Figure 1
Composition of Single-family Waste



- Multi-family residential (Exhibit 2B):* Multi-family waste was relatively similar to single-family waste in Charlotte County, although there were more Minimum Five materials disposed in the multi-family stream. Multi-family waste was also high in paper (38.6%) and organics (29.1%). Glass (5.0%) and newspaper (7.2%) were significantly higher than in single family material, likely because of the lower level of recycling in multi-family dwellings. A breakdown of major material groups in the multi-family waste stream is shown in Figure 2.

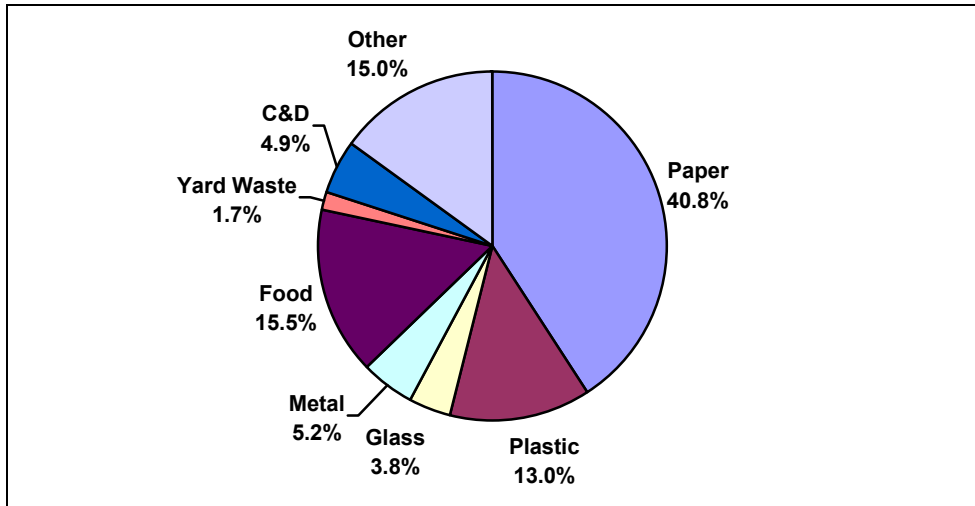
Figure 2
Composition of Multi-family Waste



- Commercial (Exhibit 2C):* Commercial waste differed significantly from residential waste in Charlotte County. Commercial waste contained an extremely high fraction of corrugated cardboard (18.8%). As expected, variation in the commercial stream (as indicated by the width of the confidence intervals) is significantly higher

compared to the residential waste stream. The breakdown of commercial waste by major material group is shown in Figure 3.

Figure 3
Composition of Commercial Waste



AGGREGATE ANNUAL RESULTS

In order to estimate the aggregate composition of the waste disposed in Charlotte County, it is necessary to calculate a weighted average of the composition of all three generating sectors targeted in the study. Table 1 summarizes the annual tons disposed at the Charlotte County landfill, as well as an estimate of the tons disposed by generating sector.

Table 1
Waste Disposed in Charlotte County Landfill (Jan - Dec 1999)

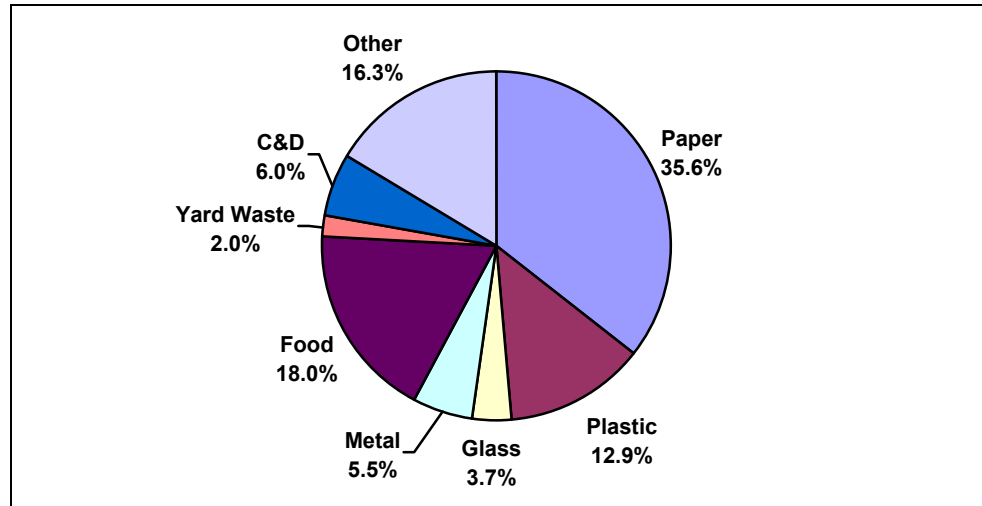
Generating Sector	Annual Tons Disposed	Percent of Total*
County-wide Aggregate	100,747	100%
Single-Family Waste	51,381	51%
Multi-family Waste	10,075	10%
Commercial Waste	39,291	39%

* Percentages disposed by generating sector represent best estimates based on available data.

Based on these data, Exhibit 3 illustrates the aggregate composition of waste disposed in Charlotte County (combining the single-family residential, multi-family residential, and commercial waste sectors). Exhibit 3 also includes standard deviations and confidence intervals for each material type.

A breakdown of major material groups in the aggregate Charlotte County waste stream is shown in Figure 4.

Figure 4
County-wide Aggregate Waste Composition



COMPUTER MODEL INPUT

Ultimately, the data collected in Charlotte County will be used as input into the computer model being developed as part of this Innovative Grant. An objective of the computer model is to define waste quantities in accordance with FDEP reporting requirements.

The Charlotte County waste composition study divided the waste stream into 31 separate material types. For compatibility with FDEP's annual reporting requirements, these 31 material types will need to be mapped into the 19 material types included in FDEP documents (such as Recycling and Education Grant documentation). Table 2 summarizes how the Charlotte County results will be mapped into the FDEP-defined material categories for purposes of computer model development.

Table 2

Mapping of Charlotte County Sort Categories into FDEP-defined Material Categories

Charlotte County Material Categories	Maps into FDEP-Defined Material Category
Newspaper	Newspaper
Corrugated Cardboard	Corrugated Cardboard
Office Paper	Office Paper
Polycoated/Aseptic	Other Paper
Mixed Paper	Other Paper
Other Paper	Other Paper
#1 PET Bottles	Plastic Bottles
#2 HDPE Bottles	Plastic Bottles
#3-#7 Bottles	Plastic Bottles
Polystyrene Foam	Other Plastic
Other Rigid Plastic	Other Plastic
Film Plastic	Other Plastic
Recyclable Glass	Glass
Non-recyclable Glass	Glass
Steel/Bi-metal Cans	Steel Cans
Other Ferrous	Ferrous
Aluminum Cans	Aluminum Cans
Other Non-Ferrous	Other Nonferrous
Food Waste	Food Waste
Yard Waste	Yard Waste
Rubber	Rubber
Diapers & Sanitary Products	Miscellaneous
Wood	Miscellaneous
Other Organics	Miscellaneous
Textiles	Textiles
C&D Debris	C&D Debris
White Goods	White Goods
Tires	Tires
Hazardous	Miscellaneous
Brown Goods	Miscellaneous
Other Inorganics	Miscellaneous

Based on the material category mapping shown in the Table above, Exhibit 4 summarizes single family residential, multi-family residential, and commercial waste composition according to FDEP-defined material categories.

COUNTY-WIDE WASTE STREAM SUMMARY

The sole objective of this study was to estimate the composition of the waste being disposed in the Charlotte County landfill. Such composition data is useful for evaluating the success of current recycling efforts, and also to help understand which materials may be candidates for future recycling or source reduction efforts.

It was beyond the scope of the study to develop a definitive recycling rate for Charlotte County. However, the composition data obtained in the study will greatly assist the County in developing not only a County-wide recycling rate, but also in estimating defensible material-specific recycling rates. The purpose of this section is to illustrate how the results of this study can be used to determine material-specific recycling rates. Note that additional effort may be required to verify and update the data used to illustrate this exercise.

Exhibit 5 presents County-wide waste disposal, recycling, and generation by material category³. Waste disposal quantities are derived by applying the mean composition of each material category to the total annual disposal quantity reported by the County. Recycling quantities are those reported from FDEP-Certified Recovered Material Dealers for Charlotte County.

IMPACT OF MOISTURE CONTENT ON RECYCLING RATE

As described in the Florida Methodology, a significant portion of disposed waste is moisture. It was beyond the scope of the Charlotte County study to determine moisture content of disposed waste categories through laboratory testing. However, prior waste composition studies performed in the State of Florida have included such testing.

Based on an assessment of existing moisture analyses performed during other Florida waste composition studies, R. W. Beck has developed average moisture content data for use in Florida. Table 3 summarizes the average estimated moisture content for each of the FDEP-defined material categories. These data will be incorporated into development of the computer model, and are presented here for use by Charlotte County.

³ The data used to perform this exercise have been compiled from multiple sources across different calendar years. These results should not be construed to represent the true Charlotte County recycling rate.

Table 3

Moisture Content Analyses Comparison

Material Categories	Average Moisture Content
Newspaper	27.9%
Corrugated	24.1%
Office Paper	13.4%
Other Paper	26.9%
Plastic Bottles	4.6%
Other Plastic	19.2%
Glass	3.0%
Steel Cans	9.1%
Ferrous	5.4%
Aluminum Cans	12.9%
Non-ferrous	16.9%
Food Waste	59.8%
Yard Waste	50.6%
Textiles	17.2%
C&D	8.9%
White Goods	NA
Tires	NA
Miscellaneous	29.1%
Rubber	NA

Source: R. W. Beck Technical Memorandum dated April 23, 2001.

By applying the moisture content factors shown in Table 3, it is possible to calculate the dry (i.e., net of moisture) quantity of waste disposed and recycled in Charlotte County. Exhibit 6 summarizes disposed and recycled waste, excluding moisture content, for the County, and recalculates the County recycling rates. Note that the process of netting out moisture will mathematically increase the recycling rate.

CONSTRUCTION AND DEMOLITION VISUAL SAMPLES

The Charlotte County waste sort exclusively targeted *municipal solid waste* that was *disposed* at the County landfill. It was beyond the scope of this study to perform in-depth analysis of other waste streams (recyclables, brush/yard waste, tires, construction & demolition, etc.).

However, selected visual surveying of construction and demolition (C&D) truckloads was performed in Charlotte County as part of a joint effort with another project team⁴. C&D samples were visually surveyed at the Southwest Land Developers C&D landfill located in Charlotte County. C&D visual sampling was performed during the same week as MSW physical sorting. A total of 50 samples were targeted for C&D visual sampling.

⁴ Dr. Tim Townsend of the University of Florida and Dr. Debra Reinhart of the University of Central Florida are conducting an independent study to assess the generation and composition of C&D waste in Florida (C&D Project Team). In cooperation with this independent project, R. W. Beck arranged to perform visual sampling of C&D samples generated in Charlotte County. Results of the visual sampling will be provided to the C&D Project Team for analysis.

The C&D visual survey data has been compiled and delivered under separate cover. A copy of the raw data from the C&D surveying effort is included as Appendix A.

ACKNOWLEDGEMENTS

R. W. Beck would like to thank the following individuals and organizations who assisted in providing data for developing the sampling plan, organizing and conducting the field data collection, and analyzing the results of the study.

Charlotte County	Barbara Kula, Recycling Coordinator Operational staff at the Charlotte County Landfill who assisted throughout the field data collection
Incorporated Cities	Punta Gorda
Haulers	Waste Management/Englewood Englewood Transfer Station operational staff who assisted in field data collection
C&D Landfill Operators	Southwest Land Developers

Exhibit 1

Charlotte County, FL

Summary of Trucks Sampled

Summer Season (September 18-22, 2000)

Sample Number	Date	Facility	Hauler	Truck Number	Truck Type	Single Family	Multi-Family	Commercial
1	9/18/2000	Landfill	Waste Management	200363	FEL			1
2	9/18/2000	Landfill	Waste Management	200364	FEL			1
3	9/18/2000	Landfill	Waste Management	304447	RL	1		
4	9/18/2000	Landfill	Punta Gorda	4410	RL			1
5	9/18/2000	Landfill	Waste Management	406551	RO		1	
6	9/18/2000	Landfill	Waste Management	406551	RO		1	
7	9/18/2000	Landfill	Waste Management	304484	RL	1		
8	9/18/2000	Landfill	Waste Management		RL	1		
9	9/19/2000	Landfill	Waste Management	200363	FEL			1
10	9/19/2000	Landfill	Waste Management	650217	RO		1	
11	9/19/2000	Landfill	Punta Gorda	4410	RL			1
12	9/19/2000	Landfill	Waste Management	304450	RL	1		
13	9/19/2000	Landfill	Punta Gorda	4394	RL	1		
14	9/19/2000	Landfill	Waste Management	306011	RL	1		
15	9/20/2000	Landfill	Waste Management	650217	RO			1
16	9/20/2000	Landfill	Waste Management	200364	FEL			1
17	9/20/2000	Landfill	Punta Gorda	4394	RI	1		
18	9/20/2000	Landfill	Punta Gorda	4393	RL	1		
19	9/20/2000	Landfill	Waste Management	200363	FEL			1
20	9/20/2000	Landfill	Waste Management	304447	RL	1		
21	9/20/2000	Landfill	Waste Management	304452	RL	1		
22	9/20/2000	Landfill	Waste Management	650217	RO		1	
24	9/21/2000	Landfill	Waste Management	650217	FEL	1		
25	9/21/2000	Landfill	Waste Management	406551	RO			1
26	9/21/2000	Landfill	Waste Management	406551	RO			1
27	9/21/2000	Landfill	Waste Management	404603	RO			1
28	9/21/2000	Landfill	Englewood	400560	RO			1
29	9/21/2000	Landfill	Waste Management	200364	FEL			1
30	9/21/2000	Landfill	Waste Management	300550	RL	1		
31	9/21/2000	Landfill	Waste Management	200363	FEL			1
32	9/21/2000	Landfill	Waste Management	304450	RL		1	
33	9/21/2000	Landfill	Waste Management	360610	RL	1		
34	9/21/2000	Landfill	Waste Management	200364	FEL			1
35	9/22/2000	Landfill	Punta Gorda	4394	RL		1	
36	9/22/2000	Landfill	Punta Gorda	4394	RL		1	
37	9/22/2000	Landfill	Punta Gorda	4394	RL		1	
Totals						13	8	15

Exhibit 1

Charlotte County, FL

Summary of Trucks Sampled

Winter Season (March 5-9, 2001)

Sample Number	Date		Hauler	Truck Number	Truck Type	Single Family	Multi-Family	Commercial
1	3/5/2001	Landfill	Punta Gorda	440	RL			1
2	3/5/2001	Landfill	Waste Management	200363	FEL			1
3	3/5/2001	Landfill	Waste Management		FEL			1
4	3/5/2001	Landfill	Waste Management	200364	FEL			1
5	3/5/2001	Landfill	Waste Management	405484	Roll-off			1
6	3/5/2001	Landfill	Waste Management	406511	Roll-off		1	
7	3/5/2001	Landfill	Waste Management	406511	Roll-off		1	
8	3/5/2001	Landfill	Waste Management	304449	RL	1		
9	3/5/2001	Landfill	Waste Management	30449	RL	1		
10	3/5/2001	Landfill	Waste Management	30447	RL		1	
11	3/5/2001	Landfill	Waste Management	300550	RL		1	
12	3/6/2001	Landfill	Waste Management	406551	Roll-off		1	
13	3/6/2001	Landfill	Punta Gorda	4410	RL			1
14	3/6/2001	Landfill	Waste Management	406554	Roll-off			1
15	3/6/2001	Landfill	Waste Management	200364	FEL			1
16	3/6/2001	Landfill	Waste Management	200364	FEL			1
17	3/6/2001	Landfill	Waste Management	200363	FEL			1
18	3/6/2001	Landfill	Waste Management	200363	FEL			1
19	3/5/2001	Landfill	Waste Management	406551	Roll-off			1
20	3/6/2001	Landfill	Punta Gorda	4451	RL		1	
21	3/6/2001	Landfill	Punta Gorda	4394	RL	1		
22	3/6/2001	Landfill	Waste Management	304450	RL	1		
23	3/6/2001	Landfill	Punta Gorda	4451	RL		1	
24	3/6/2001	Landfill	Waste Management	304484	RL	1		
25	3/6/2001	Landfill	Waste Management	30001	RL	1		
26	3/6/2001	Landfill	Waste Management		RL	1		
27	3/7/2001	Englewood	Waste Management	400813	Roll-off		1	
28	3/7/2001	Englewood	Waste Management	400813	Roll-off		1	
29	3/7/2001	Englewood	Waste Management	306014	RL	1		
30	3/7/2001	Englewood	Waste Management	306014	RL	1		
31	3/7/2001	Englewood	Waste Management	306014	RL	1		
32	3/7/2001	Englewood	Waste Management	306014	RL	1		
33	3/7/2001	Englewood	Waste Management	700253	FEL			1
34	3/7/2001	Englewood	Waste Management	201430	FEL			1
35	3/7/2001	Englewood	Waste Management	306014	RL	1		
36	3/7/2001	Englewood	Waste Management	304452	RL	1		
37	3/8/2001	Englewood	Waste Management	200753	FEL			1
38	3/8/2001	Englewood	Waste Management	200753	FEL			1
39	3/8/2001	Englewood	Waste Management	200753	FEL		1	
40	3/8/2001	Englewood	Waste Management	200753	FEL		1	
41	3/9/2001	Englewood	Waste Management	200753	FEL		1	
42	3/9/2001	Englewood	Waste Management	200753	FEL			1
Totals						13	12	17

Exhibit 1
Charlotte County, FL
Summary of Trucks Sampled

		Single Family	Multi- Family	Commercial
Total Samples=	78	26	20	32

Exhibit 2A
Charlotte County Single-family Results

		Material Categories	Annual Average	Standard Deviation	Lower Bound	Upper Bound
Paper	1	Newspaper	2.9%	2.7%	1.8%	4.3%
	2	Corrugated Cardboard	5.3%	3.3%	3.9%	6.8%
	3	Office Paper	0.9%	1.5%	0.4%	1.6%
	4	Polycoated/Aseptic	0.6%	0.7%	0.3%	0.9%
	5	Mixed Paper	7.6%	7.1%	4.3%	11.6%
	6	Other Paper	13.8%	8.1%	10.4%	17.5%
			TOTAL PAPER	31.0%	9.8%	27.0%
Plastic	7	#1 PET Bottles	0.8%	0.7%	0.5%	1.2%
	8	#2 HDPE Bottles	1.0%	0.7%	0.7%	1.3%
	9	#3-#7 Bottles	0.4%	0.6%	0.2%	0.7%
	10	Polystyrene Foam	0.8%	0.5%	0.6%	1.0%
	11	Other Rigid Plastic	2.8%	2.0%	1.9%	3.8%
	12	Film Plastic	7.4%	3.7%	6.0%	8.8%
			TOTAL PLASTIC	13.0%	3.4%	11.7%
Glass	13	Recyclable Glass	2.5%	2.0%	1.7%	3.4%
	14	Non-recyclable Glass	0.9%	1.4%	0.4%	1.6%
			TOTAL GLASS	3.4%	2.4%	2.6%
Metal	15	Steel/Bi-metal Cans	1.9%	1.5%	1.3%	2.6%
	16	Other Ferrous	1.8%	2.7%	0.9%	3.0%
	17	Aluminum Cans	1.2%	1.3%	0.8%	1.6%
	18	Other Non-Ferrous	0.6%	1.1%	0.3%	1.0%
			TOTAL NON-FERROUS	5.5%	3.7%	4.1%
Organic	19	Food Waste	19.5%	8.7%	16.3%	23.0%
	20	Yard Waste	2.2%	3.1%	1.1%	3.7%
	21	Rubber	0.4%	0.9%	0.2%	0.8%
	22	Diapers & Sanitary Products	2.1%	2.0%	1.3%	3.1%
	23	Wood	1.5%	1.9%	0.8%	2.5%
	24	Other Organics	3.6%	5.1%	1.9%	5.9%
		TOTAL ORGANICS	29.5%	9.5%	25.6%	33.4%
Textiles	25	Textiles	5.5%	5.4%	3.8%	7.5%
C&D	26	C&D Debris	7.5%	7.4%	4.5%	11.2%
Wh. Goods	27	White Goods	0.2%	1.0%	0.0%	0.4%
Tires	28	Tires	0.0%	0.0%	0.0%	0.0%
Misc	29	Hazardous	0.8%	0.9%	0.4%	1.2%
	30	Brown Goods	0.5%	0.7%	0.2%	0.8%
	31	Other Inorganics	3.2%	5.1%	1.5%	5.6%
			TOTAL MISCELLANEOUS	4.4%	5.5%	2.7%
TOTAL			100.0%	0.0%	100.0%	100.0%

Exhibit 2B
Charlotte County Multi-family Results

		Material Categories	Annual Average	Standard Deviation	Lower Bound	Upper Bound
Paper	1	Newspaper	7.2%	6.0%	4.5%	10.5%
	2	Corrugated Cardboard	7.3%	6.6%	4.4%	10.8%
	3	Office Paper	1.3%	2.0%	0.5%	2.4%
	4	Polycoated/Aseptic	0.4%	0.6%	0.2%	0.8%
	5	Mixed Paper	7.1%	7.7%	3.3%	12.3%
	6	Other Paper	15.2%	10.2%	10.8%	20.2%
			TOTAL PAPER	38.6%	12.5%	32.7%
Plastic	7	#1 PET Bottles	1.0%	0.7%	0.7%	1.4%
	8	#2 HDPE Bottles	0.9%	0.7%	0.5%	1.3%
	9	#3-#7 Bottles	0.4%	0.6%	0.2%	0.8%
	10	Polystyrene Foam	1.0%	0.6%	0.8%	1.4%
	11	Other Rigid Plastic	1.9%	0.6%	1.6%	2.2%
	12	Film Plastic	6.7%	2.8%	5.4%	8.1%
			TOTAL PLASTIC	12.0%	3.3%	10.5%
Glass	13	Recyclable Glass	4.1%	3.8%	2.4%	6.3%
	14	Non-recyclable Glass	0.9%	1.7%	0.3%	1.8%
			TOTAL GLASS	5.0%	4.1%	3.1%
Metal	15	Steel/Bi-metal Cans	1.9%	1.3%	1.3%	2.6%
	16	Other Ferrous	2.3%	3.0%	1.1%	4.1%
	17	Aluminum Cans	1.0%	0.6%	0.7%	1.3%
	18	Other Non-Ferrous	1.6%	3.9%	0.4%	3.3%
			TOTAL NON-FERROUS	6.8%	4.3%	4.9%
Organic	19	Food Waste	19.5%	11.2%	14.4%	25.2%
	20	Yard Waste	2.2%	4.0%	0.7%	4.5%
	21	Rubber	0.3%	0.4%	0.1%	0.5%
	22	Diapers & Sanitary Products	3.0%	2.3%	1.9%	4.4%
	23	Wood	2.3%	4.1%	0.9%	4.3%
	24	Other Organics	1.9%	2.4%	0.8%	3.5%
		TOTAL ORGANICS	29.1%	10.3%	24.2%	34.2%
Textiles	25	Textiles	2.1%	1.4%	1.5%	2.9%
C&D	26	C&D Debris	3.0%	8.3%	0.8%	6.6%
Wh. Goods	27	White Goods	0.0%	0.0%	0.0%	0.0%
Tires	28	Tires	0.0%	0.0%	0.0%	0.0%
Misc	29	Hazardous	0.9%	2.0%	0.3%	1.7%
	30	Brown Goods	1.3%	2.7%	0.4%	2.7%
	31	Other Inorganics	1.3%	2.6%	0.4%	2.7%
			TOTAL MISCELLANEOUS	3.5%	3.7%	1.7%
TOTAL			100.0%	0.0%	100.0%	100.0%

**Exhibit 2C
Charlotte County Commercial Results**

		Material Categories	Annual Average	Standard Deviation	Lower Bound	Upper Bound
Paper	1	Newspaper	2.9%	4.9%	1.5%	4.9%
	2	Corrugated Cardboard	18.8%	18.3%	12.3%	26.3%
	3	Office Paper	2.9%	6.0%	1.3%	5.1%
	4	Polycoated/Aseptic	0.7%	1.8%	0.3%	1.3%
	5	Mixed Paper	7.1%	7.8%	4.2%	10.8%
	6	Other Paper	8.4%	6.5%	5.7%	11.5%
			TOTAL PAPER	40.8%	20.2%	32.5%
Plastic	7	#1 PET Bottles	0.9%	1.0%	0.5%	1.3%
	8	#2 HDPE Bottles	0.6%	0.8%	0.3%	1.0%
	9	#3-#7 Bottles	0.2%	0.4%	0.1%	0.4%
	10	Polystyrene Foam	1.6%	2.0%	1.0%	2.3%
	11	Other Rigid Plastic	4.5%	11.0%	2.4%	7.2%
	12	Film Plastic	5.3%	3.5%	3.8%	6.9%
			TOTAL PLASTIC	13.0%	11.6%	9.2%
Glass	13	Recyclable Glass	3.4%	4.5%	1.9%	5.5%
	14	Non-recyclable Glass	0.4%	0.7%	0.1%	0.7%
			TOTAL GLASS	3.8%	4.6%	2.1%
Metal	15	Steel/Bi-metal Cans	1.7%	3.2%	0.8%	2.8%
	16	Other Ferrous	1.8%	3.0%	0.9%	3.1%
	17	Aluminum Cans	0.8%	1.1%	0.5%	1.2%
	18	Other Non-Ferrous	0.9%	4.1%	0.3%	1.8%
			TOTAL NON-FERROUS	5.2%	7.5%	3.1%
Organic	19	Food Waste	15.5%	15.8%	9.4%	22.9%
	20	Yard Waste	1.7%	3.8%	0.7%	3.1%
	21	Rubber	0.7%	1.4%	0.3%	1.2%
	22	Diapers & Sanitary Products	0.9%	2.0%	0.4%	1.6%
	23	Wood	3.6%	8.4%	1.4%	6.7%
	24	Other Organics	1.8%	3.4%	0.8%	3.2%
			TOTAL ORGANICS	24.3%	15.5%	18.1%
Textiles	25	Textiles	2.7%	5.7%	1.3%	4.6%
C&D	26	C&D Debris	4.9%	15.4%	1.7%	9.8%
Wh. Good	27	White Goods	1.3%	5.3%	0.4%	2.8%
Tires	28	Tires	0.3%	1.6%	0.1%	0.6%
Misc	29	Hazardous	0.3%	0.8%	0.1%	0.6%
	30	Brown Goods	1.3%	3.8%	0.5%	2.5%
	31	Other Inorganics	2.1%	3.7%	0.9%	3.7%
			TOTAL MISCELLANEOUS	3.7%	6.6%	1.8%
TOTAL			100.0%	0.0%	100.0%	100.0%

Exhibit 3
Charlotte County Aggregate Waste Stream Composition

	Material Categories	Average	Standard Deviation	Lower Bound	Upper Bound
Paper	1 Newspaper	3.4%	4.0%	2.5%	4.4%
	2 Corrugated Cardboard	10.8%	11.6%	8.2%	13.7%
	3 Office Paper	1.7%	3.9%	1.1%	2.6%
	4 Polycoated/Aseptic	0.6%	1.3%	0.4%	0.9%
	5 Mixed Paper	7.3%	8.0%	5.4%	9.8%
	6 Other Paper	11.8%	8.4%	9.8%	14.1%
	TOTAL PAPER	35.6%	15.3%	31.8%	39.5%
Plastic	7 #1 PET Bottles	0.8%	0.9%	0.6%	1.1%
	8 #2 HDPE Bottles	0.8%	0.8%	0.6%	1.0%
	9 #3-#7 Bottles	0.3%	0.6%	0.2%	0.5%
	10 Polystyrene Foam	1.1%	1.3%	0.9%	1.4%
	11 Other Rigid Plastic	3.3%	6.9%	2.4%	4.5%
	12 Film Plastic	6.5%	4.0%	5.6%	7.5%
	TOTAL PLASTIC	12.9%	7.7%	11.3%	14.7%
Glass	13 Recyclable Glass	3.0%	3.3%	2.3%	3.9%
	14 Non-recyclable Glass	0.7%	1.3%	0.4%	1.1%
	TOTAL GLASS	3.7%	3.6%	2.9%	4.7%
Metal	15 Steel/Bi-metal Cans	1.8%	2.4%	1.4%	2.4%
	16 Other Ferrous	1.9%	3.1%	1.3%	2.7%
	17 Aluminum Cans	1.0%	1.3%	0.8%	1.3%
	18 Other Non-Ferrous	0.8%	2.8%	0.5%	1.3%
	TOTAL NON-FERROUS	5.5%	5.7%	4.5%	6.7%
Organic	19 Food Waste	18.0%	12.5%	15.1%	21.3%
	20 Yard Waste	2.0%	3.7%	1.3%	3.0%
	21 Rubber	0.5%	1.2%	0.3%	0.8%
	22 Diapers & Sanitary Products	1.7%	2.2%	1.3%	2.3%
	23 Wood	2.4%	5.5%	1.5%	3.7%
	24 Other Organics	2.7%	5.0%	1.8%	4.0%
	TOTAL ORGANICS	27.4%	12.8%	24.4%	30.7%
Textiles	25 Textiles	4.1%	5.9%	3.1%	5.3%
C&D	26 C&D Debris	6.0%	11.6%	4.1%	8.7%
Wh. Goods	27 White Goods	0.6%	3.3%	0.3%	1.2%
Tires	28 Tires	0.1%	1.0%	0.0%	0.2%
Misc	29 Hazardous	0.6%	1.0%	0.4%	0.9%
	30 Brown Goods	0.9%	2.5%	0.5%	1.4%
	31 Other Inorganics	2.6%	5.1%	1.6%	3.9%
	TOTAL MISCELLANEOUS	4.0%	6.4%	2.9%	5.5%
TOTAL		100.0%			

Exhibit 4

DEP-Defined Material Category Composition Summary

DEP-defined Material Category	Single-Family			Multi-Family			Commercial			County-wide Aggregate		
	Average	Lower	Upper	Average	Lower	Upper	Average	Lower	Upper	Average	Lower	Upper
1 Newspaper	2.9%	1.8%	4.3%	7.2%	4.5%	10.5%	2.9%	1.5%	4.9%	3.4%	2.5%	4.4%
2 Corrugated	5.3%	3.9%	6.8%	7.3%	4.4%	10.8%	18.8%	12.3%	26.3%	10.8%	8.2%	13.7%
3 Office Paper	0.9%	0.4%	1.6%	1.3%	0.5%	2.4%	2.9%	1.3%	5.1%	1.7%	1.1%	2.6%
4 Other Paper	21.9%	17.7%	26.4%	22.8%	18.4%	27.5%	16.2%	11.3%	21.8%	19.8%	15.6%	24.8%
5 Plastic Bottles	2.2%	1.7%	2.7%	2.3%	1.8%	2.9%	1.7%	1.1%	2.4%	2.0%	1.5%	2.6%
6 Other Plastics	10.9%	9.6%	12.2%	9.7%	8.4%	11.0%	11.3%	7.8%	15.4%	10.9%	8.9%	13.3%
7 Glass	3.4%	2.6%	4.4%	5.0%	3.1%	7.3%	3.8%	2.1%	5.9%	3.7%	2.7%	5.0%
8 Steel Cans	1.9%	1.3%	2.6%	1.9%	1.3%	2.6%	1.7%	0.8%	2.8%	1.8%	1.4%	2.4%
9 Ferrous	1.8%	0.9%	3.0%	2.3%	1.1%	4.1%	1.8%	0.9%	3.1%	1.9%	1.3%	2.7%
10 Aluminum	1.2%	0.8%	1.6%	1.0%	0.7%	1.3%	0.8%	0.5%	1.2%	1.0%	0.8%	1.3%
11 Non-ferrous	0.6%	0.3%	1.0%	1.6%	0.4%	3.3%	0.9%	0.3%	1.8%	0.8%	0.5%	1.3%
12 Food Waste	19.5%	16.3%	23.0%	19.5%	14.4%	25.2%	15.5%	9.4%	22.9%	18.0%	15.1%	21.3%
13 Yard Waste	2.2%	1.1%	3.7%	2.2%	0.7%	4.5%	1.7%	0.7%	3.1%	2.0%	1.3%	3.0%
14 Textiles	5.5%	3.8%	7.5%	2.1%	1.5%	2.9%	2.7%	1.3%	4.6%	4.1%	3.1%	5.3%
15 C&D Debris	7.5%	4.5%	11.2%	3.0%	0.8%	6.6%	4.9%	1.7%	9.8%	6.0%	4.1%	8.7%
16 White Goods	0.2%	0.0%	0.4%	0.0%	0.0%	0.0%	1.3%	0.4%	2.8%	0.6%	0.3%	1.2%
17 Tires	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.1%	0.6%	0.1%	0.0%	0.2%
18 Miscellaneous	11.7%	8.7%	15.1%	10.6%	7.8%	13.9%	10.0%	5.9%	14.9%	10.9%	7.1%	16.2%
19 Rubber	0.4%	0.2%	0.8%	0.3%	0.1%	0.5%	0.7%	0.3%	1.2%	0.5%	0.3%	0.8%
Total	100.0%			100.0%			100.0%			100.0%		

Exhibit 5
Charlotte County Waste Disposal and Recycling Summary

	Aggregate Composition at County LF (Mean)	1999 Tons Disposed, County LF [2] (Mean)	1999 Tons Disposed Elsewhere [3]	1999 Tons Recycled [4]	Total Generation (tons)	Recycling Rate
	A	B	C	D	E	F
Categories		A x total			B + C +D	D / E
Newspaper	3.4%	3,381		6,017	9,398	64.0%
Corrugated	10.8%	10,832		5,601	16,433	34.1%
Office Paper	1.7%	1,729		58	1,787	3.2%
Other Paper	19.8%	19,909		3,443	23,352	14.7%
Plastic Bottles	2.0%	2,009		566	2,575	22.0%
Other Plastic	10.9%	11,008		306	11,314	2.7%
Glass	3.7%	3,761		2,118	5,879	36.0%
Steel Cans	1.8%	1,833		431	2,264	19.0%
Ferrous	1.9%	1,880		1,163	3,043	38.2%
Aluminum Cans	1.0%	1,008		801	1,809	44.3%
Non-ferrous	0.8%	820		310	1,130	27.4%
Food Waste	18.0%	18,105		-	18,105	0.0%
Yard Waste	2.0%	2,044		263	2,307	11.4%
Textiles	4.1%	4,087		798	4,885	16.3%
C&D Debris	6.0%	6,081	27,622	170	33,873	0.5%
White Goods	0.6%	622		-	622	0.0%
Tires	0.1%	114		150	264	56.8%
Miscellaneous	10.9%	10,998		1,017	12,015	8.5%
Rubber	0.5%	527			527	0.0%
Totals	100.0%	100,747	27,622	23,212	151,581	15.3%

[1] See Exhibit 4, County-wide Aggregate average composition

[2] Total quantity landfilled as reported in 2000 Recycling and Education Grant (CY 1999).

[3] As reported to DEP for CY1999 by Southwest Land Developers and WasteCorp (Polk County).

[4] As reported in 2000 Recycling and Education Grant (CY 1999).

Exhibit 6
Net Impact of Moisture Analysis

Categories	Percent Moisture [1]	Tons Disposed (Mean)	Net Tons Disposed	Tons Recycled (Mean)	Net Tons Recycled [2]	Net Generation (tons)	Moisture-Adjusted Recycling Rate
Newspaper	27.9%	3,381.2	2,439.6	6,017.0	4,341.3	6,780.8	64.0%
Corrugated	24.1%	10,831.6	8,226.6	5,601.0	4,254.0	12,480.6	34.1%
Office Paper	13.4%	1,728.9	1,497.2	58.0	50.2	1,547.4	3.2%
Other Paper	26.9%	19,909.2	14,545.5	3,443.0	2,515.4	17,061.0	14.7%
Plastic Bottles	4.6%	2,008.9	1,916.8	566.0	540.1	2,456.9	22.0%
Other Plastic	19.2%	11,008.1	8,894.5	306.0	247.2	9,141.8	2.7%
Glass	3.0%	3,760.6	3,646.4	2,118.0	2,053.7	5,700.0	36.0%
Steel Cans	9.1%	1,833.1	1,666.5	431.0	391.8	2,058.4	19.0%
Ferrous	5.4%	1,879.8	1,778.3	1,163.0	1,100.2	2,878.5	38.2%
Aluminum Cans	12.9%	1,007.6	877.6	801.0	697.7	1,575.3	44.3%
Non-ferrous	16.9%	819.9	681.3	310.0	257.6	938.9	27.4%
Food Waste	59.8%	18,105.0	7,287.3	0.0	0.0	7,287.3	0.0%
Yard Waste	50.6%	2,044.5	1,010.0	263.0	129.9	1,139.9	11.4%
Textiles	17.2%	4,087.4	3,384.3	798.0	660.7	4,045.1	16.3%
C&D Debris	8.9%	33,702.7	30,703.2	170.0	154.9	30,858.1	0.5%
White Goods	NA	621.9	621.9	0.0	0.0	621.9	0.0%
Tires	NA	113.9	113.9	150.0	150.0	263.9	56.8%
Miscellaneous	29.1%	10,998.0	7,797.9	1,017.0	721.1	8,518.9	8.5%
Rubber	NA	526.7	526.7	0.0	0.0	526.7	0.0%
Totals		128,369.0	97,615.6	23,212.0	18,265.8	115,881.4	15.8%

[1] As documented in Technical Memorandum dated April 23, 2001.

[2] No analysis has been performed to determine the moisture content of recycled materials.

The same moisture content was used to net out moisture for both disposed material and recycled material. The actual moisture content for recycled material may be different than that used to net out moisture from recycled material.

**FINAL REPORT
COMPOSITION OF MUNICIPAL SOLID WASTE
DISPOSED IN CHARLOTTE COUNTY, FLORIDA**

APPENDIX A

MEMORANDUM



To: Dr. Tim Townsend, University of Florida

cc: Barb Kula, Charlotte County, w/ enclosure
Sam Sanders, Southwest Land Developers w/ enclosure
Chuck McLendon, R. W. Beck, w/o enclosure

From: John Culbertson

Subject: **Charlotte County C&D Composition Data**

Date: May 7, 2001

R. W. Beck recently completed field data collection for a two-season municipal solid waste (MSW) composition study in Charlotte County that is being performed as part of an Innovative Recycling Grant awarded by the Florida Department of Environmental Protection (FDEP). As you know, while conducting the MSW field study, we arranged to visually survey truckloads of construction and demolition debris (C&D) generated and/or disposed in Charlotte County. Southwest Land Developers, which operates a C&D landfill in Charlotte County, hosted the visual surveying effort.

The purpose of this memorandum is to transmit the raw data collected during R. W. Beck's visual sampling of incoming C&D truckloads at the Southwest Land Developers facility (from March 5 through March 9). These data were collected in accordance with the visual sampling protocol provided by your project team in January 2001. This protocol included:

- Interview of the driver to ascertain the origin of each truckload;
- Measurement of the volume of the incoming truckload and tipped pile of C&D;
- Visual assessment of the percentage (by volume) of various material types contained in the load; and
- Photographing the load from two angles.

Note that R. W. Beck has made no attempt to analyze the resulting data. As intended at the outset of our project, our hope is that these data will assist your project team in its ongoing evaluation of C&D waste generation and composition in Florida.

Attached you will find the following summary exhibits detailing the data collected in Charlotte County:

- Exhibit 1- Summary of Trucks Sampled;
- Exhibit 2- Residential Construction Raw Data;
- Exhibit 3- Non-Residential Construction Raw Data;
- Exhibit 4- Residential Renovation Raw Data;
- Exhibit 5- Non-Residential Renovation Raw Data; and
- Exhibit 6- Residential Demolition Raw Data.

Note that no Non-Residential Demolition samples were delivered during our field observations.

These exhibits are contained in a Microsoft Excel spreadsheet on the enclosed CD. The CD also includes photographs of all samples (in jpeg format).

MEMORANDUM to: Dr. Tim Townsend, University of Florida

May 7, 2001

Page 2

Please contact me at (407) 648-3563 if you have any questions or desire additional details regarding the sampling protocol or tabulation of raw data. Thank you for your attention.

Exhibit 1
Summary of Trucks Sampled in Charlotte County

Sample Number	Date	Hauler	County	Volume of Truck (yd ³)	Circumference of Pile [1]	Construction		Renovation		Demolition	
						Res	Non-Res	Res	Non-Res	Res	Non-Res
1	3/5/2001	WM	Lee	10		1					
2	3/5/2001	Private	Charlotte	40						1	
3	3/5/2001	Alley Cat	Charlotte	23		1					
4	3/5/2001	WM-406551	Charlotte	10		1					
5	3/5/2001	Colonial Lee Consuette	Charlotte	15	72'0"	1					
6	3/5/2001	Tersa Morris	Lee	13		1					
7	3/5/2001	None	Charlotte	15	33'8"					1	
8	3/5/2001	Unknown	Charlotte	20	41'6"	1					
9	3/5/2001	Busts U-Call	Lake	11		1					
10	3/5/2001	Independent	Charlotte	20		1					
11	3/6/2001	Stigger	Lee	12	41'2"		1				
12	3/6/2001	Independent	Lee	20	101'6"	1					
13	3/6/2001	J+W Hauling	Charlotte	30		1					
14	3/6/2001	Mendo clean-Up	Charlotte	20		1					
15	3/6/2001	Korvanen	Charlotte	20	61'10"	1					
16	3/6/2001	Bill's Construction	Collier	30		1					
17	3/6/2001	Doug Dunne Roofing	Charlotte	5	39'4"	1					
18	3/6/2001	Pigott Roofing	Lee	12	40'6"				1		
19	3/6/2001	C+W Quality Roofing	Charlotte	12	41'6"	1					
20	3/6/2001	Bill's Construction	Charlotte	30	65'6"	1					
21	3/6/2001	Wehausen Construction Clean-Up	Lee	44	95'0"	1					
22	3/6/2001	All Const	Lee	20	79'8"	1					
23	3/6/2001	Wehausen Construction Clean-Up	Lee	13	61'6"	1					
24	3/6/2001	Independent	Charlotte	20	40'10"					1	
25	3/6/2001	Colonial Lee Consuette	Lee	15	44'8"	1					
26	3/6/2001	FL Const. Clean-Up	Lee	30	112'6"	1					
27	3/7/2001	Murphis Job Site Clean-up	Charlotte	10	55'4"					1	
28	3/7/2001	Murphis Job Site Clean-up	Charlotte	10	66'6"	1					
29	3/7/2001	Ron Rebel New Construction Clean	Charlotte	10	49'2"	1					
30	3/7/2001	Mendon-Purt	Charlotte	20	50'2"	1					
31	3/7/2001	Olin Waltrid-Roofing	Charlotte	20	58'8"				1		
32	3/7/2001	Demolition Experts	Lee	8	47'2"	1					

Exhibit 1

Summary of Trucks Sampled in Charlotte County

33	3/7/2001	Independent	Lee	8	49'0"	1					
34	3/7/2001	Independent	Lee	20	71'2"	1					
35	3/7/2001	Pro-Disp Serv.	Collier	40	72'8"	1					
36	3/7/2001	Murphy's Clean-Up	Charlotte	10	62'10"			1			
37	3/7/2001	Marine cons.	Charlotte	20	52'8"				1		
38	3/7/2001	Murphy's Clean-Up	Charlotte	20	27'0"	1					
39	3/7/2001	Pro-Disp Serv.	Charlotte	20	51'0"	1					
40	3/7/2001	Independent	Charlotte	5		1					
41	3/7/2001	Murphy's Clean-Up	Charlotte	10	49'4"	1					
42	3/7/2001	J+W Hauling	Charlotte	10		1					
43	3/7/2001	Dr. Good Roof	Charlotte	20	25'4"			1			
44	3/7/2001	Forsburg	Charlotte	30	40'2"		1				
45	3/7/2001	Forsburg	Charlotte	20	29'0"	1					
46	3/7/2001	Les Pettehed	Charlotte			1					
47	3/7/2001	Pro-Disp Serv.	Collier	20	47'0"	1					
48	3/7/2001	Commercial Demolition	Lee	20	57'2"				1		
49	3/7/2001	FL Const. Clean-Up	Lee	30	72'8"	1					
50	3/7/2001	Murphy's Clean-Up	Charlotte	10	40'0"	1					
51	3/7/2001	Independent	Charlotte	5	24'6"	1					
Totals						39	2	2	4	4	0

	Construction		Renovation		Demolition	
	Res	Non-Res	Res	Non-Res	Res	Non-Res
Total Samples = 51	39	2	2	4	4	0

[1] A meaningful circumference could not be obtained for all piles

Exhibit 2

Residential Construction Raw Data

	Sample Number	1	3	4	5	6	8	9	10	12	13	14
	Material Categories	%	%	%	%	%	%	%	%	%	%	%
	1 Wood	79.0%	15.0%	80.0%	0.0%	90.0%	5.0%	55.0%	3.0%	85.0%	30.0%	3.0%
	2 Concrete	5.0%	0.0%	3.0%	0.0%	0.0%	45.0%	15.0%	0.0%	0.0%	2.0%	0.0%
	3 Drywall	2.0%	80.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.0%	30.0%	90.0%
	4 Dirt/soil	0.0%	0.0%	2.0%	0.0%	0.0%	5.0%	5.0%	0.0%	0.0%	5.0%	0.0%
	5 Metal	2.0%	0.0%	0.0%	0.0%	2.0%	5.0%	5.0%	0.0%	0.0%	5.0%	5.0%
	6 Land Clearing Debris	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	7 Cardboard	3.0%	5.0%	10.0%	0.0%	5.0%	40.0%	10.0%	10.0%	10.0%	20.0%	2.0%
	8 Roofing Materials	2.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	9 Plastic	0.0%	0.0%	1.0%	0.0%	3.0%	0.0%	5.0%	0.0%	0.0%	0.0%	0.0%
	10 MSW	2.0%	0.0%	1.0%	0.0%	0.0%	0.0%	0.0%	10.0%	0.0%	0.0%	0.0%
	11 Misc.	3.0%	0.0%	3.0%	0.0%	0.0%	0.0%	5.0%	77.0%	0.0%	8.0%	0.0%
	12 Carpet	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	13 Tile	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	14 Other	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
TOTAL		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Exhibit 2

Residential Construction Raw Data

	Sample Number	15	16	17	19	20	21	22	23	25	26	28
	Material Categories	%	%	%	%	%	%	%	%	%	%	%
	1 Wood	90.0%	20.0%	70.0%	0.0%	65.0%	95.0%	5.0%	40.0%	19.0%	20.0%	0.0%
	2 Concrete	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	3 Drywall	0.0%	75.0%	0.0%	0.0%	0.0%	0.0%	90.0%	60.0%	0.0%	60.0%	99.0%
	4 Dirt/soil	0.0%	0.0%	0.0%	0.0%	10.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	5 Metal	0.0%	0.0%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	6 Land Clearing Debris	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	7 Cardboard	5.0%	0.0%	2.0%	0.0%	10.0%	2.0%	5.0%	0.0%	0.0%	15.0%	0.0%
	8 Roofing Materials	0.0%	0.0%	25.0%	100.0%	0.0%	0.0%	0.0%	0.0%	80.0%	0.0%	0.0%
	9 Plastic	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%
	10 MSW	5.0%	5.0%	0.0%	0.0%	10.0%	3.0%	0.0%	0.0%	1.0%	5.0%	0.0%
	11 Misc.	0.0%	0.0%	1.0%	0.0%	5.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	12 Carpet	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	13 Tile	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	14 Other	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
TOTAL		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Exhibit 2

Residential Construction Raw Data

	Sample Number	29	30	32	33	34	35	38	39	40	41	42
	Material Categories	%	%	%	%	%	%	%	%	%	%	%
	1 Wood	10.0%	23.0%	70.0%	96.0%	80.0%	5.0%	82.0%	0.0%	0.0%	0.0%	75.0%
	2 Concrete	0.0%	2.0%	8.0%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	3 Drywall	85.0%	0.0%	0.0%	0.0%	10.0%	0.0%	0.0%	99.0%	30.0%	95.0%	0.0%
	4 Dirt/soil	0.0%	20.0%	0.0%	0.0%	0.0%	95.0%	0.0%	0.0%	20.0%	0.0%	0.0%
	5 Metal	3.0%	2.0%	10.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	6 Land Clearing Debris	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	7 Cardboard	2.0%	3.0%	2.0%	1.0%	0.0%	0.0%	5.0%	0.0%	0.0%	3.0%	5.0%
	8 Roofing Materials	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	9 Plastic	0.0%	5.0%	0.0%	0.0%	0.0%	0.0%	3.0%	0.0%	0.0%	0.0%	3.0%
	10 MSW	0.0%	0.0%	10.0%	1.0%	10.0%	0.0%	10.0%	1.0%	30.0%	2.0%	17.0%
	11 Misc.	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	20.0%	0.0%	0.0%
	12 Carpet	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	13 Tile	0.0%	45.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	14 Other	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
TOTAL		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Exhibit 2
Residential Construction Raw Data

	Sample Number	45	46	47	49	50	51	Average	Std. Dev.
	Material Categories	%	%	%	%	%	%	%	%
	1 Wood	65.0%	5.0%	15.0%	55.0%	40.0%	0.0%	38.2%	35.1%
	2 Concrete	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.1%	7.6%
	3 Drywall	0.0%	85.0%	0.0%	40.0%	0.0%	20.0%	27.1%	37.7%
	4 Dirt/soil	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.2%	15.7%
	5 Metal	0.0%	0.0%	0.0%	2.0%	0.0%	0.0%	1.1%	2.2%
	6 Land Clearing Debris	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	7 Cardboard	20.0%	3.0%	35.0%	0.0%	35.0%	0.0%	6.9%	10.2%
	8 Roofing Materials	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	7.9%	25.4%
	9 Plastic	5.0%	0.0%	0.0%	0.0%	5.0%	0.0%	0.8%	1.7%
	10 MSW	10.0%	5.0%	0.0%	0.0%	10.0%	70.0%	5.6%	12.2%
	11 Misc.	0.0%	0.0%	10.0%	3.0%	10.0%	5.0%	3.8%	12.7%
	12 Carpet	0.0%	2.0%	40.0%	0.0%	0.0%	5.0%	1.2%	6.4%
	13 Tile	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%	7.2%
	14 Other	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.3%
TOTAL		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

Exhibit 3

Non-Residential Construction Raw Data

	Sample Number	11	44	Average	Std. Dev.
	Material Categories	%	%	%	%
	1 Wood	0.0%	5.0%	2.5%	3.5%
	2 Concrete	60.0%	0.0%	30.0%	42.4%
	3 Drywall	0.0%	0.0%	0.0%	0.0%
	4 Dirt/soil	5.0%	75.0%	40.0%	49.5%
	5 Metal	5.0%	10.0%	7.5%	3.5%
	6 Land Clearing Debris	30.0%	0.0%	15.0%	21.2%
	7 Cardboard	0.0%	5.0%	2.5%	3.5%
	8 Roofing Materials	0.0%	0.0%	0.0%	0.0%
	9 Plastic	0.0%	5.0%	2.5%	3.5%
	10 MSW	0.0%	0.0%	0.0%	0.0%
	11 Misc.	0.0%	0.0%	0.0%	0.0%
	12 Carpet	0.0%	0.0%	0.0%	0.0%
	13 Tile	0.0%	0.0%	0.0%	0.0%
	14 Other	0.0%	0.0%	0.0%	0.0%
TOTAL		100.0%	100.0%	100.0%	

Exhibit 4
Residential Renovation Raw Data

	Sample Number	36	43	Average	Std. Dev.
	Material Categories	%	%	%	%
	1 Wood	43.0%	50.0%	46.5%	4.9%
	2 Concrete	0.0%	0.0%	0.0%	0.0%
	3 Drywall	5.0%	0.0%	2.5%	3.5%
	4 Dirt/soil	0.0%	0.0%	0.0%	0.0%
	5 Metal	0.0%	0.0%	0.0%	0.0%
	6 Land Clearing Debris	0.0%	0.0%	0.0%	0.0%
	7 Cardboard	37.0%	0.0%	18.5%	26.2%
	8 Roofing Materials	10.0%	50.0%	30.0%	28.3%
	9 Plastic	0.0%	0.0%	0.0%	0.0%
	10 MSW	5.0%	0.0%	2.5%	3.5%
	11 Misc.	0.0%	0.0%	0.0%	0.0%
	12 Carpet	0.0%	0.0%	0.0%	0.0%
	13 Tile	0.0%	0.0%	0.0%	0.0%
	14 Other	0.0%	0.0%	0.0%	0.0%
TOTAL		100.0%	100.0%	100.0%	

Exhibit 5

Non-Residential Renovation Raw Data

	Sample Number	18	31	37	48	Average	Std. Dev.
	Material Categories	%	%	%	%	%	%
	1 Wood	0.0%	9.0%	99.0%	20.0%	32.0%	45.4%
	2 Concrete	0.0%	0.0%	0.0%	10.0%	2.5%	5.0%
	3 Drywall	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	4 Dirt/soil	0.0%	0.0%	0.0%	70.0%	17.5%	35.0%
	5 Metal	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	6 Land Clearing Debris	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	7 Cardboard	1.0%	0.0%	0.0%	0.0%	0.3%	0.5%
	8 Roofing Materials	99.0%	0.0%	0.0%	0.0%	24.8%	49.5%
	9 Plastic	0.0%	1.0%	1.0%	0.0%	0.5%	0.6%
	10 MSW	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	11 Misc.	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	12 Carpet	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	13 Tile	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	14 Other	0.0%	90.0%	0.0%	0.0%	22.5%	45.0%
TOTAL		100.0%	100.0%	100.0%	100.0%	100.0%	

Exhibit 6

Residential Demolition Raw Data

	Sample Number	2	7	24	27	Average	Std. Dev.
	Material Categories	%	%	%	%	%	%
	1 Wood	98.0%	95.0%	20.0%	15.0%	57.0%	45.7%
	2 Concrete	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	3 Drywall	0.0%	0.0%	0.0%	60.0%	15.0%	30.0%
	4 Dirt/soil	0.0%	0.0%	0.0%	5.0%	1.3%	2.5%
	5 Metal	1.0%	0.0%	75.0%	5.0%	20.3%	36.6%
	6 Land Clearing Debris	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	7 Cardboard	0.0%	0.0%	0.0%	15.0%	3.8%	7.5%
	8 Roofing Materials	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	9 Plastic	1.0%	0.0%	0.0%	0.0%	0.3%	0.5%
	10 MSW	0.0%	0.0%	5.0%	0.0%	1.3%	2.5%
	11 Misc.	0.0%	5.0%	0.0%	0.0%	1.3%	2.5%
	12 Carpet	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	13 Tile	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	14 Other	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
TOTAL		100.0%	100.0%	100.0%	100.0%	100.0%	

Exhibit 7

Non-Residential Demolition Raw Data

	Sample Number	
	Material Categories	%
	1 Wood	-
	2 Concrete	-
	3 Drywall	-
	4 Dirt/soil	-
	5 Metal	-
	6 Land Clearing Debris	-
	7 Cardboard	-
	8 Roofing Materials	-
	9 Plastic	-
	10 MSW	-
	11 Misc.	-
	12 Carpet	-
	13 Tile	-
	14 Other	-
TOTAL		0.0%

APPENDIX C

**COMPOSITION OF MUNICIPAL SOLID WASTE
DISPOSED IN CITRUS COUNTY**

Final Report

Composition of Municipal Waste Disposed in Citrus County, Florida

Florida Department of Environmental Protection
Statewide Waste Composition Computer Model
1999-2000 Innovative Recycling Grant



August 2001

1999-2000 FLORIDA INNOVATIVE RECYCLING GRANT CITRUS COUNTY WASTE COMPOSITION STUDY

INTRODUCTION

In early 2000, Charlotte County was awarded an Innovative Recycling Grant by the Florida Department of Environmental Protection (FDEP) for the purpose of developing a State-wide statistical model to predict the composition of municipal solid waste disposed within each of Florida's counties. As part of the model development process, the Grant provided for Charlotte County and three other partner counties (Citrus, Okaloosa, and Sarasota) to conduct county-wide waste composition studies. The results of these four studies will be used as input in the development of the computer model. A complete overview of the project can be found in Charlotte County's 1999-2000 Innovative Recycling Grant Proposal, found at the following address: http://www8.myflorida.com/environment/learn/wastemanagement/recycling/grants_igg00_full.html.

In 1996, the Florida Center for Solid and Hazardous Waste developed, and FDEP subsequently approved, a methodology for conducting waste characterization analyses in the state of Florida¹ ("Florida Methodology"). An objective of the Innovative Recycling Grant project was to perform all field studies in accordance with the Florida Methodology.

R. W. Beck, Inc., was ultimately retained by Charlotte County to perform the field data collection and subsequently develop a State-wide waste composition computer model. The remainder of this report summarizes the results of the Citrus County waste composition study, conducted by R. W. Beck (in accordance with the Florida Methodology) over two seasons in August 2000 and February 2001.

SAMPLING SUMMARY

In accordance with the Florida Methodology, sampling and sorting was conducted over two seasons to capture representative samples from both summer (non-tourist) and winter (tourist) seasons. Field sampling and sorting targeted the following three generating sectors:

- Single-family residential waste;
- Multi-family residential waste; and
- Commercial waste (including industrial, institutional, and all other non-residential waste).

Prior to conducting the field sorts, R. W. Beck surveyed all of the haulers (both public and private) that deliver municipal solid waste (MSW) to the Citrus County Central landfill. Haulers were asked to provide a list of truck numbers and truck types, and also to specify the origin(s) of waste collected on each truck. Based on these responses, as well as on annual disposal tonnages provided by Citrus County, R. W. Beck developed a sampling plan for the two-season waste composition study.

Exhibit 1 lists the single-family residential, multi-family residential and commercial trucks from which samples were taken during both seasons of sorting at the Citrus County Central landfill. Sampling highlights include:

- Sampling was conducted over two one-week periods. Summer (non-tourist) season sampling was performed from August 21-25, 2000. Winter (tourist) season was performed from February 26-March 2, 2001;
- A total of 80 samples were ultimately sorted, including
 - 29 single-family residential samples,

¹ "Method for Conducting Composition Study for Discarded Waste," Florida Center for Solid and Hazardous Waste Management, January 1996.

- 21 multi-family residential samples, and
- 30 commercial samples;
- The samples were divided between the summer and winter seasons, with slightly more samples (41 out of 80) taken during the winter season to reflect the higher waste disposal volumes during this season;
- Samples were targeted at 200 pounds, and were randomly selected from targeted truckloads;
- Over 19,500 pounds of waste were ultimately sorted over the two seasons; and
- Samples averaged 243 pounds by weight, with weights ranging from a low of 206 pounds to a high of 381 pounds.

COMPOSITION SUMMARY BY WASTE STREAM

All field data collected over both seasons was entered into a specially designed spreadsheet for statistical analysis. Field data were analyzed separately for single family residential, multi-family residential, and commercial waste samples. For each generating sector, R. W. Beck calculated the mean composition, standard deviation, and upper and lower confidence intervals at a 95 percent level of confidence for each material type defined in the study.

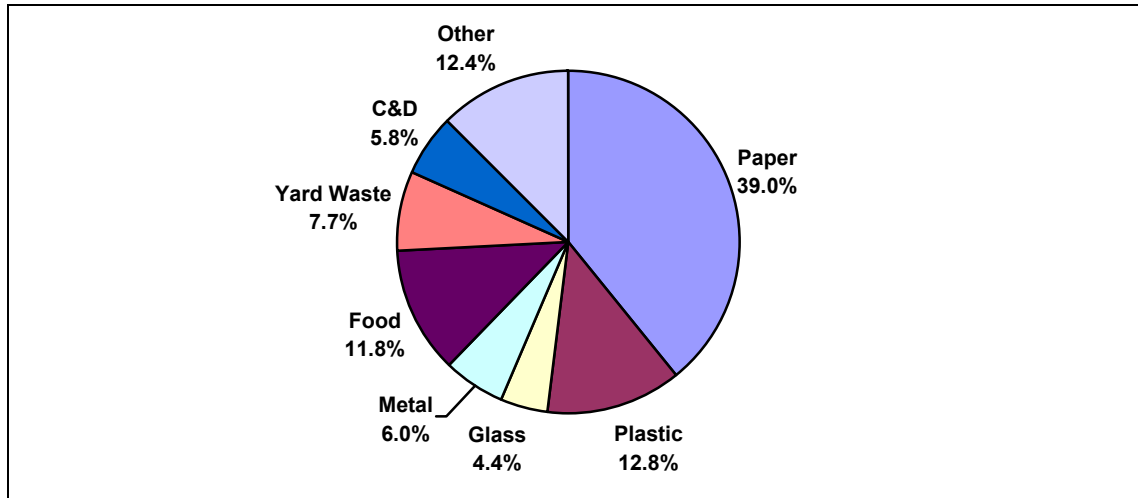
Exhibits 2A, 2B, and 2C summarize the results of the statistical analysis for the single-family residential, multi-family residential, and commercial waste, respectively, disposed² in Citrus County.

Sampling highlights include:

- *Single-family residential (Exhibit 2A)*: Paper (39.0%) and organics (26.4%) were the two largest material groups disposed by single-family households. Food waste was the single largest material category (11.8%), just slightly higher than mixed paper (11.4%). Interestingly, the study found significant quantities of both yard waste (7.7%) and C&D debris (5.8%) in the single-family stream. Minimum Five recyclable materials are also being disposed at significant levels, which is not surprising given the lack of curbside recycling available in the County. A pie chart of major material groups is shown in Figure 1.

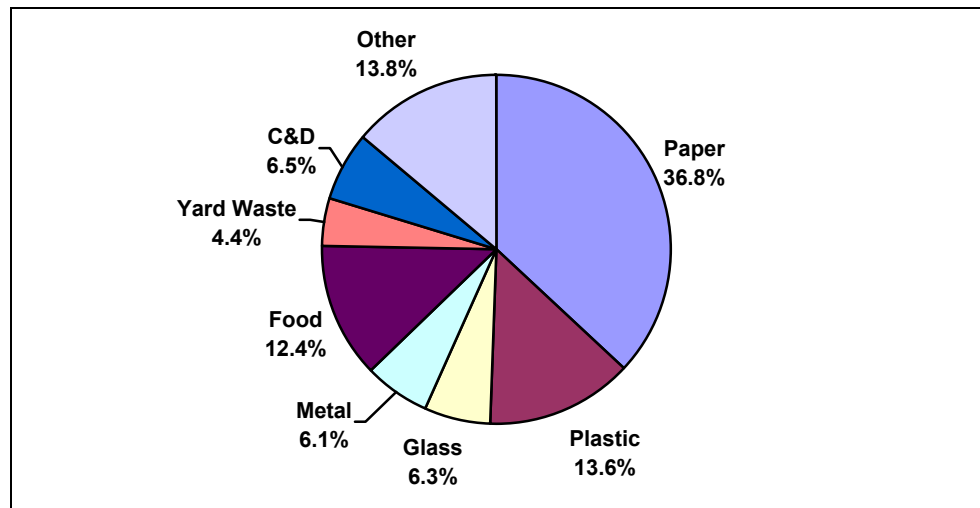
² Note that the study attempted to characterize only the waste being disposed in the County's landfill. No attempt was made to include recyclables, yard waste, tires, or other wastes handled by the County but not disposed in the landfill.

Figure 1
Composition of Single-family Waste



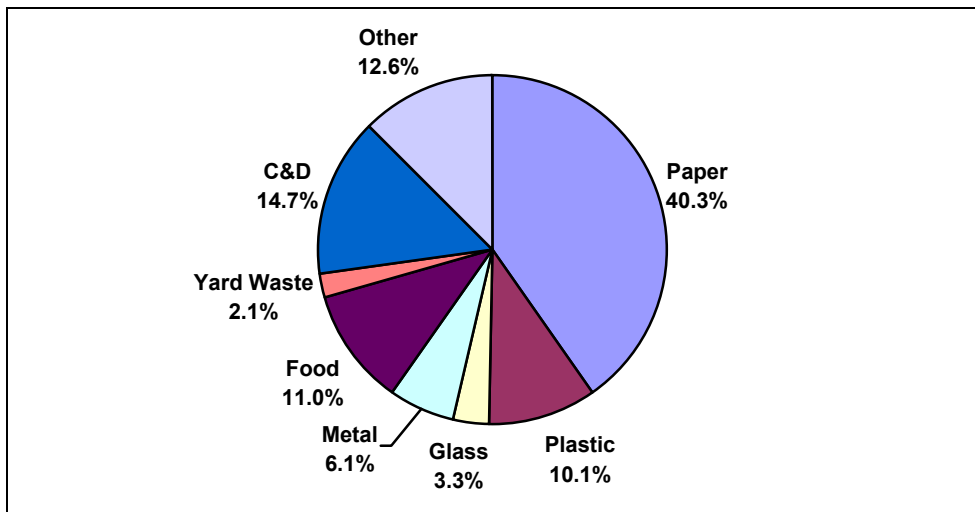
- Multi-family residential (Exhibit 2B):* Multi-family waste was quite similar to single-family waste in Citrus County. Multi-family waste was also high in paper (36.8%) and organics (23.0%), although yard waste was significantly lower when compared to single family waste. A breakdown of major material groups in the multi-family waste stream is shown in Figure 2.

Figure 2
Composition of Multi-family Waste



- Commercial (Exhibit 2C):* Commercial waste differed significantly from residential waste in Citrus County. Commercial waste contained extremely high fractions of corrugated cardboard (15.1%) and C&D debris (14.7%). As expected, variation in the commercial stream (as indicated by the width of the confidence intervals) is significantly higher compared to the residential waste stream. The breakdown of commercial waste by major material group is shown in Figure 3.

Figure 3
Composition of Commercial Waste



AGGREGATE ANNUAL RESULTS

In order to estimate the aggregate composition of the waste disposed in Citrus County, it is necessary to calculate a weighted average of the composition of all three generating sectors targeted in the study. Table 1 summarizes the annual tons disposed at the Citrus County landfill, as well as an estimate of the tons disposed by generating sector. Appendix A provides a detailed summary of the derivation of Table 1.

Table 1
Waste Disposed in Citrus County (1999)

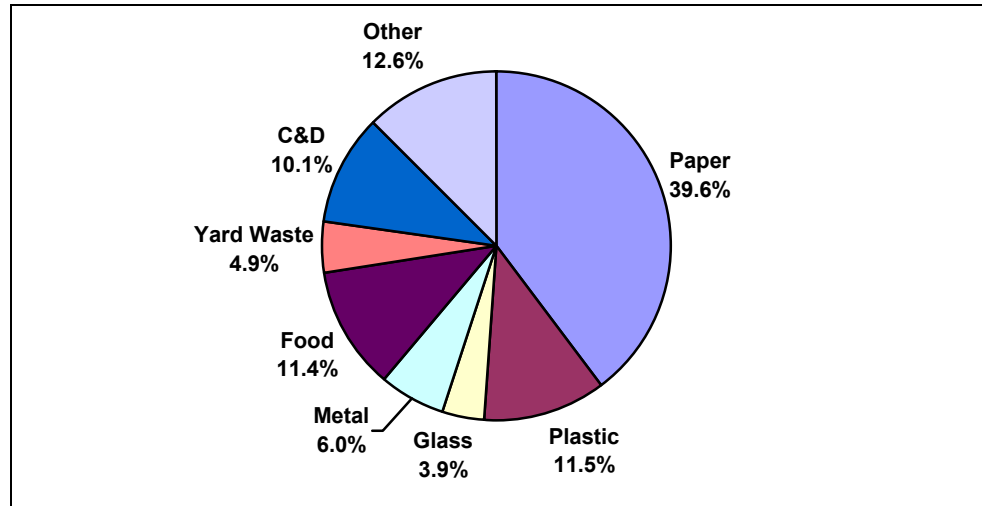
Generating Sector	Annual Tons Disposed	Percent of Total*
County-wide Aggregate	75,853	100.0%
Single-Family Waste	37,708	49.7%
Multi-family Waste	1,571	2.1%
Commercial Waste	36,574	48.2%

* Percentages disposed by generating sector represent best estimates based on available data.

Based on these data, Exhibit 3 illustrates the aggregate composition of waste disposed in Citrus County (combining the single-family residential, multi-family residential, and commercial waste sectors). Exhibit 3 also includes standard deviations and confidence intervals for each material type.

A breakdown of major material groups in the aggregate Citrus County waste stream is shown in Figure 4.

Figure 4
County-wide Aggregate Waste Composition



COMPUTER MODEL INPUT

Ultimately, the data collected in Citrus County will be used as input into the computer model being developed as part of this Innovative Grant. An objective of the computer model is to define waste quantities in accordance with FDEP reporting requirements.

The Citrus County waste composition study divided the waste stream into 31 separate material types. For compatibility with FDEP's annual reporting requirements, these 31 material types will need to be mapped into the 19 material types included in FDEP documents (such as Recycling and Education Grant documentation). Table 2 summarizes how the Citrus County results will be mapped into the FDEP-defined material categories for purposes of computer model development.

Table 2

Mapping of Citrus County Sort Categories into FDEP Material Categories

Citrus County Material Categories	Maps into FDEP-Defined Material Category
Newspaper	Newspaper
Corrugated Cardboard	Corrugated Cardboard
Office Paper	Office Paper
Polycoated/Aseptic	Other Paper
Mixed Paper	Other Paper
Other Paper	Other Paper
#1 PET Bottles	Plastic Bottles
#2 HDPE Bottles	Plastic Bottles
#3-#7 Bottles	Plastic Bottles
Polystyrene Foam	Other Plastic
Other Rigid Plastic	Other Plastic
Film Plastic	Other Plastic
Recyclable Glass	Glass
Non-recyclable Glass	Glass
Steel/Bi-metal Cans	Steel Cans
Other Ferrous	Ferrous
Aluminum Cans	Aluminum Cans
Other Non-Ferrous	Other Nonferrous
Food Waste	Food Waste
Yard Waste	Yard Waste
Rubber	Rubber
Diapers & Sanitary Products	Miscellaneous
Wood	Miscellaneous
Other Organics	Miscellaneous
Textiles	Textiles
C&D Debris	C&D Debris
White Goods	White Goods
Tires	Tires
Hazardous	Miscellaneous
Brown Goods	Miscellaneous
Other Inorganics	Miscellaneous

Based on the material category mapping shown in the Table above, Exhibit 4 summarizes single family residential, multi-family residential, and commercial waste composition according to FDEP-defined material categories.

COUNTY-WIDE WASTE STREAM SUMMARY

The sole objective of this study was to estimate the composition of the waste being disposed in Citrus County. Such composition data is useful for evaluating the success of current

recycling efforts, and also to help understand which materials may be candidates for future recycling or source reduction efforts.

It was beyond the scope of the study to develop a definitive recycling rate for Citrus County. However, the composition data obtained in the study will greatly assist the County in developing not only a County-wide recycling rate, but also in estimating defensible material-specific recycling rates. The purpose of this section is to illustrate how the results of this study can be used to determine material-specific recycling rates. Note that additional effort may be required to verify and update the data used to illustrate this exercise.

Exhibit 5 presents County-wide waste disposal, recycling, and generation by material category³. Waste disposal quantities are derived by applying the mean composition of each material category to the total annual disposal quantity reported by the County. Recycling quantities are those reported from FDEP-Certified Recovered Material Dealers for Citrus County.

IMPACT OF MOISTURE CONTENT ON RECYCLING RATE

As described in the Florida Methodology, a significant portion of disposed waste is moisture. It was beyond the scope of the Citrus County study to determine moisture content of disposed waste categories through laboratory testing. However, prior waste composition studies performed in the State of Florida have included such testing.

Based on an assessment of existing moisture analyses performed during other Florida waste composition studies, R. W. Beck has developed average moisture content data for use in Florida. Table 3 summarizes the average estimated moisture content for each of the FDEP-defined material categories. These data will be incorporated into development of the computer model, and are presented here for use by Citrus County.

³ The data used to perform this exercise have been compiled from multiple sources. These results do not necessarily represent the true CitrusCounty recycling rate.

Table 3
Moisture Content Analyses Comparison

Material Categories	Moisture Content
Newspaper	27.9%
Corrugated	24.1%
Office Paper	13.4%
Other Paper	26.9%
Plastic Bottles	4.6%
Other Plastic	19.2%
Glass	3.0%
Steel Cans	9.1%
Ferrous	5.4%
Aluminum Cans	12.9%
Non-ferrous	16.9%
Food Waste	59.8%
Yard Waste	50.6%
Textiles	17.2%
C&D	8.9%
White Goods	NA
Tires	NA
Miscellaneous	29.1%
Rubber	NA

By applying the moisture content factors shown in Table 3, it is possible to calculate the dry quantity of waste disposed and recycled in Citrus County. Exhibit 6 summarizes disposed and recycled waste, excluding moisture content, for the County, and re-calculates the County recycling rates. Note that the County’s recycling rate decreases if moisture is excluded.

CONSTRUCTION AND DEMOLITION VISUAL SAMPLES

The Citrus County waste sort exclusively targeted *municipal solid waste* that was *disposed* at the Citrus County landfill. It was beyond the scope of this study to perform in-depth analysis of other waste streams (recyclables, brush/yard waste, tires, construction & demolition, etc.).

However, selected visual surveying of construction and demolition (C&D) truckloads was performed in Citrus County as part of a joint effort with another project team⁴. C&D samples were visually surveyed at the Sand/Land of Florida landfill located in Citrus County. C&D visual sampling was performed during the same week as MSW physical sorting. A total of 50 samples were targeted for C&D visual sampling.

Incoming C&D truckloads were categorized into six different generating sectors, as shown in Table 4.

4 Dr. Tim Townsend of the University of Florida and Dr. Debra Reinhart of the University of Central Florida are conducting an independent study to assess the generation and composition of C&D waste in Florida (C&D Project Team). In cooperation with this independent project, R. W. Beck arranged to perform visual sampling of C&D samples generated in Citrus County. Results of the visual sampling will be provided to the C&D Project Team for analysis.

Table 4
Origin of C&D Debris

Residentially Generated	Commercially Generated
Construction Waste	Construction Waste
Demolition Waste	Demolition Waste
Renovation Waste	Renovation Waste

The C&D visual survey data has been compiled and delivered under separate cover. A copy of the raw data from the C&D surveying effort is included as Appendix B.

ACKNOWLEDGEMENTS

R. W. Beck would like to thank the following individuals and organizations who assisted in providing data for developing the sampling plan, organizing and conducting the field data collection, and analyzing the results of the study.

Citrus County	Susan Metcalfe, Solid Waste Management Director Frank Wentzel, Recycling Specialist Operational staff at the Citrus County Landfill who assisted throughout the field data collection
Incorporated Cities	Crystal River
Haulers	Waste Management FDS Nature Coast Majestic Superior
C&D Landfill Operators	Sand/Land of Florida

Exhibit 1
Summary of Trucks Sampled

Summer Season (August 21- 25, 2000)

Sample Number	Date	Hauler	Truck Number	Truck Type	Single Family	Multi-Family	Commercial
1	8/21/2000	Nature Coast	47-02		1		
2	8/21/2000	Majestic	49-6	RO	1		
3	8/21/2000	Waste Management	275	FEL			1
4	8/21/2000	Nature Coast	47-03	RL	1		
5	8/21/2000	Waste Management	257	FEL	1		
6	8/21/2000	Beverly Hills WM	81	RL	1		
7	8/22/2000	Waste Management	275	FEL		1	
8	8/22/2000	Superior	303009				1
9	8/22/2000	Waste Management	272	FEL			1
10	8/22/2000	Superior	307012				1
11	8/22/2000	Waste Management	275	FEL		1	
12	8/22/2000	Waste Management	275	FEL		1	
13	8/22/2000	Waste Management	275	FEL		1	
14	8/22/2000	FDS	6	FEL			1
15	8/22/2000	Crystal River	53	RL		1	
16	8/22/2000	Crystal River	53	RL		1	
17	8/23/2000	Superior	307009	FEL			1
18	8/23/2000	Waste Management	272	FEL			1
19	8/23/2000	Waste Management	275	FEL			1
20	8/23/2000	Superior	304014	RL	1		
21	8/23/2000	Superior	307012	FEL		1	
22	8/23/2000	Crystal River	53	RL		1	
23	8/23/2000	Waste Management	272	FEL		1	
24	8/23/2000	FDS	50-5	SL	1		
25	8/23/2000	Self-Haul (drop-off)			1		
26	8/24/2000	Waste Management	275	FEL			1
27	8/24/2000	Superior		FEL			1
28	8/24/2000	Waste Management	272	FEL			1
29	8/24/2000	Majestic	49-03	RL	1		
30	8/24/2000	Self-Haul (drop-off)			1		
31	8/24/2000	Superior	307009	FEL			1
32	8/24/2000	Waste Management	270	FEL	1		
33	8/24/2000	Superior	304017	RL	1		
34	8/24/2000	Superior	304001	RL	1		
35	8/24/2000	Crystal River	06-053	RL	1		
36	8/25/2000	Waste Management	275	FEL			1
37	8/25/2000	Superior	307009	FEL			1
38	8/25/2000	Waste Management	272	FEL	1		
39	8/25/2000	Waste Management	275	FEL		1	
Totals					15	10	14

Exhibit 1
Summary of Trucks Sampled

Winter Season (February 26-March 2, 2001)

Sample Number	Date	Hauler	Truck Number	Truck Type	Single Family	Multi-Family	Commercial
1	2/26/2001	FDS	5	SL	1		
2	2/26/2001	City of Crystal River	653	RL			1
3	2/26/2001	Waste Management	272	FL			1
4	2/26/2001	City of Crystal River	669	RL			1
5	2/26/2001	Nature Coast	47-03	RL	1		
6	2/28/2001	Superior	7009	FL			1
7	2/26/2001	FDS	50-6	FL			1
8	2/26/2001	Superior	7012	FL		1	
9	2/26/2001	Crystal River	669	FL	1		
10	2/27/2001	Waste Management	272	FL			1
11	2/27/2001	Superior	7012	FL			1
12	2/27/2001	Superior	7009	FL			1
13	2/27/2001	Waste Management	238				1
14	2/27/2001	Majestic	4904	RL	1		
15	2/27/2001	Superior	4011	RL	1		
16	2/27/2001	FDS	505	RL	1		
17	2/27/2001	Beverly Hills	01-81	RL	1		
18	2/27/2001	Majestic	4904	RL	1		
19	2/28/2001	Waste Management	235	FL		1	
20	2/28/2001	Waste Management	235	FL		1	
21	2/28/2001	Waste Management	276	FL		1	
22	2/28/2001	Superior	7012	FL			1
23	2/28/2001	Superior	7012	FL		1	
25	2/28/2001	Waste Management	235	FL		1	
26	2/28/2001	Waste Management	235	FL		1	
27	2/28/2001	Superior	7012	FL			1
28	2/28/2001	Superior	7012	FL		1	
29	3/1/2001	Superior	7012	FL			1
30	3/1/2001	Waste Management	272	FL			1
31	3/1/2001	Superior	7009	FL		1	
32	3/1/2001	Waste Management	238	FL			1
33	3/1/2001	Majestic	4904	RL	1		
34	3/1/2001	Superior	4011	RL	1		
35	3/1/2001	Beverly Hills	150	RL	1		
36	3/1/2001	City of Silver Spring	169	RL		1	
37	3/1/2001	Waste Management	272	FL		1	
38	3/2/2001	Self-Haul (drop-off)			1		
39	3/2/2001	Waste Management	272	FL			1
40	3/2/2001	Superior	4011	FL	1		
41	3/2/2001	Superior	7009	FL			1
42	3/1/2001	Self-Haul (drop-off)			1		
Totals					14	11	16

Exhibit 1
Summary of Trucks Sampled

	Single Family	Multi- Family	Commercial
Total Samples = 80	29	21	30

**Exhibit 2A
Citrus County Single-family Results**

	Material Categories	Annual Average	Standard Deviation	Lower Bound	Upper Bound
Paper	1 Newspaper	9.5%	5.6%	7.2%	12.0%
	2 Corrugated Cardboard	6.3%	8.4%	3.9%	9.1%
	3 Office Paper	1.6%	1.4%	1.1%	2.3%
	4 Polycoated/Aseptic	0.4%	0.6%	0.2%	0.5%
	5 Mixed Paper	11.4%	5.1%	9.5%	13.3%
	6 Other Paper	9.9%	4.7%	8.1%	11.9%
	TOTAL PAPER	39.0%	13.9%	33.5%	44.7%
Plastic	7 #1 PET Bottles	1.1%	0.6%	0.9%	1.3%
	8 #2 HDPE Bottles	1.1%	0.6%	0.9%	1.4%
	9 #3-#7 Bottles	0.1%	0.1%	0.1%	0.2%
	10 Polystyrene Foam	0.6%	0.3%	0.5%	0.8%
	11 Other Rigid Plastic	5.2%	9.6%	3.1%	7.6%
	12 Film Plastic	4.7%	1.7%	3.8%	5.6%
	TOTAL PLASTIC	12.8%	8.6%	10.2%	15.6%
Glass	13 Recyclable Glass	4.2%	3.2%	2.9%	5.7%
	14 Non-recyclable Glass	0.3%	0.6%	0.1%	0.5%
	TOTAL GLASS	4.4%	3.1%	3.2%	5.9%
Metal	15 Steel/Bi-metal Cans	1.7%	0.9%	1.3%	2.1%
	16 Other Ferrous	2.5%	3.8%	1.3%	4.1%
	17 Aluminum Cans	0.8%	0.6%	0.6%	1.1%
	18 Other Non-Ferrous	1.0%	1.9%	0.5%	1.6%
	TOTAL METAL	6.0%	4.0%	4.6%	7.5%
Organic	19 Food Waste	11.8%	5.4%	9.9%	14.0%
	20 Yard Waste	7.7%	12.8%	3.6%	13.2%
	21 Rubber	0.5%	1.2%	0.2%	0.9%
	22 Diapers & Sanitary Products	2.1%	2.6%	1.2%	3.2%
	23 Wood	2.1%	4.8%	0.9%	3.9%
	24 Other Organics	2.2%	2.9%	1.1%	3.5%
	TOTAL ORGANICS	26.4%	11.7%	22.0%	31.1%
Textiles	25 Textiles	2.2%	1.6%	1.7%	2.9%
C&D	26 C&D Debris	5.8%	9.3%	2.9%	9.7%
Wh. Goods	27 White Goods	0.0%	0.0%	0.0%	0.0%
Tires	28 Tires	0.0%	0.0%	0.0%	0.0%
Misc	29 Hazardous	0.7%	0.9%	0.4%	1.0%
	30 Brown Goods	1.2%	1.8%	0.6%	2.0%
	31 Other Inorganics	1.4%	2.3%	0.7%	2.4%
	TOTAL MISCELLANEOUS	3.3%	4.0%	2.1%	4.8%
TOTAL		100.0%			

**Exhibit 2B
Citrus County Multi-family Results**

	Material Categories	Annual Average	Standard Deviation	Lower Bound	Upper Bound
Paper	1 Newspaper	9.9%	6.5%	6.9%	13.5%
	2 Corrugated Cardboard	7.0%	5.0%	4.6%	10.0%
	3 Office Paper	2.7%	3.1%	1.5%	4.2%
	4 Polycoated/Aseptic	0.3%	0.4%	0.1%	0.4%
	5 Mixed Paper	9.0%	2.9%	7.7%	10.4%
	6 Other Paper	7.9%	2.8%	6.5%	9.4%
	TOTAL PAPER	36.8%	11.1%	31.6%	42.2%
Plastic	7 #1 PET Bottles	1.5%	0.8%	1.2%	1.9%
	8 #2 HDPE Bottles	1.1%	0.5%	0.8%	1.4%
	9 #3-#7 Bottles	0.1%	0.1%	0.0%	0.2%
	10 Polystyrene Foam	0.7%	0.4%	0.6%	0.9%
	11 Other Rigid Plastic	4.5%	5.9%	2.7%	6.7%
	12 Film Plastic	5.7%	2.8%	4.5%	6.9%
	TOTAL PLASTIC	13.6%	7.0%	10.8%	16.7%
Glass	13 Recyclable Glass	6.0%	4.7%	4.2%	8.1%
	14 Non-recyclable Glass	0.3%	0.4%	0.1%	0.5%
	TOTAL GLASS	6.3%	4.6%	4.5%	8.3%
Metal	15 Steel/Bi-metal Cans	1.7%	1.0%	1.3%	2.2%
	16 Other Ferrous	2.3%	3.2%	1.1%	3.9%
	17 Aluminum Cans	1.0%	0.6%	0.7%	1.3%
	18 Other Non-Ferrous	1.1%	2.5%	0.5%	2.0%
	TOTAL METAL	6.1%	3.8%	4.5%	7.8%
Organic	19 Food Waste	12.4%	6.0%	9.6%	15.5%
	20 Yard Waste	4.4%	5.2%	2.1%	7.6%
	21 Rubber	1.2%	1.9%	0.5%	2.2%
	22 Diapers & Sanitary Products	1.8%	1.7%	1.0%	2.8%
	23 Wood	1.3%	2.4%	0.5%	2.3%
	24 Other Organics	1.9%	2.5%	1.0%	3.2%
	TOTAL ORGANICS	23.0%	5.6%	20.5%	25.7%
Textiles	25 Textiles	4.1%	3.4%	2.8%	5.7%
C&D	26 C&D Debris	6.5%	13.4%	2.4%	12.4%
Wh. Goods	27 White Goods	0.0%	0.0%	0.0%	0.0%
Tires	28 Tires	0.1%	0.5%	0.0%	0.3%
Misc	29 Hazardous	0.6%	0.7%	0.3%	1.0%
	30 Brown Goods	1.0%	2.7%	0.3%	2.0%
	31 Other Inorganics	1.8%	2.9%	0.8%	3.4%
	TOTAL MISCELLANEOUS	3.4%	4.6%	1.9%	5.4%
TOTAL		100.0%			

**Exhibit 2C
Citrus County Commercial Results**

	Material Categories	Annual Average	Standard Deviation	Lower Bound	Upper Bound
Paper	1 Newspaper	4.5%	4.7%	2.9%	6.5%
	2 Corrugated Cardboard	15.1%	15.9%	10.0%	21.0%
	3 Office Paper	3.5%	5.3%	1.8%	5.6%
	4 Polycoated/Aseptic	0.2%	0.2%	0.1%	0.3%
	5 Mixed Paper	7.3%	6.2%	5.0%	9.9%
	6 Other Paper	9.8%	5.1%	7.6%	12.1%
	TOTAL PAPER	40.3%	18.3%	33.1%	47.7%
Plastic	7 #1 PET Bottles	0.8%	0.7%	0.5%	1.1%
	8 #2 HDPE Bottles	0.7%	0.7%	0.5%	1.0%
	9 #3-#7 Bottles	0.1%	0.1%	0.0%	0.1%
	10 Polystyrene Foam	0.5%	0.5%	0.3%	0.7%
	11 Other Rigid Plastic	3.6%	4.2%	2.3%	5.3%
	12 Film Plastic	4.4%	3.0%	3.1%	5.8%
	TOTAL PLASTIC	10.1%	6.3%	7.4%	13.1%
Glass	13 Recyclable Glass	3.1%	3.8%	1.9%	4.7%
	14 Non-recyclable Glass	0.1%	0.3%	0.1%	0.3%
	TOTAL GLASS	3.3%	3.9%	2.0%	4.9%
Metal	15 Steel/Bi-metal Cans	0.9%	1.0%	0.5%	1.3%
	16 Other Ferrous	2.5%	4.4%	1.2%	4.1%
	17 Aluminum Cans	0.5%	0.5%	0.4%	0.7%
	18 Other Non-Ferrous	2.2%	6.8%	0.8%	4.1%
	TOTAL METAL	6.1%	9.3%	3.6%	9.1%
Organic	19 Food Waste	11.0%	10.7%	7.2%	15.4%
	20 Yard Waste	2.1%	4.3%	0.9%	3.9%
	21 Rubber	0.7%	2.1%	0.3%	1.2%
	22 Diapers & Sanitary Products	0.6%	1.0%	0.3%	1.1%
	23 Wood	3.4%	5.1%	1.8%	5.5%
	24 Other Organics	0.7%	0.9%	0.3%	1.1%
	TOTAL ORGANICS	18.4%	11.3%	14.4%	22.8%
Textiles	25 Textiles	3.8%	6.3%	2.1%	5.9%
C&D	26 C&D Debris	14.7%	21.6%	7.4%	24.0%
Wh. Goods	27 White Goods	0.0%	0.0%	0.0%	0.0%
Tires	28 Tires	0.5%	2.6%	0.1%	1.0%
Misc	29 Hazardous	0.3%	0.5%	0.1%	0.5%
	30 Brown Goods	1.4%	3.1%	0.6%	2.5%
	31 Other Inorganics	1.3%	2.3%	0.6%	2.2%
	TOTAL MISCELLANEOUS	3.0%	4.2%	1.6%	4.7%
TOTAL		100.0%			

Exhibit 3
Citrus County Aggregate Waste Stream Composition

	Material Categories	Average	Standard Deviation	Lower Bound	Upper Bound
Paper	1 Newspaper	7.1%	6.0%	5.8%	8.6%
	2 Corrugated Cardboard	10.5%	14.3%	7.9%	13.6%
	3 Office Paper	2.5%	4.3%	1.7%	3.6%
	4 Polycoated/Aseptic	0.3%	0.5%	0.2%	0.4%
	5 Mixed Paper	9.3%	6.4%	7.9%	10.9%
	6 Other Paper	9.8%	5.6%	8.5%	11.3%
	TOTAL PAPER	39.6%	18.4%	35.3%	44.0%
Plastic	7 #1 PET Bottles	0.9%	0.7%	0.8%	1.1%
	8 #2 HDPE Bottles	0.9%	0.7%	0.8%	1.1%
	9 #3-#7 Bottles	0.1%	0.1%	0.1%	0.1%
	10 Polystyrene Foam	0.6%	0.5%	0.5%	0.7%
	11 Other Rigid Plastic	4.4%	8.6%	3.2%	5.8%
	12 Film Plastic	4.5%	2.8%	3.8%	5.3%
	TOTAL PLASTIC	11.5%	8.7%	9.7%	13.5%
Glass	13 Recyclable Glass	3.7%	4.0%	2.9%	4.8%
	14 Non-recyclable Glass	0.2%	0.5%	0.1%	0.3%
	TOTAL GLASS	3.9%	4.0%	3.1%	4.9%
Metal	15 Steel/Bi-metal Cans	1.3%	1.1%	1.1%	1.6%
	16 Other Ferrous	2.5%	4.7%	1.7%	3.6%
	17 Aluminum Cans	0.7%	0.6%	0.6%	0.8%
	18 Other Non-Ferrous	1.6%	5.6%	0.9%	2.5%
	TOTAL METAL	6.0%	8.0%	4.7%	7.7%
Organic	19 Food Waste	11.4%	9.5%	9.4%	13.8%
	20 Yard Waste	4.9%	11.1%	2.9%	7.7%
	21 Rubber	0.6%	1.9%	0.4%	0.9%
	22 Diapers & Sanitary Products	1.4%	2.3%	0.9%	2.0%
	23 Wood	2.7%	5.6%	1.8%	4.0%
	24 Other Organics	1.4%	2.5%	0.9%	2.1%
	TOTAL ORGANICS	22.5%	13.1%	19.6%	25.6%
Textiles	25 Textiles	3.0%	5.2%	2.2%	4.1%
C&D	26 C&D Debris	10.1%	18.7%	6.4%	14.9%
Wh. Goods	27 White Goods	0.0%	0.0%	0.0%	0.0%
Tires	28 Tires	0.2%	2.0%	0.1%	0.5%
Misc	29 Hazardous	0.5%	0.9%	0.3%	0.7%
	30 Brown Goods	1.3%	2.9%	0.8%	2.0%
	31 Other Inorganics	1.4%	2.6%	0.9%	2.0%
	TOTAL MISCELLANEOUS	3.2%	4.6%	2.3%	4.2%
TOTAL		100.0%			

Exhibit 4

DEP-Defined Material Category Composition Summary

DEP-defined Material Categories	Single-Family			Multi-Family			Commercial			Aggregate		
	Average	Lower	Upper	Average	Lower	Upper	Average	Lower	Upper	Average	Lower	Upper
1 Newspaper	9.5%	7.2%	12.0%	9.9%	6.9%	13.5%	4.5%	2.9%	6.5%	7.1%	5.8%	8.6%
2 Corrugated	6.3%	3.9%	9.1%	7.0%	4.6%	10.0%	15.1%	10.0%	21.0%	10.5%	7.9%	13.6%
3 Office Paper	1.6%	1.1%	2.3%	2.7%	1.5%	4.2%	3.5%	1.8%	5.6%	2.5%	1.7%	3.6%
4 Other Paper	21.6%	19.0%	24.4%	17.2%	15.1%	19.3%	17.2%	13.4%	21.3%	19.4%	16.6%	22.5%
5 Plastic Bottles	2.3%	1.9%	2.7%	2.7%	2.2%	3.2%	1.6%	1.1%	2.1%	2.0%	1.6%	2.4%
6 Other Plastic	10.5%	8.1%	13.2%	10.9%	8.2%	14.0%	8.5%	6.2%	11.2%	9.5%	7.6%	11.9%
7 Glass	4.4%	3.2%	5.9%	6.3%	4.5%	8.3%	3.3%	2.0%	4.9%	3.9%	3.0%	5.1%
8 Steel Cans	1.7%	1.3%	2.1%	1.7%	1.3%	2.2%	0.9%	0.5%	1.3%	1.3%	1.1%	1.6%
9 Ferrous	2.5%	1.3%	4.1%	2.3%	1.1%	3.9%	2.5%	1.2%	4.1%	2.5%	1.7%	3.6%
10 Aluminum Cans	0.8%	0.6%	1.1%	1.0%	0.7%	1.3%	0.5%	0.4%	0.7%	0.7%	0.6%	0.8%
11 Non-ferrous	1.0%	0.5%	1.6%	1.1%	0.5%	2.0%	2.2%	0.8%	4.1%	1.6%	0.9%	2.5%
12 Food Waste	11.8%	9.9%	14.0%	12.4%	9.6%	15.5%	11.0%	7.2%	15.4%	11.4%	9.4%	13.8%
13 Yard Waste	7.7%	3.6%	13.2%	4.4%	2.1%	7.6%	2.1%	0.9%	3.9%	4.9%	2.9%	7.7%
14 Textiles	2.2%	1.7%	2.9%	4.1%	2.8%	5.7%	3.8%	2.1%	5.9%	3.0%	2.2%	4.1%
15 C&D Debris	5.8%	2.9%	9.7%	6.5%	2.4%	12.4%	14.7%	7.4%	24.0%	10.1%	6.4%	14.9%
16 White Goods	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
17 Tires	0.0%	0.0%	0.0%	0.1%	0.0%	0.3%	0.5%	0.1%	1.0%	0.2%	0.1%	0.5%
18 Miscellaneous	9.7%	7.2%	12.5%	8.4%	6.3%	10.8%	7.7%	5.6%	10.0%	8.7%	5.6%	12.8%
19 Rubber	0.5%	0.2%	0.9%	1.2%	0.5%	2.2%	0.7%	0.3%	1.2%	0.6%	0.4%	0.9%
Total	100.0%			100.0%			100.0%			100.0%		

**Exhibit 5
Citrus County Waste Disposal and Recycling Summary**

Categories	Aggregate Composition at County LF (Mean) A	Tons Disposed at County LF [1] (Mean) B A x total	Tons Disposed Elsewhere C	Tons Recycled [1] (1999 data) D	Total Generation		Recycling Rate G D / E
					(tons) E B + C + D	(%) F	
Minimum 5 Materials							
Newspaper	7.1%	5,377	0	4,908	10,285	4.4%	47.7%
Glass	3.9%	2,971	0	687	3,658	1.6%	18.8%
Aluminum Cans	0.7%	519	0	598	1,117	0.5%	53.5%
Plastic Bottles	2.0%	1,482	0	115	1,597	0.7%	7.2%
Steel Cans	1.3%	986	0	76	1,062	0.5%	7.2%
Special Waste Materials							
C&D Debris	10.1%	7,672	89,784 ²	3	97,459	41.3%	0.0%
Yard Waste	4.9%	3,748	0	35,375 ³	39,123	16.6%	90.4%
White Goods	<0.1%	NE	0	1,048	1,048	0.4%	>75.0%
Tires	0.2%	174	0	950	1,124	0.5%	84.5%
Other Waste Materials							
Other Plastic	9.5%	7,224	0	30	7,254	3.1%	0.4%
Ferrous	2.5%	1,883	0	4,510	6,393	2.7%	70.5%
Non-ferrous	1.6%	1,186	0	1,890	3,076	1.3%	61.4%
Corrugated	10.5%	7,993	0	2,504	10,497	4.4%	23.9%
Office Paper	2.5%	1,932	0	2	1,934	0.8%	0.1%
Other Paper	19.4%	14,712	0	0	14,712	6.2%	0.0%
Food Waste	11.4%	8,674	0	3	8,677	3.7%	0.0%
Textiles	3.0%	2,281	0	41	2,322	1.0%	1.8%
Miscellaneous	8.7%	6,589	0	17,600 ⁴	24,189	10.3%	72.8%
Rubber	0.6%	450	0	0	450	0.2%	0.0%
Totals	100.0%	75,853	89,784	70,340	235,977	100.0%	29.8%

NE = Not estimated

[1] As reported in Citrus County's 1999 Recycling and Education Grant.

[2] Quantities reported by Citrus Sand & Debris, Material Exchange Corp., and Sand Land of Florida to be generated in Citrus County.

[3] Includes 31,095 tons of "left on the lawn" recycling.

[4] Includes 17,500 tons of recycled industrial waste from FPL.

Exhibit 6
Net Impact of Moisture Analysis

Categories	Percent Moisture [1]	Tons Disposed (Mean)	Net Tons Disposed	Tons Recycled (Mean)	Net Tons Recycled [2]	Net Generation (tons)	Moisture-Adjusted Recycling Rate
Minimum 5 Materials							
Newspaper	27.9%	5,377	3,880	4,908	3,541	7,421	47.7%
Glass	3.0%	2,971	2,881	687	666	3,547	18.8%
Aluminum Cans	12.9%	519	452	598	521	973	53.5%
Plastic Bottles	4.6%	1,482	1,414	115	110	1,524	7.2%
Steel Cans	9.1%	986	896	76	69	965	7.2%
Special Waste Materials							
C&D Debris	8.9%	97,456	88,782	3	3	88,785	0.0%
Yard Waste	50.6%	3,748	1,852	35,375	17,475	19,327	90.4%
White Goods	NA	NA	NA	1,048	1,048	1,048	>75.0%
Tires	NA	174	174	950	950	1,124	84.5%
Other Waste Materials							
Other Plastic	19.2%	7,224	5,837	30	24	5,861	0.4%
Ferrous	5.4%	1,883	1,781	4,510	4,266	6,048	70.5%
Non-ferrous	16.9%	1,186	986	1,890	1,571	2,556	61.4%
Corrugated	24.1%	7,993	6,071	2,504	1,902	7,973	23.9%
Office Paper	13.4%	1,932	1,673	2	2	1,675	0.1%
Other Paper	26.9%	14,712	10,749	0	0	10,749	0.0%
Food Waste	59.8%	8,674	3,491	3	1	3,493	0.0%
Textiles	17.2%	2,281	1,888	41	34	1,922	1.8%
Miscellaneous	29.1%	6,589	4,671	17,600	12,479	17,150	72.8%
Rubber	NA	450	450	0	0	450	0.0%
Totals		165,637	137,929	70,340	44,662	182,590	24.5%

[1] As documented in Technical Memorandum dated April 23, 2001.

[2] No analysis has been performed to determine the moisture content of recycled materials.

The same moisture content was used to net out moisture for both disposed material and recycled material. The actual moisture content for recycled material may be different than that used to net out moisture from recycled material.

**FINAL REPORT
COMPOSITION OF MUNICIPAL SOLID WASTE
DISPOSED IN CITRUS COUNTY, FLORIDA**

APPENDIX A

INTRODUCTION

The breakdown of Citrus County disposed waste between the single-family residential, multi-family residential and commercial generating sectors is shown in Table A-1. The remainder of this appendix presents background data that were used to develop this breakdown. Unless otherwise specified, data presented in this appendix are from calendar year 1999.

Citrus County contains the incorporated cities of Inverness and Crystal River. This analysis of waste disposal looked separately at these two incorporated jurisdictions, as well as the Citrus County unincorporated area.

Table A-2 presents a breakdown of the source of waste entering the Citrus County landfill, according to scalehouse records. In 1999, Crystal River collected much of its own waste. All other areas of the county, including Inverness and the county unincorporated areas, were collected by private haulers. As shown in the table, most of these line items could be categorized as either 100 percent residential or 100 percent commercial. Estimates from these sources were provided by the County based on reports by franchise haulers and the cities themselves. (Table A-3 provides an additional derivation of the source of roll-off waste between the two incorporated cities).

Table A-4 further evaluates the split between residential and commercial waste from each jurisdiction. As shown in the table, just over half of all waste disposed in Citrus County is estimated to be from the residential sector. Based on County records, it is assumed that 96% of the residential waste is from single-family homes, with only 4% from multi-family dwellings. (Table A-5 provides a detailed derivation of the split between residential and commercial waste in the City of Crystal River.)

The data shown represent the best estimate of the sources of waste in Citrus County, based on currently available information. However, future study may be warranted to further refine these estimates. Table A-6 shows a comparison of per-household generation rates (both residential and commercial) between Crystal River, Inverness, and the County unincorporated area. As shown in the table, there appear to be significant differences in the quantity of waste being generated.

A relatively high level of variation would be expected in the commercial generation rates, as commercial establishments are not uniformly distributed across the three jurisdictions. (For example, the county's largest retail shopping mall is located in Crystal River, likely biasing the Crystal River commercial generation rate upward.) However, there is no immediately obvious explanation for the wide variation in residential generation rates. The residential generation rates suggest that the residents of Crystal River, Inverness and the County unincorporated area have vastly different waste generating behaviors, such as varying access to recycling programs, or varying levels of yard waste recycling. Because of the demographic homogeneity of Citrus County, this level of variation in generation rates seems unlikely, or at least worthy of further study.

**Table A-1
Citrus County Summary
Disposed Waste Breakdown by Generating Sector**

Generating Sector	Tons	%
Residential Single-family	38,113	50%
Residential Multi-family	1,588	2%
Commercial	36,152	48%
Total	75,853	100%

**Table A-2
Breakdown from County Scalehouse Records**

	Total (tons)	Notes
County-wide Totals		
Weighed waste	73,816	Residential and commercial waste
Flat fee waste	1,823	Residential waste only
Pass waste	214	All residential waste
Total	75,853	
Subtotals by Jurisdiction		
Crystal River		
City Trucks	4,168	Residential and commercial waste
Franchise Commercial	2,276	Commercial waste only
Roll-off waste	691	Derived from Table A-3, column D
Subtotal Crystal River	7,135	
Inverness		
Inverness Franchise Residential	2,115	Residential waste only
Inverness Franchise Commercial	4,238	Commercial waste only
Roll-off waste	761	Derived from Table A-3, column D
Subtotal Inverness	7,114	
County Unincorporated Areas	61,604	

Source: CY 1999 scalehouse records

**Table A-3
Derivation of Crystal River and Inverness Roll-off Waste**

	Monthly Total [1]	Pct	Annual Total [2]	Annual Breakdown
	A	B	C	D
		% of A		B x C
Crystal River Roll-offs	93.25	48%		691
Inverness Roll-offs	102.82	52%		761
Total	196.07	100%	1,452	1,452

[1] Based on detailed analysis of incoming roll-offs from May 2001

[2] CY1999 data from County scale records

Table A-4
Derivation of County-Wide Residential/Commercial Split

	Total	Breakdown			Tons	
		Res'l	Com'l	Notes	Res'l [3]	Com'l
County Unincorporated	Tons					
Weighed Waste	59,567	55%	45%	[1]	32,762	26,805
Flat Fee	1,823	100%	0%		1,823	-
Pass Waste	214	100%	0%		214	-
Subtotal					34,799	26,805
Crystal River						
City Trucks + Franchise	6,444	43%	57%	[2]	2,788	3,656
Roll-off	691	0%	100%		-	691
Subtotal					2,788	4,347
Inverness						
Franchise Residential	2,115	100%	0%		2,115	-
Franchise Commercial + Roll-off	4,999	0%	100%		-	4,999
Subtotal					2,115	4,999
Total	75,853				39,701	36,152

[1] Provided by Citrus County for unincorporated areas (based on assessment)

[2] Derived from Table A-5

[3] Residential tons will split between single family and multi-family households based on the proportion of each type of household in the County. Citrus County planning department reports comparable persons/household in both single and multi-family households, supporting the use of household counts for dividing single family and multi-family waste

Table A-5
Derivation of Crystal River Residential/Commercial Split

Waste Delivered by	Tons [1]	Pct.	Notes
City Trucks	173.4	43.3%	All residences in City
Franchise Haulers	227.4	56.7%	All commercial establishments
Total	400.8		

Data from May 2001

Table A-6
Comparison of Generation Rates

Jurisdiction	Population [1]	Households [2]	Res'l Waste (tons)	Com'l Waste (tons)	Generation Rates	
					Res'l Tons/HH	Com'l Tons/HH
Crystal River	4,524	1,596	2,788	4,347	1.75	2.72
Inverness	7,248	2,970	2,115	4,999	0.71	1.68
Citrus County Unincorporated	106,313	55,345	34,799	26,805	0.63	0.48
Totals	118,085	59,911	39,701	36,152	0.66	0.60

[1] 2000 U.S. Census

[2] Provided by each jurisdiction

**FINAL REPORT
COMPOSITION OF MUNICIPAL SOLID WASTE
DISPOSED IN CITRUS COUNTY, FLORIDA**

APPENDIX B

MEMORANDUM



To: Dr. Tim Townsend, University of Florida

cc: Susan Metcalfe, Citrus County, w/ attachments
Larry Conrad, Sand/Land of Florida, w/ attachments
Barb Kula, Charlotte County, w/ attachments
Chuck McLendon, R. W. Beck, w/o attachments

From: John Culbertson

Subject: **Citrus County C&D Composition Data**

Date: April 24, 2001

R. W. Beck recently completed field data collection for a two-season municipal solid waste (MSW) composition study in Citrus County that is being performed as part of an Innovative Recycling Grant awarded by the Florida Department of Environmental Protection (FDEP). As you know, while conducting the MSW field study, we arranged to visually survey truckloads of construction and demolition debris (C&D) generated in Citrus County. Sand/Land of Florida, which operates a C&D landfill in Citrus County, hosted the visual surveying effort.

The purpose of this memorandum is to transmit the raw data collected during R. W. Beck's visual sampling of incoming C&D truckloads at the Sand/Land landfill (from February 26 through March 2). These data were collected in accordance with the visual sampling protocol provided by your project team in January 2001. This protocol included:

- Interview of the driver to ascertain the origin of each truckload;
- Measurement of the volume of the incoming truckload and tipped pile of C&D;
- Visual assessment of the percentage (by volume) of various material types contained in the load; and
- Photographing the load from two angles.

Note that R. W. Beck has made no attempt to analyze the resulting data. As intended at the outset of our project, our hope is that these data will assist your project team in its ongoing evaluation of C&D waste generation and composition in Florida.

Attached you will find the following summary exhibits detailing the data collected in Citrus County:

- Exhibit 1- Summary of Trucks Sampled;
- Exhibit 2- Residential Construction Raw Data;
- Exhibit 3- Non-Residential Construction Raw Data;
- Exhibit 4- Residential Renovation Raw Data;
- Exhibit 5- Non-Residential Renovation Raw Data;
- Exhibit 6- Residential Demolition Raw Data; and,
- Exhibit 7- Non-Residential Demolition Raw Data.

MEMORANDUM to: Dr. Tim Townsend, University of Florida

April 24, 2001

Page 2

These exhibits are contained in a Microsoft Excel spreadsheet on the enclosed CD. The CD also includes photographs of all samples (in jpeg format).

In the next several weeks, we will be delivering similar results for visual C&D sampling conducted in Okaloosa, Charlotte, and Sarasota Counties. Please contact me at (407) 648-3563 if you have any questions or desire additional details regarding the sampling protocol or tabulation of raw data. Thank you for your attention.

Exhibit 1
Summary of Trucks Sampled

Sample Number	Date	Hauler	County	Volume of Truck (yd ³)	Pile Dimensions [1]			Construction		Renovation		Demolition	
					Length	Width	Height	Res	Non-Res	Res	Non-Res	Res	Non-Res
1	2/26/2001	Alan's Roofing	Citrus	15	16'	7'	4'		1				
2	2/26/2001	Donle Ent	Citrus	10	13'2"	5'1"	2'10"						1
3	2/26/2001	Self Haul	Citrus	2	7'5"	8'1"	15'					1	
4	2/26/2001	Self Haul	Citrus	3	7'2"	8'5"	2'8"			1			
5	2/26/2001	Superior	Citrus	20	22'6"	11'6"	5'	1					
6	2/26/2001	N/A	Citrus	6	8'6"	5'2"	3'			1			
7	2/26/2001	N/A	Citrus	4	7'2"	5'6"	3'			1			
8	2/26/2001	Sandcippine	Citrus	4						1			
9	2/26/2001	Superior	Citrus	20	22'	10'10"	5'	1					
10	2/27/2001	Donle Ent	Citrus	4	14'	7'6"	2.5'			1			
11	2/27/2001	Self Haul	Citrus	1	6'	4'	1'			1			
13	2/27/2001	Sand Land	Citrus	20	46'	7'6"	4'		1				
14	2/27/2001	All Counlins Roofing	Citrus	8	18'	9'	3.5'			1			
15	2/27/2001	N/A	Citrus	6	9.5'	5.5'	3.5'			1			
16	2/27/2001	Citrus Sita Development	Citrus	25	19'	8'6"	4'6"	1					
17	2/26/2001	Dons Septic and Coutrium	Citrus	40	58'	9'6"	4'6"				1		
18	2/27/2001	Self Haul	Citrus	1						1			
19	2/27/2001	Sand Land	Citrus	15	9'	23'6"	4'			1			
20	2/27/2001	Self Haul	Citrus	2						1			
21	2/27/2001	Alan's Roofing	Citrus	10	15'6"	9'6"	4'6"			1			
22	2/27/2001	Home Depot Roofing	Citrus	8	15'	8'6"	4'			1			
23	2/27/2001	Citrus County parks and Rec	Citrus	4	11'6"	4'6"	3'6"				1		
24	2/27/2001	Newco Homes	Citrus	10	18'	8.5'	3'9"	1					
25	2/27/2001	Superior	Citrus	30	15'6"	9'6"	5'	1					
26	2/27/2001	Self Haul	Citrus	4	6'	5'	2.5'			1			
27	2/28/2001	Self Haul	Citrus	2	6'6"	7'	2'				1		
28	2/28/2001	Self Haul	Citrus	3						1			
29	2/28/2001	Self Haul	Citrus	6	10'6"	7'	3'	1					
30	2/28/2001	M&H Services	Citrus	80	40'	8'	8'					1	
31	2/28/2001	Self Haul	Citrus	2	6'	6'6"	1'			1			
32	2/28/2001	Self Haul	Citrus	1	6'	4'6"	6"			1			
33	2/28/2001	Sand Land	Citrus	20	24'	8'	5'				1		

Exhibit 1
Summary of Trucks Sampled

Sample Number	Date	Hauler	County	Volume of Truck (yd ³)	Pile Dimensions [1]			Construction		Renovation		Demolition	
					Length	Width	Height	Res	Non-Res	Res	Non-Res	Res	Non-Res
34	2/28/2001	Self Haul	Citrus	5	10'6"	5'6"	2'			1			
35	2/28/2001	Self Haul	Citrus	2	4'	4'6"	1'			1			
36	2/28/2001	N/A	Citrus	10	21'6"	7'6"	3'	1					
37	2/28/2001	Sand Land	Citrus	20	36'	8'6"	4'	1					
38	2/28/2001	Joe Ruth Construction	Citrus	6						1			
39	2/28/2001	Spectrum Ent	Citrus	30	33'	7'6"	4'6"	1					
40	3/1/2001	Sand Land	Citrus	15	18'6"	9'	3'6"			1			
41	3/1/2001	Sand Land	Citrus	13	21'6"	12'	4'			1			
42	3/1/2001	Spectrum Ent	Citrus	30	31'6"	11'6"	5'	1					
43	3/1/2001	Self Haul	Citrus	3	9'	2'	2'			1			
44	3/1/2001	Self Haul	Citrus	2						1			
45	3/1/2001	Spectrum Ent	Citrus	8				1					
46	3/1/2001	Self Haul	Citrus	3	9'	6'6"	3'			1			
47	3/1/2001	Sand Land	Citrus						1				
48	3/1/2001	Self Haul	Citrus	3						1			
49	3/2/2001	Superior	Citrus	30	32'6"	9'6"	4'6"	1					
50	3/2/2001	Sand Land	Citrus	13	18'6"	7'6"	4'				1		
51	3/2/2001	All Counties Roofing	Citrus	7	12'6"	8'6"	4'6"			1			
52	2/13/2001	Self Haul	Marion	2						1			
53	2/13/2001	Sand Land	Citrus	20						1			
54	2/13/2001	CNS Roofing	Marion	12						1			
55	2/13/2001	Sand Land	Citrus	20				1					

	Construction		Renovation		Demolition	
	Res	Non-Res	Res	Non-Res	Res	Non-Res
Total Samples = 54	13	3	30	5	2	1

[1] Some piles were scattered or tipped atop other material. Dimensions for these piles would not meaningfully reflect the size of the pile and therefore are not shown.

Exhibit 2
Residential Construction Raw Data

	Sample Number	5	9	16	24	25	29	36
	Material Categories	%	%	%	%	%	%	%
	1 Wood	55.0%	15.0%	0.0%	10.0%	45.0%	0.0%	49.0%
	2 Concrete	15.0%	18.0%	0.0%	65.0%	0.0%	2.0%	0.0%
	3 Drywall	0.0%	0.0%	60.0%	0.0%	0.0%	0.0%	10.0%
	4 Dirt/soil	15.0%	19.0%	22.0%	20.0%	0.0%	0.0%	0.0%
	5 Metal	2.0%	1.0%	1.0%	1.5%	2.0%	5.0%	8.0%
	6 Land Clearing Debris	0.0%	20.0%	2.0%	0.0%	0.0%	0.0%	0.0%
	7 Cardboard	1.0%	5.0%	8.0%	1.0%	35.0%	50.0%	24.0%
	8 Roofing Materials	2.0%	0.0%	0.0%	0.0%	0.0%	31.0%	0.0%
	9 Plastic	1.0%	1.0%	1.0%	0.5%	1.0%	2.0%	5.0%
	10 MSW	1.0%	10.0%	0.0%	1.0%	12.0%	3.0%	0.0%
	11 Misc.	2.0%	5.0%	6.0%	1.0%	0.0%	5.0%	0.0%
	12 Carpet	3.0%	0.0%	0.0%	0.0%	5.0%	2.0%	0.0%
	13 Tile	2.0%	5.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	14 Other _____	1.0%	1.0%	0.0%	0.0%	0.0%	0.0%	4.0%
TOTAL		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Exhibit 2
Residential Construction Raw Data

	Sample Number	37	39	42	45	49	55	Average	Std Dev
	Material Categories	%	%	%	%	%	%	%	%
	1 Wood	55.0%	50.0%	10.0%	20.0%	10.0%	20.0%	26.1%	20.5%
	2 Concrete	18.0%	25.0%	25.0%	45.0%	8.0%	3.0%	17.2%	18.8%
	3 Drywall	0.0%	0.0%	45.0%	0.0%	25.0%	2.0%	10.9%	19.2%
	4 Dirt/soil	8.0%	15.0%	10.0%	25.0%	20.0%	3.0%	12.1%	8.8%
	5 Metal	3.0%	2.0%	2.0%	0.0%	2.0%	3.0%	2.5%	2.0%
	6 Land Clearing Debris	0.0%	0.0%	0.0%	0.0%	10.0%	0.0%	2.5%	5.7%
	7 Cardboard	8.0%	0.0%	2.0%	5.0%	15.0%	50.0%	15.7%	17.6%
	8 Roofing Materials	1.0%	5.0%	1.0%	0.0%	0.0%	0.0%	3.1%	8.2%
	9 Plastic	2.0%	2.0%	1.0%	3.0%	5.0%	5.0%	2.3%	1.6%
	10 MSW	1.0%	0.0%	1.0%	0.5%	2.0%	3.0%	2.7%	3.7%
	11 Misc.	3.0%	1.0%	2.0%	0.5%	3.0%	9.0%	2.9%	2.6%
	12 Carpet	0.0%	0.0%	1.0%	0.0%	0.0%	2.0%	1.0%	1.5%
	13 Tile	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	1.4%
	14 Other _____	1.0%	0.0%	0.0%	1.0%	0.0%	0.0%	0.6%	1.1%
TOTAL		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

Exhibit 3

Non-Residential Construction Raw Data

	Sample Number	1	47	13	Average	Std Dev
	Material Categories	%	%	%	%	%
	1 Wood	0.0%	51.0%	40.0%	30.3%	26.8%
	2 Concrete	0.0%	25.0%	35.0%	20.0%	18.0%
	3 Drywall	0.0%	0.0%	0.0%	0.0%	0.0%
	4 Dirt/soil	0.0%	5.0%	0.0%	1.7%	2.9%
	5 Metal	0.0%	5.0%	0.0%	1.7%	2.9%
	6 Land Clearing Debris	0.0%	0.0%	0.0%	0.0%	0.0%
	7 Cardboard	1.0%	5.0%	10.0%	5.3%	4.5%
	8 Roofing Materials	95.0%	0.0%	10.0%	35.0%	52.2%
	9 Plastic	1.0%	3.0%	2.0%	2.0%	1.0%
	10 MSW	0.0%	4.0%	3.0%	2.3%	2.1%
	11 Misc.	1.0%	2.0%	0.0%	1.0%	1.0%
	12 Carpet	0.0%	0.0%	0.0%	0.0%	0.0%
	13 Tile	0.0%	0.0%	0.0%	0.0%	0.0%
	14 Other _____	2.0%	0.0%	0.0%	0.7%	1.2%
TOTAL		100.0%	100.0%	100.0%	100.0%	

Exhibit 4
Residential Renovation Raw Data

	Sample Number	4	6	7	8	10	11	14	15	18
	Material Categories	%	%	%	%	%	%	%	%	%
	1 Wood	0.0%	0.0%	0.0%	0.0%	1.0%	90.0%	0.0%	35.0%	64.0%
	2 Concrete	0.0%	90.0%	95.0%	0.0%	93.0%	0.0%	0.0%	0.0%	35.0%
	3 Drywall	98.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	13.0%	0.0%
	4 Dirt/soil	0.0%	10.0%	5.0%	100.0%	5.5%	0.0%	0.0%	6.0%	0.0%
	5 Metal	0.0%	0.0%	0.0%	0.0%	0.5%	5.0%	5.0%	1.0%	1.0%
	6 Land Clearing Debris	0.0%	0.0%	0.0%	0.0%	0.0%	5.0%	0.0%	0.0%	0.0%
	7 Cardboard	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	10.0%	0.0%
	8 Roofing Materials	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	95.0%	0.0%	0.0%
	9 Plastic	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.0%	0.0%
	10 MSW	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	10.0%	0.0%
	11 Misc.	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	20.0%	0.0%
	12 Carpet	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	13 Tile	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	14 Other _____	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	0.0%
TOTAL		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Exhibit 4
Residential Renovation Raw Data

	Sample Number	19	20	21	22	26	28	31	32	34
	Material Categories	%	%	%	%	%	%	%	%	%
	1 Wood	0.0%	10.0%	0.0%	2.0%	97.0%	60.0%	48.0%	90.0%	68.0%
	2 Concrete	0.0%	85.0%	0.0%	0.5%	0.0%	0.0%	30.0%	0.0%	0.0%
	3 Drywall	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	4 Dirt/soil	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	5 Metal	0.0%	2.0%	2.0%	5.0%	0.0%	0.0%	20.0%	5.0%	10.0%
	6 Land Clearing Debris	0.0%	0.0%	0.0%	0.5%	0.0%	20.0%	0.0%	0.0%	0.0%
	7 Cardboard	0.0%	0.0%	0.5%	0.5%	0.0%	0.0%	0.0%	5.0%	0.0%
	8 Roofing Materials	100.0%	0.0%	97.0%	91.0%	0.0%	10.0%	0.0%	0.0%	20.0%
	9 Plastic	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	2.0%	0.0%	0.0%
	10 MSW	0.0%	0.0%	0.5%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%
	11 Misc.	0.0%	3.0%	0.0%	0.0%	0.0%	3.0%	0.0%	0.0%	0.0%
	12 Carpet	0.0%	0.0%	0.0%	0.0%	0.0%	5.0%	0.0%	0.0%	0.0%
	13 Tile	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	14 Other _____	0.0%	0.0%	0.0%	0.0%	3.0%	0.0%	0.0%	0.0%	2.0%
TOTAL		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Exhibit 4
Residential Renovation Raw Data

	Sample Number	35	38	40	41	43	44	46	48	51
	Material Categories	%	%	%	%	%	%	%	%	%
	1 Wood	0.0%	93.0%	5.0%	0.0%	5.0%	0.0%	84.0%	99.0%	0.0%
	2 Concrete	100.0%	0.0%	0.0%	0.0%	93.0%	2.0%	0.0%	0.0%	0.0%
	3 Drywall	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	4 Dirt/soil	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	5 Metal	0.0%	2.0%	0.0%	0.0%	1.0%	0.0%	1.0%	1.0%	1.0%
	6 Land Clearing Debris	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	15.0%	0.0%	0.0%
	7 Cardboard	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	10.0%
	8 Roofing Materials	0.0%	3.0%	92.0%	100.0%	0.0%	0.0%	0.0%	0.0%	88.0%
	9 Plastic	0.0%	1.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%
	10 MSW	0.0%	0.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%
	11 Misc.	0.0%	1.0%	1.0%	0.0%	1.0%	0.0%	0.0%	0.0%	0.0%
	12 Carpet	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	13 Tile	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	14 Other _____	0.0%	0.0%	0.0%	0.0%	0.0%	98.0%	0.0%	0.0%	0.0%
TOTAL		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Exhibit 4
Residential Renovation Raw Data

	Sample Number	52	53	54	Average	Std Dev
	Material Categories	%	%	%	%	%
	1 Wood	0.0%	0.0%	0.0%	28.4%	38.5%
	2 Concrete	0.0%	100.0%	0.0%	24.1%	40.0%
	3 Drywall	0.0%	0.0%	0.0%	3.7%	18.0%
	4 Dirt/soil	0.0%	0.0%	0.0%	4.2%	18.2%
	5 Metal	0.0%	0.0%	1.0%	2.1%	4.1%
	6 Land Clearing Debris	0.0%	0.0%	0.0%	1.4%	4.5%
	7 Cardboard	0.0%	0.0%	0.0%	0.9%	2.6%
	8 Roofing Materials	0.0%	0.0%	99.0%	26.5%	42.4%
	9 Plastic	0.0%	0.0%	0.0%	0.3%	0.7%
	10 MSW	0.0%	0.0%	0.0%	0.4%	1.8%
	11 Misc.	0.0%	0.0%	0.0%	1.0%	3.7%
	12 Carpet	0.0%	0.0%	0.0%	0.2%	0.9%
	13 Tile	0.0%	0.0%	0.0%	0.0%	0.0%
	14 Other _____	100.0%	0.0%	0.0%	6.8%	25.1%
TOTAL		100.0%	100.0%	100.0%	100.0%	

Exhibit 5

Non-Residential Renovation Raw Data

	Sample Number	17	23	27	33	50	Average	Std Dev
	Material Categories	%	%	%	%	%	%	%
	1 Wood	37.0%	0.0%	100.0%	78.0%	40.0%	54.5%	44.0%
	2 Concrete	0.0%	80.0%	0.0%	0.0%	0.0%	20.0%	40.0%
	3 Drywall	32.0%	0.0%	0.0%	1.0%	0.0%	0.3%	0.5%
	4 Dirt/soil	5.0%	19.5%	0.0%	0.0%	0.0%	4.9%	9.8%
	5 Metal	5.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	6 Land Clearing Debris	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	7 Cardboard	0.0%	0.0%	0.0%	4.0%	10.0%	3.5%	4.7%
	8 Roofing Materials	12.0%	0.0%	0.0%	15.0%	45.0%	15.0%	21.2%
	9 Plastic	2.0%	0.5%	0.0%	2.0%	0.0%	0.6%	0.9%
	10 MSW	3.0%	0.0%	0.0%	0.0%	4.0%	1.0%	2.0%
	11 Misc.	3.0%	0.0%	0.0%	0.0%	1.0%	0.3%	0.5%
	12 Carpet	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	13 Tile	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	14 Other _____	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
TOTAL		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

Exhibit 6
Residential Demolition Raw Data

	Sample Number	3	30	Average	Std Dev
	Material Categories	%	%	%	%
	1 Wood	0.0%	68.0%	34.0%	48.1%
	2 Concrete	100.0%	0.0%	50.0%	70.7%
	3 Drywall	0.0%	0.0%	0.0%	0.0%
	4 Dirt/soil	0.0%	0.0%	0.0%	0.0%
	5 Metal	0.0%	20.0%	10.0%	14.1%
	6 Land Clearing Debris	0.0%	0.0%	0.0%	0.0%
	7 Cardboard	0.0%	0.0%	0.0%	0.0%
	8 Roofing Materials	0.0%	0.0%	0.0%	0.0%
	9 Plastic	0.0%	0.0%	0.0%	0.0%
	10 MSW	0.0%	0.0%	0.0%	0.0%
	11 Misc.	0.0%	0.0%	0.0%	0.0%
	12 Carpet	0.0%	0.0%	0.0%	0.0%
	13 Tile	0.0%	0.0%	0.0%	0.0%
	14 Other _____	0.0%	12.0%	6.0%	8.5%
TOTAL		100.0%	100.0%	100.0%	

Exhibit 7

Non-Residential Demolition Raw Data

	Sample Number	2	Average	Std Dev
	Material Categories	%	%	%
	1 Wood	1.0%	1.0%	-
	2 Concrete	80.0%	80.0%	-
	3 Drywall	0.0%	0.0%	-
	4 Dirt/soil	16.0%	16.0%	-
	5 Metal	0.0%	0.0%	-
	6 Land Clearing Debris	0.0%	0.0%	-
	7 Cardboard	0.5%	0.5%	-
	8 Roofing Materials	0.0%	0.0%	-
	9 Plastic	0.5%	0.5%	-
	10 MSW	0.0%	0.0%	-
	11 Misc.	1.0%	1.0%	-
	12 Carpet	0.0%	0.0%	-
	13 Tile	0.0%	0.0%	-
	14 Other _____	1.0%	1.0%	-
TOTAL		100.0%	100.0%	

APPENDIX D

**COMPOSITION OF MUNICIPAL SOLID WASTE
DISPOSED IN OKALOOSA COUNTY**

Final Report

Composition of Municipal Waste Disposed in Okaloosa County, Florida

Florida Department of Environmental Protection
Statewide Waste Composition Computer Model
1999-2000 Innovative Recycling Grant



July 2001

1999-2000 FLORIDA INNOVATIVE RECYCLING GRANT OKALOOSA COUNTY WASTE COMPOSITION STUDY

INTRODUCTION

In early 2000, Charlotte County was awarded an Innovative Recycling Grant by the Florida Department of Environmental Protection (FDEP) for the purpose of developing a State-wide statistical model to predict the composition of municipal solid waste disposed within each of Florida's counties. As part of the model development process, the Grant provided for Charlotte County and three other partner counties (Citrus, Okaloosa, and Sarasota) to conduct county-wide waste composition studies. The results of these four studies will be used as input in the development of the computer model. A complete overview of the project can be found in Charlotte County's 1999-2000 Innovative Recycling Grant Proposal, found on the Web at <http://www.dep.state.fl.us/dwm/programs/recycling/>.

In 1996, the Florida Center for Solid and Hazardous Waste developed, and FDEP subsequently approved, a methodology for conducting waste characterization analyses in the state of Florida¹ ("Florida Methodology"). An objective of the Innovative Recycling Grant project was to perform all field studies in accordance with the Florida Methodology.

R. W. Beck, Inc., was ultimately retained by Charlotte County to perform the field data collection and subsequently develop a State-wide waste composition computer model. The remainder of this report summarizes the results of the Okaloosa County waste composition study, conducted by R. W. Beck (in accordance with the Florida Methodology) over two seasons in September 2000 and March 2001.

SAMPLING SUMMARY

In accordance with the Florida Methodology, sampling and sorting was conducted over two seasons to capture representative samples from both summer (non-tourist) and winter (tourist) seasons. Field sampling and sorting targeted the following three generating sectors:

- Single-family residential waste;
- Multi-family residential waste; and
- Commercial waste (including industrial, institutional, and all other non-residential waste).

Prior to conducting the field sorts, R. W. Beck surveyed all of the haulers (both public and private) that deliver municipal solid waste (MSW) to the South County Transfer Station² (owned and operated by Waste Management). Haulers were asked to provide a list of truck numbers and truck types, and also to specify the origin(s) of waste collected on each truck. Based on these responses, as well as on annual disposal tonnages provided by Okaloosa County, R. W. Beck developed a sampling plan for the two-season waste composition study.

Exhibit 1 lists the single-family residential, multi-family residential and commercial trucks from which samples were taken during both seasons of sorting at the Okaloosa South County Transfer Station. Sampling highlights include:

- Sampling was conducted over two one-week periods. Summer (non-tourist) season sampling was performed from September 11-15, 2000. Winter (tourist) season was performed from March 5-9, 2001;
- A total of 79 samples were ultimately sorted, including

¹ "Method for Conducting Composition Study for Discarded Waste," Florida Center for Solid and Hazardous Waste Management, January 1996.

² A second transfer station is located in the Northern region of Okaloosa county. Due to the small fraction of waste delivered to this facility, it was excluded from the sampling and sorting activities.

- 26 single-family residential samples,
- 22 multi-family residential samples, and
- 31 commercial samples;
- The samples were divided between the summer and winter seasons, with slightly more samples (42 out of 79) taken during the winter season to reflect the higher waste disposal volumes during this season;
- Samples were targeted at 200 pounds, and were randomly selected from targeted truckloads;
- Over 19,500 pounds of waste were ultimately sorted over the two seasons; and
- Samples averaged 276 pounds by weight, with weights ranging from a low of 165 pounds to a high of 435 pounds.

COMPOSITION SUMMARY BY WASTE STREAM

All field data collected over both seasons was entered into a specially designed spreadsheet for statistical analysis. Field data were analyzed separately for single family residential, multi-family residential, and commercial waste samples. For each generating sector, R. W. Beck calculated the mean composition, standard deviation, and upper and lower confidence intervals at a 95 percent level of confidence for each material type defined in the study.

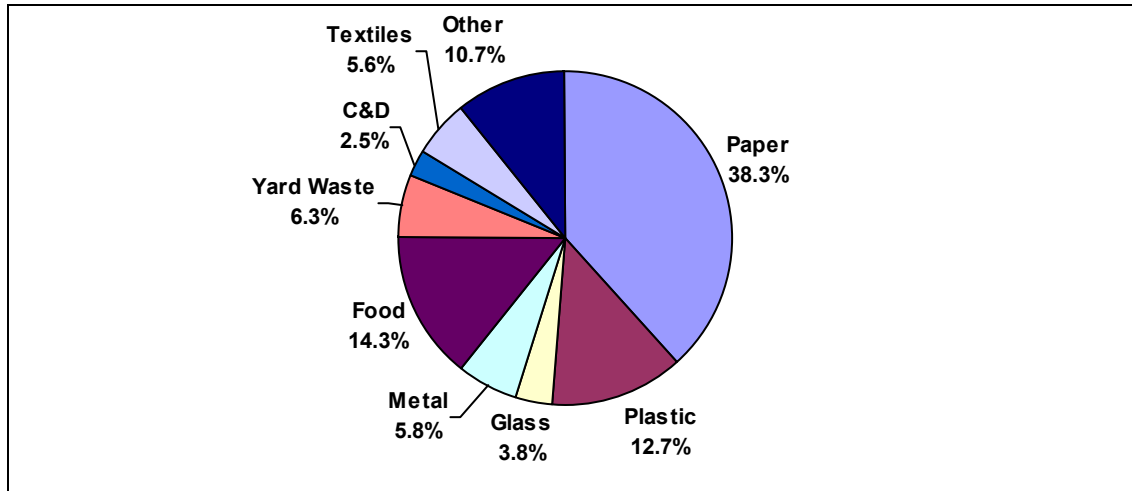
Exhibits 2A, 2B, and 2C summarize the results of the statistical analysis for the single-family residential, multi-family residential, and commercial waste, respectively, disposed³ in Okaloosa County.

Sampling highlights include:

- *Single-family residential (Exhibit 2A):* Paper (38.3%) and organics (27.7%) were the two largest material groups disposed by single-family households. Mixed paper was the single largest material category (16.2%), just slightly higher than food waste (14.3%). Interestingly, the study found significant quantities of both yard waste (6.3%) and textiles (5.6%) in the single-family stream. A pie chart of major material groups is shown in Figure 1.

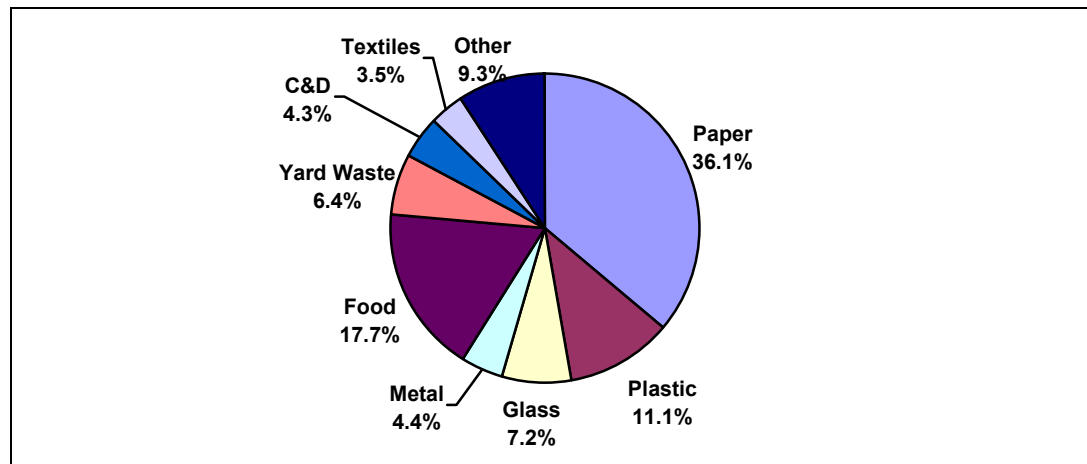
³ Note that the study attempted to characterize only the waste being disposed in the County's landfill. No attempt was made to include recyclables, yard waste, tires, or other wastes handled by the County but not disposed in the landfill.

Figure 1
Composition of Single-family Waste



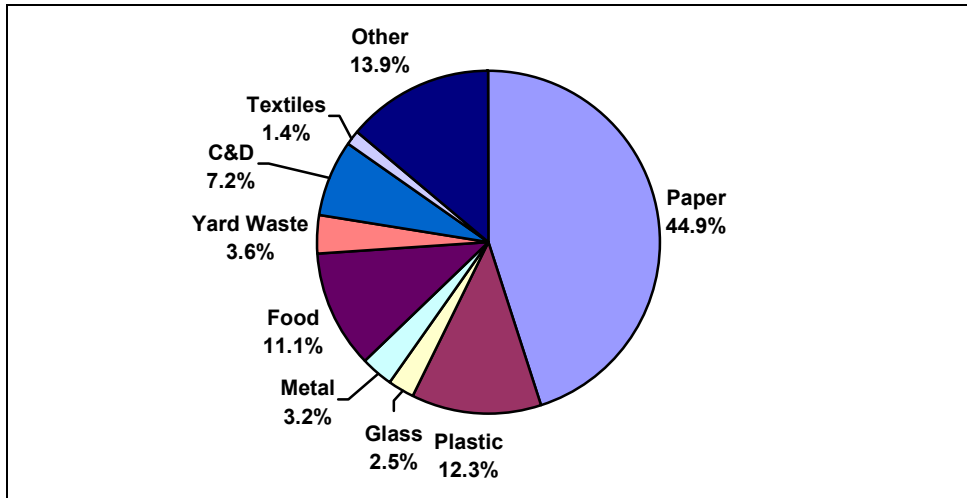
- Multi-family residential (Exhibit 2B):* Multi-family waste was quite similar to single-family waste in Okaloosa County. Multi-family waste was also high in paper (36.1%) and organics (31.0%). There were generally more Minimum Five recyclables being disposed in the multi-family stream. A breakdown of major material groups in the multi-family waste stream is shown in Figure 2.

Figure 2
Composition of Multi-family Waste



- Commercial (Exhibit 2C):* Commercial waste differed significantly from residential waste in Okaloosa County. Commercial waste contained extremely high fractions of corrugated cardboard (20.5%) and C&D debris (7.2%). As expected, variation in the commercial stream (as indicated by the width of the confidence intervals) is significantly higher compared to the residential waste stream. The breakdown of commercial waste by major material group is shown in Figure 3.

Figure 3
Composition of Commercial Waste



AGGREGATE ANNUAL RESULTS

In order to estimate the aggregate composition of the waste disposed in Okaloosa County, it is necessary to calculate a weighted average of the composition of all three generating sectors targeted in the study. Table 1 summarizes the annual tons disposed at the Okaloosa County landfill, as well as an estimate of the tons disposed by generating sector.

Table 1
Waste Disposed in Okaloosa County (1999)

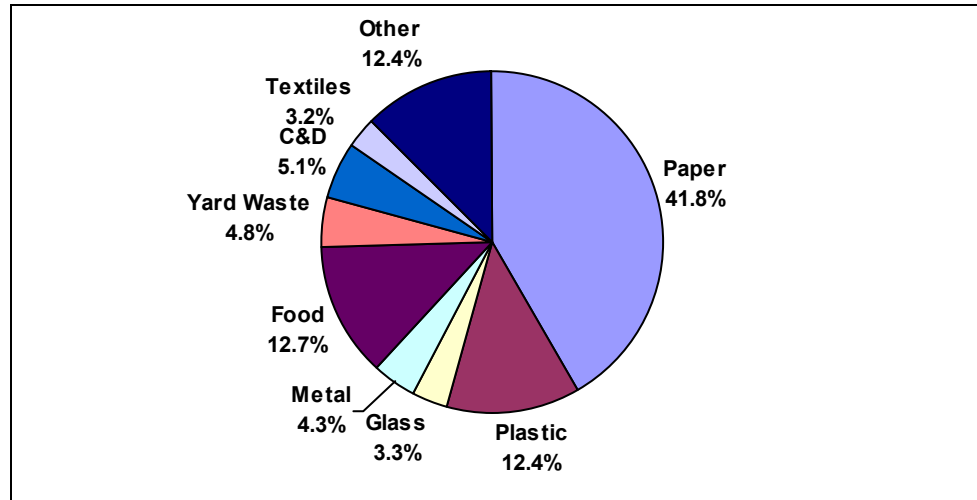
Generating Sector	Annual Tons Disposed	Percent of Total*
County-wide Aggregate	130,943	100.0%
Single-Family Waste	44,036	33.6%
Multi-family Waste	7,372	5.6%
Commercial Waste	79,535	60.7%

* Percentages disposed by generating sector represent best estimates based on available data.

Based on these data, Exhibit 3 illustrates the aggregate composition of waste disposed in Okaloosa County (combining the single-family residential, multi-family residential, and commercial waste sectors). Exhibit 3 also includes standard deviations and confidence intervals for each material type.

A breakdown of major material groups in the aggregate Okaloosa County waste stream is shown in Figure 4.

Figure 4
County-wide Aggregate Waste Composition



COMPUTER MODEL INPUT

Ultimately, the data collected in Okaloosa County will be used as input into the computer model being developed as part of this Innovative Grant. An objective of the computer model is to define waste quantities in accordance with FDEP reporting requirements.

The Okaloosa County waste composition study divided the waste stream into 31 separate material types. For compatibility with FDEP's annual reporting requirements, these 31 material types will need to be mapped into the 19 material types included in FDEP documents (such as Recycling and Education Grant documentation). Table 2 summarizes how the Okaloosa County results will be mapped into the FDEP-defined material categories for purposes of computer model development.

Table 2

Mapping of Okaloosa County Sort Categories into FDEP Material Categories

Okaloosa County Material Categories	Maps into FDEP-Defined Material Category
Newspaper	Newspaper
Corrugated Cardboard	Corrugated Cardboard
Office Paper	Office Paper
Polycoated/Aseptic	Other Paper
Mixed Paper	Other Paper
Other Paper	Other Paper
#1 PET Bottles	Plastic Bottles
#2 HDPE Bottles	Plastic Bottles
#3-#7 Bottles	Plastic Bottles
Polystyrene Foam	Other Plastic
Other Rigid Plastic	Other Plastic
Film Plastic	Other Plastic
Recyclable Glass	Glass
Non-recyclable Glass	Glass
Steel/Bi-metal Cans	Steel Cans
Other Ferrous	Ferrous
Aluminum Cans	Aluminum Cans
Other Non-Ferrous	Other Nonferrous
Food Waste	Food Waste
Yard Waste	Yard Waste
Rubber	Rubber
Diapers & Sanitary Products	Miscellaneous
Wood	Miscellaneous
Other Organics	Miscellaneous
Textiles	Textiles
C&D Debris	C&D Debris
White Goods	White Goods
Tires	Tires
Hazardous	Miscellaneous
Brown Goods	Miscellaneous
Other Inorganics	Miscellaneous

Based on the material category mapping shown in the Table above, Exhibit 4 summarizes single family residential, multi-family residential, and commercial waste composition according to FDEP-defined material categories.

COUNTY-WIDE WASTE STREAM SUMMARY

The sole objective of this study was to estimate the composition of the waste being disposed in Okaloosa County. Such composition data is useful for evaluating the success of current recycling efforts, and also to help understand which materials may be candidates for future recycling or source reduction efforts.

It was beyond the scope of the study to develop a definitive recycling rate for Okaloosa County. However, the composition data obtained in the study will greatly assist the County in developing not only a County-wide recycling rate, but also in estimating defensible material-specific recycling rates. The purpose of this section is to illustrate how the results of this study can be used to determine material-specific recycling rates. Note that additional effort may be required to verify and update the data used to illustrate this exercise.

Exhibit 5 presents County-wide waste disposal, recycling, and generation by material category⁴. Waste disposal quantities are derived by applying the mean composition of each material category to the total annual disposal quantity reported by the County. Recycling quantities are those reported from FDEP-Certified Recovered Material Dealers for Charlotte County.

IMPACT OF MOISTURE CONTENT ON RECYCLING RATE

As described in the Florida Methodology, a significant portion of disposed waste is moisture. It was beyond the scope of the Okaloosa County study to determine moisture content of disposed waste categories through laboratory testing. However, prior waste composition studies performed in the State of Florida have included such testing.

Based on an assessment of existing moisture analyses performed during other Florida waste composition studies, R. W. Beck has developed average moisture content data for use in Florida. Table 3 summarizes the average estimated moisture content for each of the FDEP-defined material categories. These data will be incorporated into development of the computer model, and are presented here for use by Okaloosa County.

⁴ The data used to perform this exercise have been compiled from multiple sources across different calendar years. These results should not be construed to represent the true Charlotte County recycling rate.

Table 3

Moisture Content Analyses Comparison

Material Categories	Moisture Content
Newspaper	27.9%
Corrugated	24.1%
Office Paper	13.4%
Other Paper	26.9%
Plastic Bottles	4.6%
Other Plastic	19.2%
Glass	3.0%
Steel Cans	9.1%
Ferrous	5.4%
Aluminum Cans	12.9%
Non-ferrous	16.9%
Food Waste	59.8%
Yard Waste	50.6%
Textiles	17.2%
C&D	8.9%
White Goods	NA
Tires	NA
Miscellaneous	29.1%
Rubber	NA

By applying the moisture content factors shown in Table 3, it is possible to calculate the dry quantity of waste disposed and recycled in Okaloosa County. Exhibit 6 summarizes disposed and recycled waste, excluding moisture content, for the County, and re-calculates the County recycling rates. Note that the County’s recycling rate decreases if moisture is excluded.

CONSTRUCTION AND DEMOLITION VISUAL SAMPLES

The Okaloosa County waste sort exclusively targeted *municipal solid waste* that was *disposed* in Okaloosa County. It was beyond the scope of this study to perform in-depth analysis of other waste streams (recyclables, brush/yard waste, tires, construction & demolition, etc.).

However, selected visual surveying of construction and demolition (C&D) truckloads was performed in Okaloosa County as part of a joint effort with another project team⁵. C&D samples were visually surveyed at both the JMB of North Florida and the Point Center C&D disposal facilities located in Okaloosa County. C&D visual sampling was performed during the same week as MSW physical sorting. A total of 50 samples were targeted for C&D visual sampling.

5 Dr. Tim Townsend of the University of Florida and Dr. Debra Reinhart of the University of Central Florida are conducting an independent study to assess the generation and composition of C&D waste in Florida (C&D Project Team). In cooperation with this independent project, R. W. Beck arranged to perform visual sampling of C&D samples generated in Okaloosa County. Results of the visual sampling will be provided to the C&D Project Team for analysis.

The C&D visual survey data has been compiled and delivered under separate cover. A copy of the raw data from the C&D surveying effort is included as Appendix A.

ACKNOWLEDGEMENTS

R. W. Beck would like to thank the following individuals and organizations who assisted in providing data for developing the sampling plan, organizing and conducting the field data collection, and analyzing the results of the study.

Okaloosa County	Jim Reece, Recycling Coordinator
Incorporated Cities	Fort Walton Beach Valparaiso
Haulers	Waste Management BFI Vaden Sanitation
Facility Operators	Pointe Center JMB of North Florida Waste Management/South County Transfer Station

Exhibit 1
Okaloosa County Summary of Trucks Sampled

Summer Season (September 11-15, 2000)

Sample Number	Date	Hauler	Truck Number	Truck Type	Single Family	Multi-Family	Commercial
1	9/11/2000	Waste Management	256	RO			1
2	9/11/2000	Waste Management	363	FEL			1
3	9/11/2000	Fort Walton Beach	2284	FEL		1	
4	9/11/2000	Fort Walton Beach	2415	FEL			1
5	9/11/2000	Waste Management	865	SL	1		
6	9/11/2000	Fort Walton Beach	2284	FEL		1	
7	9/12/2000	Waste Management	256	RO			1
8	9/12/2000	Fort Walton Beach	2389	FEL			1
9	9/12/2000	Waste Management	363	FEL		1	
10	9/12/2000	Fort Walton Beach	2415	FEL			1
11	9/12/2000	Fort Walton Beach	2367	SL	1		
12	9/12/2000	Fort Walton Beach	2389	FEL		1	
13	9/12/2000	Fort Walton Beach	2370	SL	1		
14	9/12/2000	Waste Management	2799	FEL		1	
15	9/12/2000	Waste Management	217	RL	1		
16	9/12/2000	Fort Walton Beach	2388	SL	1		
17	9/13/2000	Fort Walton Beach	2415	FEL			1
18	9/13/2000	Waste Management	363	FEL			1
19	9/13/2000	Fort Walton Beach	2389	FEL			1
20	9/13/2000	Waste Management	365	FEL			1
21	9/13/2000	Waste Management	211	RL	1		
22	9/13/2000	Waste Management	217	RL	1		
23	9/13/2000	Waste Management	866	SL	1		
24	9/13/2000	Waste Management	1789	RL	1		
25	9/13/2000	Waste Management	362	FEL		1	
26	9/13/2000	Waste Management	369	FEL	1		
27	9/14/2000	Fort Walton Beach	2415	FEL		1	
28	9/14/2000	Waste Management	365	FEL			1
29	9/14/2000	Fort Walton Beach	2389	FEL			1
30	9/14/2000	Fort Walton Beach	2284	FEL		1	
31	9/14/2000	Fort Walton Beach	2415	FEL			1
32	9/14/2000	Waste Management	362	FEL			1
33	9/14/2000	Waste Management	799	FEL		1	
34	9/14/2000	Waste Management	363	FEL		1	
35	9/14/2000	Waste Management	257	FEL			1
36	9/14/2000	Vaden	111	RL	1		
37	9/14/2000	Valparaiso		RL	1		
Totals					12	10	15

Exhibit 1
Okaloosa County Summary of Trucks Sampled

Winter Season (March 5-9, 2001)

Sample Number	Date	Hauler	Truck Number	Truck Type	Single Family	Multi-Family	Commercial
1	3/5/2001	Waste Management	363	FL			1
2	3/5/2001	City of Ft. Walton	2415	FL		1	
3	3/5/2001	Waste Management	259	FL			1
4	3/5/2001	Waste Management	361	FL		1	
5	3/5/2001	Waste Management	865	SL	1		
6	3/5/2001	Waste Management	405	RL	1		
7	3/5/2001	City of Ft. Walton	2367	SL	1		
8	3/5/2001	Waste Management	363	FL			1
9	3/5/2001	Waste Management	1058	SL	1		
10	3/5/2001	Waste Management	211	RL	1		
11	3/5/2001	Waste Management	212	RL	1		
12	3/5/2001	Waste Management	259	FL		1	
13	3/5/2001	Waste Management		RO			1
14	3/5/2001	Waste Management	799	FL		1	
15	3/5/2001	Waste Management	363	FL		1	
16	3/5/2001	BFI	693	RL	1		
17	3/6/2001	Waste Management	259	FL		1	
18	3/6/2001	City of Ft. Walton	2389	FL			1
19	3/6/2001	Waste Management	363	FL			1
20	3/6/2001	Waste Management	363	FL		1	
21	3/6/2001	Waste Management	363	FL		1	
22	3/6/2001	Waste Management	101143	SL	1		
23	3/6/2001	Waste Management	360220	RL	1		
24	3/6/2001	Waste Management	205299	FL			1
25	3/7/2001	Waste Management	363	FL		1	
26	3/7/2001	City of Ft. Walton	2357	FL			1
27	3/7/2001	Waste Management	259	FL			1
28	3/7/2001	Waste Management	789	RL	1		
29	3/7/2001	Waste Management	58	SL	1		
30	3/7/2001	Waste Management	363	FL			1
31	3/7/2001	Valparaiso	V17	SL			1
32	3/7/2001	Waste Management	362	FL		1	
33	3/8/2001	Waste Management	259	RO			1
34	3/8/2001	City of Ft. Walton	389	FL			1
35	3/8/2001	Waste Management	361	FL		1	
36	3/8/2001	City of Ft. Walton	389	FL		1	
37	3/8/2001	Waste Management	798	FL			1
38	3/8/2001	City of Ft. Walton	2388	SL	1		
39	3/8/2001	Valparaiso	V19	SL	1		
40	3/8/2001	Vaden	6	RL	1		
41	3/9/2001	Waste Management	256	RO			1
42	3/9/2001	Waste Management	363	FL			1
Totals					14	12	16

Exhibit 1
Okaloosa County Summary of Trucks Sampled

	Single Family	Multi-Family	Commercial
Total Samples = 79	26	22	31

**Exhibit 2A
Okaloosa County Single-family Results**

	Material Categories	Annual Average	Standard Deviation	Lower Bound	Upper Bound
Paper	1 Newspaper	5.2%	2.8%	4.1%	6.3%
	2 Corrugated Cardboard	4.8%	3.6%	3.6%	6.2%
	3 Office Paper	3.1%	5.5%	1.6%	5.1%
	4 Polycoated/Aseptic	0.4%	0.5%	0.2%	0.6%
	5 Mixed Paper	16.2%	6.0%	13.8%	18.8%
	6 Other Paper	8.5%	2.9%	7.4%	9.7%
	TOTAL PAPER	38.3%	9.8%	34.4%	42.3%
Plastic	7 #1 PET Bottles	0.9%	0.4%	0.7%	1.1%
	8 #2 HDPE Bottles	0.9%	0.5%	0.6%	1.2%
	9 #3-#7 Bottles	0.2%	0.4%	0.1%	0.3%
	10 Polystyrene Foam	0.7%	0.4%	0.5%	0.8%
	11 Other Rigid Plastic	4.2%	5.0%	2.9%	5.8%
	12 Film Plastic	5.8%	1.9%	5.1%	6.6%
	TOTAL PLASTIC	12.7%	5.7%	10.7%	14.8%
Glass	13 Recyclable Glass	3.6%	2.3%	2.6%	4.7%
	14 Non-recyclable Glass	0.1%	0.2%	0.1%	0.3%
	TOTAL GLASS	3.8%	2.4%	2.8%	4.9%
Metal	15 Steel/Bi-metal Cans	2.5%	1.4%	2.0%	3.0%
	16 Other Ferrous	1.7%	2.7%	0.9%	2.7%
	17 Aluminum Cans	1.2%	0.6%	0.9%	1.5%
	18 Other Non-Ferrous	0.5%	0.8%	0.3%	0.8%
	TOTAL METAL	5.8%	2.6%	4.9%	6.8%
Organic	19 Food Waste	14.3%	5.3%	12.2%	16.6%
	20 Yard Waste	6.3%	6.5%	3.6%	9.6%
	21 Rubber	0.2%	0.2%	0.1%	0.3%
	22 Diapers & Sanitary Products	2.8%	2.6%	1.9%	3.9%
	23 Wood	2.4%	5.4%	1.0%	4.3%
	24 Other Organics	1.8%	1.9%	1.0%	2.8%
	TOTAL ORGANICS	27.7%	7.2%	24.9%	30.6%
Textiles	25 Textiles	5.6%	5.4%	3.7%	7.9%
C&D	26 C&D Debris	2.5%	3.7%	1.1%	4.4%
Wh. Goods	27 White Goods	0.0%	0.0%	0.0%	0.0%
Tires	28 Tires	0.4%	2.0%	0.1%	0.9%
Misc	29 Hazardous	0.3%	0.3%	0.1%	0.4%
	30 Brown Goods	1.5%	3.1%	0.7%	2.6%
	31 Other Inorganics	1.5%	2.1%	0.7%	2.5%
	TOTAL MISCELLANEOUS	3.2%	3.9%	2.0%	4.8%
TOTAL		100.0%	0.0%	100.0%	100.0%

Exhibit 2B
Okaloosa County Multi-family Results

	Material Categories	Annual Average	Standard Deviation	Lower Bound	Upper Bound
Paper	1 Newspaper	5.8%	5.2%	3.8%	8.2%
	2 Corrugated Cardboard	7.8%	7.5%	5.0%	11.2%
	3 Office Paper	2.1%	5.6%	0.8%	3.9%
	4 Polycoated/Aseptic	0.3%	0.3%	0.2%	0.4%
	5 Mixed Paper	11.6%	5.7%	9.1%	14.4%
	6 Other Paper	8.4%	4.3%	6.6%	10.3%
	TOTAL PAPER	36.1%	9.9%	31.7%	40.5%
Plastic	7 #1 PET Bottles	1.0%	0.5%	0.8%	1.3%
	8 #2 HDPE Bottles	2.1%	4.9%	1.0%	3.5%
	9 #3-#7 Bottles	0.1%	0.2%	0.0%	0.2%
	10 Polystyrene Foam	0.7%	0.4%	0.6%	0.9%
	11 Other Rigid Plastic	2.5%	1.1%	2.1%	3.1%
	12 Film Plastic	4.6%	1.7%	3.9%	5.4%
	TOTAL PLASTIC	11.1%	5.4%	9.1%	13.3%
Glass	13 Recyclable Glass	6.8%	4.4%	4.8%	9.0%
	14 Non-recyclable Glass	0.5%	0.7%	0.2%	0.9%
	TOTAL GLASS	7.2%	4.4%	5.3%	9.4%
Metal	15 Steel/Bi-metal Cans	1.4%	0.8%	1.0%	1.8%
	16 Other Ferrous	1.4%	1.5%	0.8%	2.2%
	17 Aluminum Cans	1.1%	0.6%	0.8%	1.4%
	18 Other Non-Ferrous	0.5%	0.6%	0.3%	0.8%
	TOTAL METAL	4.4%	1.7%	3.7%	5.2%
Organic	19 Food Waste	17.7%	8.2%	14.4%	21.3%
	20 Yard Waste	6.4%	9.4%	2.8%	11.4%
	21 Rubber	0.5%	1.0%	0.2%	0.8%
	22 Diapers & Sanitary Products	3.3%	3.2%	2.0%	4.8%
	23 Wood	1.9%	3.2%	0.8%	3.6%
	24 Other Organics	1.2%	2.2%	0.5%	2.1%
	TOTAL ORGANICS	31.0%	9.7%	26.9%	35.3%
Textiles	25 Textiles	3.5%	3.7%	2.0%	5.3%
C&D	26 C&D Debris	4.3%	8.1%	1.7%	8.0%
Wh. Goods	27 White Goods	0.0%	0.0%	0.0%	0.0%
Tires	28 Tires	0.1%	0.4%	0.0%	0.2%
Misc	29 Hazardous	0.3%	0.5%	0.1%	0.6%
	30 Brown Goods	0.8%	1.6%	0.3%	1.6%
	31 Other Inorganics	1.2%	2.8%	0.4%	2.3%
	TOTAL MISCELLANEOUS	2.3%	2.9%	1.2%	3.7%
TOTAL		100.0%			

**Exhibit 2C
Okaloosa County Commercial Results**

	Material Categories	Annual Average	Standard Deviation	Lower Bound	Upper Bound
Paper	1 Newspaper	2.8%	4.2%	1.6%	4.3%
	2 Corrugated Cardboard	20.5%	16.4%	14.7%	26.9%
	3 Office Paper	4.4%	8.8%	2.3%	7.1%
	4 Polycoated/Aseptic	1.0%	2.1%	0.5%	1.8%
	5 Mixed Paper	9.8%	7.2%	7.4%	12.5%
	6 Other Paper	6.5%	5.0%	4.8%	8.4%
	TOTAL PAPER	44.9%	20.7%	36.8%	53.2%
Plastic	7 #1 PET Bottles	0.9%	1.1%	0.6%	1.3%
	8 #2 HDPE Bottles	0.5%	0.7%	0.3%	0.7%
	9 #3-#7 Bottles	0.1%	0.2%	0.0%	0.2%
	10 Polystyrene Foam	0.8%	0.9%	0.5%	1.2%
	11 Other Rigid Plastic	4.9%	7.8%	2.9%	7.4%
	12 Film Plastic	5.1%	2.6%	4.1%	6.1%
	TOTAL PLASTIC	12.3%	8.4%	9.5%	15.3%
Glass	13 Recyclable Glass	2.3%	2.9%	1.3%	3.5%
	14 Non-recyclable Glass	0.2%	0.6%	0.1%	0.4%
	TOTAL GLASS	2.5%	3.1%	1.5%	3.8%
Metal	15 Steel/Bi-metal Cans	0.7%	0.7%	0.5%	1.0%
	16 Other Ferrous	1.6%	3.4%	0.7%	2.7%
	17 Aluminum Cans	0.8%	1.4%	0.4%	1.1%
	18 Other Non-Ferrous	0.1%	0.2%	0.1%	0.2%
	TOTAL NON-FERROUS	3.2%	3.6%	2.1%	4.4%
Organic	19 Food Waste	11.1%	11.6%	7.1%	15.8%
	20 Yard Waste	3.6%	6.9%	1.6%	6.3%
	21 Rubber	0.7%	1.8%	0.3%	1.2%
	22 Diapers & Sanitary Products	1.8%	2.9%	0.9%	2.9%
	23 Wood	6.8%	11.7%	3.4%	11.3%
	24 Other Organics	0.6%	1.4%	0.3%	1.2%
	TOTAL ORGANICS	24.6%	15.6%	18.7%	31.0%
Textiles	25 Textiles	1.4%	2.6%	0.7%	2.2%
C&D	26 C&D Debris	7.2%	15.1%	2.9%	13.1%
Wh. Goods	27 White Goods	0.0%	0.0%	0.0%	0.0%
Tires	28 Tires	0.3%	1.6%	0.1%	0.6%
Misc	29 Hazardous	0.3%	1.1%	0.1%	0.7%
	30 Brown Goods	1.8%	6.5%	0.6%	3.4%
	31 Other Inorganics	1.6%	4.7%	0.6%	3.1%
	TOTAL MISCELLANEOUS	3.7%	7.8%	1.7%	6.3%
TOTAL		100.0%			

Exhibit 3
Okaloosa County Aggregate Waste Stream Composition

	Material Categories	Average	Standard Deviation	Lower Bound	Upper Bound
Paper	1 Newspaper	3.8%	4.4%	2.9%	4.8%
	2 Corrugated Cardboard	14.5%	16.1%	11.1%	18.3%
	3 Office Paper	3.8%	9.1%	2.5%	5.6%
	4 Polycoated/Aseptic	0.8%	2.1%	0.4%	1.2%
	5 Mixed Paper	12.0%	7.8%	10.4%	13.9%
	6 Other Paper	7.3%	5.1%	6.2%	8.5%
	TOTAL PAPER	42.2%	20.9%	37.2%	47.3%
Plastic	7 #1 PET Bottles	0.9%	1.1%	0.7%	1.1%
	8 #2 HDPE Bottles	0.7%	0.9%	0.6%	0.9%
	9 #3-#7 Bottles	0.1%	0.3%	0.1%	0.2%
	10 Polystyrene Foam	0.8%	0.9%	0.6%	1.0%
	11 Other Rigid Plastic	4.5%	8.1%	3.3%	6.1%
	12 Film Plastic	5.3%	2.7%	4.7%	6.0%
	TOTAL PLASTIC	12.3%	8.8%	10.6%	14.3%
Glass	13 Recyclable Glass	3.0%	3.2%	2.3%	3.8%
	14 Non-recyclable Glass	0.2%	0.6%	0.1%	0.3%
	TOTAL GLASS	3.2%	3.3%	2.5%	4.1%
Metal	15 Steel/Bi-metal Cans	1.3%	1.1%	1.1%	1.6%
	16 Other Ferrous	1.6%	3.7%	1.0%	2.4%
	17 Aluminum Cans	0.9%	1.4%	0.7%	1.2%
	18 Other Non-Ferrous	0.3%	0.5%	0.2%	0.4%
	TOTAL METAL	4.1%	3.8%	3.4%	4.9%
Organic	19 Food Waste	12.5%	11.7%	10.1%	15.4%
	20 Yard Waste	4.7%	7.8%	3.2%	6.6%
	21 Rubber	0.5%	1.8%	0.3%	0.8%
	22 Diapers & Sanitary Products	2.2%	3.2%	1.6%	3.0%
	23 Wood	5.0%	11.8%	3.0%	7.8%
	24 Other Organics	1.1%	1.8%	0.7%	1.5%
	TOTAL ORGANICS	26.0%	15.7%	22.4%	29.9%
Textiles	25 Textiles	2.9%	4.1%	2.2%	3.8%
C&D	26 C&D Debris	5.5%	14.9%	2.9%	9.0%
Wh. Goods	27 White Goods	0.0%	0.0%	0.0%	0.0%
Tires	28 Tires	0.3%	1.9%	0.2%	0.6%
Misc	29 Hazardous	0.3%	1.1%	0.2%	0.5%
	30 Brown Goods	1.6%	6.6%	0.9%	2.7%
	31 Other Inorganics	1.5%	4.8%	0.9%	2.5%
	TOTAL MISCELLANEOUS	3.4%	7.9%	2.2%	5.1%
TOTAL		100.0%			

Exhibit 4

DEP-Defined Material Category Composition Summary

	DEP-defined	Single-Family			Multi-Family			Commercial			County-wide Aggregate		
	Material Categories	Average	Lower	Upper	Average	Lower	Upper	Average	Lower	Upper	Average	Lower	Upper
1	Newspaper	5.2%	4.1%	6.3%	5.8%	3.8%	8.2%	2.8%	1.6%	4.3%	3.8%	2.9%	4.8%
2	Corrugated	4.8%	3.6%	6.2%	7.8%	5.0%	11.2%	20.5%	14.7%	26.9%	14.5%	11.1%	18.3%
3	Office Paper	3.1%	1.6%	5.1%	2.1%	0.8%	3.9%	4.4%	2.3%	7.1%	3.8%	2.5%	5.6%
4	Other Paper	25.2%	22.5%	27.9%	20.3%	17.4%	23.3%	17.3%	13.5%	21.4%	20.1%	53.8%	69.7%
5	Plastic Bottles	2.0%	1.7%	2.3%	3.2%	2.0%	4.8%	1.5%	1.0%	2.0%	1.7%	1.2%	2.1%
6	Other Plastic	10.7%	8.8%	12.8%	7.9%	6.9%	8.9%	10.8%	8.1%	13.8%	10.6%	18.5%	26.4%
7	Glass	3.8%	2.8%	4.9%	7.2%	5.3%	9.4%	2.5%	1.5%	3.8%	3.2%	2.6%	4.4%
8	Steel Cans	2.5%	2.0%	3.0%	1.4%	1.0%	1.8%	0.7%	0.5%	1.0%	1.3%	1.0%	2.4%
9	Ferrous	1.7%	0.9%	2.7%	1.4%	0.8%	2.2%	1.6%	0.7%	2.7%	1.6%	0.7%	1.2%
10	Aluminum Cans	1.2%	0.9%	1.5%	1.1%	0.8%	1.4%	0.8%	0.4%	1.1%	0.9%	0.2%	0.4%
11	Non-ferrous	0.5%	0.3%	0.8%	0.5%	0.3%	0.8%	0.1%	0.1%	0.2%	0.3%	3.4%	4.9%
12	Food Waste	14.3%	12.2%	16.6%	17.7%	14.4%	21.3%	11.1%	7.1%	15.8%	12.5%	3.2%	6.6%
13	Yard Waste	6.3%	3.6%	9.6%	6.4%	2.8%	11.4%	3.6%	1.6%	6.3%	4.7%	0.3%	0.8%
14	Textiles	5.6%	3.7%	7.9%	3.5%	2.0%	5.3%	1.4%	0.7%	2.2%	2.9%	2.9%	9.0%
15	C&D Debris	2.5%	1.1%	4.4%	4.3%	1.7%	8.0%	7.2%	2.9%	13.1%	5.5%	0.0%	0.0%
16	White Goods	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.6%
17	Tires	0.4%	0.1%	0.9%	0.1%	0.0%	0.2%	0.3%	0.1%	0.6%	0.3%	0.2%	0.5%
18	Miscellaneous	10.2%	7.7%	12.9%	8.7%	6.5%	11.3%	12.9%	7.9%	19.0%	11.8%	30.0%	49.5%
19	Rubber	0.2%	0.1%	0.3%	0.5%	0.2%	0.8%	0.7%	0.3%	1.2%	0.5%	1.6%	3.0%
	Total	100.0%			100.0%			100.0%			100.0%		

Exhibit 5
Okaloosa County Waste Disposal and Recycling Summary

Categories	Aggregate Composition at County LF (Mean) A	Tons Disposed at County LF [3] (Mean) B A x total	Tons Disposed Elsewhere C	Tons Recycled [1] (1999 data) D	Total Generation		Recycling Rate G D / E
					(tons) E B + C +D	(%) F	
Minimum 5 Materials							
Newspaper	3.8%	4,915		3,033	7,948	3.6%	38.2%
Glass	3.2%	4,185		1,091	5,276	2.4%	20.7%
Aluminum Cans	0.9%	1,195		297	1,492	0.7%	19.9%
Plastic Bottles	1.7%	2,272		377	2,649	1.2%	14.2%
Steel Cans	1.3%	1,753		123	1,876	0.9%	6.6%
Special Waste Materials							
C&D Debris	5.5%	7,137	46172	12	53,321	24.2%	0.0%
Yard Waste	4.7%	6,099		23,290	29,389	13.4%	79.2%
White Goods	0.0%	0		0	0	0.0%	0.0%
Tires	0.3%	410		0	410	0.2%	0.0%
Other Waste Materials							
Other Plastic	10.6%	13,890		0	13,890	6.3%	0.0%
Ferrous	1.6%	2,089		4,131	6,220	2.8%	66.4%
Non-ferrous	0.3%	374		478	852	0.4%	56.1%
Corrugated	14.5%	18,995		8,166	27,161	12.4%	30.1%
Office Paper	3.8%	5,038		525	5,563	2.5%	9.4%
Other Paper	20.1%	26,320		464	26,784	12.2%	1.7%
Food Waste	12.5%	16,412		0	16,412	7.5%	0.0%
Textiles	2.9%	3,821		500	4,321	2.0%	11.6%
Miscellaneous	11.8%	15,401		311	15,712	7.1%	2.0%
Rubber	0.5%	636		0	636	0.3%	0.0%
Totals	100.0%	130,943	46,172	42,798	219,913	100.0%	19.5%

[1] As reported in Okaloosa County's 1999 Recycling and Education Grant.

[2] Quantities from Okaloosa County reported to be disposed by Waste Recyclers of North America-Crestview, Lingenfelter Construction & Demolition Facility, Point Center, and Eglin AFB Florida.

[3] Derived from Okaloosa County 1999 R&E Grant

Exhibit 6
Net Impact of Moisture Analysis

Categories	Percent Moisture [1]	Tons Disposed (Mean)	Net Tons Disposed	Tons Recycled (Mean)	Net Tons Recycled [2]	Net Generation (tons)	Moisture-Adjusted Recycling Rate
Minimum 5 Materials							
Newspaper	27.9%	4,915	3,546	3,033	2,188	5,735	38.2%
Glass	3.0%	4,185	4,058	1,091	1,058	5,116	20.7%
Aluminum Cans	12.9%	1,195	1,040	297	259	1,299	19.9%
Plastic Bottles	4.6%	2,272	2,168	377	360	2,528	14.2%
Steel Cans	9.1%	1,753	1,594	123	112	1,706	6.6%
Special Waste Materials							
C&D Debris	8.9%	53,309	48,564	12	11	48,575	0.0%
Yard Waste	50.6%	6,099	3,013	23,290	11,505	14,518	79.2%
White Goods	NA	0	0	0	0	0	0.0%
Tires	NA	410	410	0	0	410	0.0%
Other Waste Materials							
Other Plastic	19.2%	13,890	11,223	0	0	11,223	0.0%
Ferrous	5.4%	2,089	1,976	4,131	3,908	5,884	66.4%
Non-ferrous	16.9%	374	311	478	397	708	56.1%
Corrugated	24.1%	18,995	14,427	8,166	6,202	20,629	30.1%
Office Paper	13.4%	5,038	4,363	525	455	4,818	9.4%
Other Paper	26.9%	26,320	19,229	464	339	19,568	1.7%
Food Waste	59.8%	16,412	6,606	0	0	6,606	0.0%
Textiles	17.2%	3,821	3,164	500	414	3,578	11.6%
Miscellaneous	29.1%	15,401	10,920	311	221	11,140	2.0%
Rubber	NA	636	636	0	0	636	0.0%
Totals		177,115	137,249	42,798	27,428	164,677	16.7%

[1] As documented in Technical Memorandum dated April 23, 2001.

[2] No analysis has been performed to determine the moisture content of recycled materials.

The same moisture content was used to net out moisture for both disposed material and recycled material. The actual moisture content for recycled material may be different than that used to net out moisture from recycled material.

**FINAL REPORT
COMPOSITION OF MUNICIPAL SOLID WASTE
DISPOSED IN OKALOOSA COUNTY, FLORIDA**

APPENDIX A

MEMORANDUM



To: Dr. Tim Townsend, University of Florida

cc: Jim Reece, Okaloosa County, w/ enclosure
Mike Whitfield, JMB of North Florida, w/ enclosure
Rhett Enzor, Point Center, w/ enclosure
Barb Kula, Charlotte County, w/ enclosure
Chuck McLendon, R. W. Beck, w/o enclosure

From: John Culbertson

Subject: **Okaloosa County C&D Composition Data**

Date: May 2, 2001

R. W. Beck recently completed field data collection for a two-season municipal solid waste (MSW) composition study in Okaloosa County that is being performed as part of an Innovative Recycling Grant awarded by the Florida Department of Environmental Protection (FDEP). As you know, while conducting the MSW field study, we arranged to visually survey truckloads of construction and demolition debris (C&D) generated in Okaloosa County. C&D visual surveying was ultimately performed at two C&D disposal facilities: JMB and Point Center.

The purpose of this memorandum is to transmit the raw data collected during R. W. Beck's visual sampling of incoming C&D truckloads at the Okaloosa County C&D transfer and disposal facilities (from March 5 through March 9). These data were collected in accordance with the visual sampling protocol provided by your project team in January 2001. This protocol included:

- Interview of the driver to ascertain the origin of each truckload;
- Measurement of the volume of the incoming truckload and tipped pile of C&D;
- Visual assessment of the percentage (by volume) of various material types contained in the load; and
- Photographing the load from two angles.

Note that R. W. Beck has made no attempt to analyze the resulting data. As intended at the outset of our project, our hope is that these data will assist your project team in its ongoing evaluation of C&D waste generation and composition in Florida.

Attached you will find the following summary exhibits detailing the data collected in Okaloosa County:

- Exhibit 1- Summary of Trucks Sampled;
- Exhibit 2- Residential Construction Raw Data;
- Exhibit 3- Non-Residential Construction Raw Data;
- Exhibit 4- Residential Renovation Raw Data;
- Exhibit 5- Non-Residential Renovation Raw Data;
- Exhibit 6- Non-Residential Demolition Raw Data;

MEMORANDUM to: Dr. Tim Townsend, University of Florida

May 2, 2001

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- Exhibit 7- Residential Other¹ Raw Data; and
- Exhibit 8- Non-Residential Other Raw Data.

Note that no Residential Demolition samples were delivered to either.

These exhibits are contained in a Microsoft Excel spreadsheet on the enclosed CD. The CD also includes photographs of all samples (in jpeg format).

Please contact me at (407) 648-3563 if you have any questions or desire additional details regarding the sampling protocol or tabulation of raw data. Thank you for your attention.

¹ "Other" refers to incoming truckloads that were not generated by construction, demolition, or renovation activities.

Exhibit 1
Summary of Trucks Sampled

Sample Number	Date	Hauler	Volume of Truck (yd ³)	Pile Dimensions [1]			Construction		Renovation		Demolition		Other	
				Length	Width	Height	Res	Non-Res	Res	Non-Res	Res	Non-Res	Res	Non-Res
1	3/6/2001	Wili Truck Liso	5					1						
2	3/6/2001	Self	4						1					
3	3/6/2001	BFI	25	9'6"	36'8"	4'				1				
4	3/6/2001	City of Fort Walton	18	12'6"	7'9"	5'						1		
5	3/6/2001	City of Fort Walton	18	10'9"	8'3"	5'				1				
6	3/6/2001	City of Fort Walton	12	7'	7'6"	4'9"				1				
7	3/6/2001	City of Fort Walton	10	9'6"	12'	4'						1		
8	3/6/2001	Self	3	7'6"	7'	2'6"				1				
9	3/6/2001	N/A	20	7'6"	21'	4'6"	1							
10	3/6/2001	City of Fort Walton	10	12'6"	10'	4'6"						1		
11	3/6/2001	Self	1.5								1			
12	3/6/2001	Waste Management	30	45'6"	10'6"	4'		1						
13	3/6/2001	N/A	20	36'	7'9"	4'6"				1				
14	3/6/2001	N/A	20	24'6"	8'	3'				1				
15	3/6/2001	BFI	30							1				
16	3/8/2001	Waste Management	30	26'6"	8'6"	4'6"	1							
18	3/8/2001	Self	10							1				
19	3/8/2001	Sun Belt Environmental	30	27'	9'6"	5'		1						
20	3/8/2001	Sears Dealer	25	30'	21'6"	4'								1
21	3/8/2001	Powell Disposal	20	36'6"	8'6"	5'6"				1				
22	3/8/2001	Waste Management	20	8'6"	27'6"	4'6"	1							
23	3/8/2001	BFI	30	28'	8'6"	5'6"	1							
24	3/8/2001	Arrow Disposal	20	27'6"	8'	3'6"				1				
25	3/8/2001	Waste Management	30	24'3"	8'	6'				1				
26	3/8/2001	Self	8							1				
27	3/8/2001	Arrow Disposal	15	10'	18'9"	3'					1			
28	3/8/2001	Arrow Disposal	20	25'3"	8'6"	4'		1						
29	3/8/2001	Okaaloosa County Solvers	4	6'	8'	3'								1

Exhibit 1
Summary of Trucks Sampled

Sample Number	Date	Hauler	Volume of Truck (yd ³)	Pile Dimensions [1]			Construction		Renovation		Demolition		Other	
				Length	Width	Height	Res	Non-Res	Res	Non-Res	Res	Non-Res	Res	Non-Res
30	3/8/2001	Self	2.5						1					
32	3/8/2001	Okaloosa Roofing	8	15'3"	7'6"	3'			1					
33	3/8/2001	Tom Thumb	2	13'6"	4'9"	3'				1				
34	3/8/2001	Powell Disposal	30	4'7"	8'9"	6'				1				
35	3/8/2001	C&D Moving	20											1
36	3/8/2001	Superior	25	36'	9'	4'6"			1					
37	3/8/2001	Self	2	6'	4'3"	1'			1					
38	3/8/2001	Arrow Disposal	20	8'	25'9"	4'		1						
39	3/8/2001	Powell Disposal	30	27'6"	8'9"	5'			1					
40	3/8/2001	Arrow Disposal	20	25'	8'6"	4'				1				
41	3/8/2001	Powell Disposal	30	36'9"	12'	4'6"				1				
42	3/9/2001	Waste Management	20							1				
43	3/9/2001	Self	2										1	
44	3/9/2001	Self	2										1	
45	3/9/2001	Superior	30	25'3"	11'6"	4'								1
46	3/9/2001	B&H Contracting	8	15'6"	6'9"	3'6"						1		
47	3/9/2001	B&H Contracting	10	12'9"	12'6"	4'9"						1		
48	3/9/2001	Wentworth Homes	15	51'6"	9'	4'	1							
49	3/9/2001	Self	2	4'6"	9'9"	2'6"			1					
50	3/9/2001	Self	2						1					
51	3/9/2001	Self	2						1					
Totals							5	5	12	16	0	5	2	4

	Construction		Renovation		Demolition		Other	
	Res	Non-Res	Res	Non-Res	Res	Non-Res	Res	Non-Res
Total Samples = 49	5	5	12	16	0	5	2	4

[1] Some piles were scattered or tipped atop other material. Dimensions for these piles would not meaningfully reflect the size of the pile and therefore are not shown.

Exhibit 2

Residential Construction Raw Data

	Sample Number	9	16	22	23	48	Average	Std. Dev.
	Material Categories	%	%	%	%	%	%	%
	1 Wood	25.0%	45.0%	60.0%	48.0%	36.0%	42.8%	13.1%
	2 Concrete	0.0%	0.0%	1.0%	0.0%	5.0%	1.2%	2.2%
	3 Drywall	20.0%	10.0%	20.0%	40.0%	40.0%	26.0%	13.4%
	4 Dirt/soil	0.0%	0.0%	1.0%	0.0%	5.0%	1.2%	2.2%
	5 Metal	3.0%	5.0%	0.0%	2.0%	5.0%	3.0%	2.1%
	6 Land Clearing Debris	0.0%	20.0%	3.0%	0.0%	0.0%	4.6%	8.7%
	7 Cardboard	20.0%	0.0%	10.0%	2.0%	2.0%	6.8%	8.3%
	8 Roofing Materials	0.0%	0.0%	3.0%	2.0%	0.0%	1.0%	1.4%
	9 Plastic	2.0%	5.0%	1.0%	2.0%	1.0%	2.2%	1.6%
	10 MSW	10.0%	8.0%	1.0%	0.5%	1.0%	4.1%	4.5%
	11 Misc.	10.0%	2.0%	0.0%	0.5%	0.0%	2.5%	4.3%
	12 Carpet	0.0%	5.0%	0.0%	0.0%	0.0%	1.0%	2.2%
	13 Tile	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	14 Other	10.0%	0.0%	0.0%	3.0%	5.0%	3.6%	4.2%
TOTAL		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

Exhibit 3

Non-Residential Construction Raw Data

	Sample Number	1	12	19	28	38	Average	Std. Dev.
	Material Categories	%	%	%	%	%	%	%
	1 Wood	5.0%	30.0%	15.0%	25.0%	25.0%	20.0%	10.0%
	2 Concrete	15.0%	8.0%	10.0%	0.0%	0.0%	6.6%	6.5%
	3 Drywall	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	4 Dirt/soil	10.0%	5.0%	20.0%	0.0%	5.0%	8.0%	7.6%
	5 Metal	15.0%	5.0%	2.0%	5.0%	25.0%	10.4%	9.5%
	6 Land Clearing Debris	50.0%	45.0%	0.0%	65.0%	0.0%	32.0%	30.1%
	7 Cardboard	0.0%	0.0%	40.0%	0.0%	15.0%	11.0%	17.5%
	8 Roofing Materials	3.0%	0.0%	0.0%	0.0%	0.0%	0.6%	1.3%
	9 Plastic	2.0%	1.0%	10.0%	3.0%	15.0%	6.2%	6.1%
	10 MSW	0.0%	1.0%	3.0%	1.0%	15.0%	4.0%	6.2%
	11 Misc.	0.0%	0.0%	0.0%	1.0%	0.0%	0.2%	0.4%
	12 Carpet	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	13 Tile	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	14 Other	0.0%	5.0%	0.0%	0.0%	0.0%	1.0%	2.2%
TOTAL		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

Exhibit 4
Residential Renovation Raw Data

	Sample Number	2	8	18	26	30	32	36	37	39
	Material Categories	%	%	%	%	%	%	%	%	%
	1 Wood	0.0%	10.0%	25.0%	35.0%	22.0%	2.0%	32.0%	0.0%	10.0%
	2 Concrete	0.0%	0.0%	0.0%	5.0%	0.0%	0.0%	0.0%	0.0%	2.0%
	3 Drywall	0.0%	25.0%	70.0%	0.0%	0.0%	0.0%	35.0%	0.0%	0.0%
	4 Dirt/soil	40.0%	5.0%	0.0%	10.0%	0.0%	0.0%	0.0%	0.0%	10.0%
	5 Metal	0.0%	10.0%	5.0%	25.0%	3.0%	0.0%	5.0%	0.0%	3.0%
	6 Land Clearing Debris	60.0%	0.0%	0.0%	20.0%	0.0%	0.0%	0.0%	100.0%	75.0%
	7 Cardboard	0.0%	10.0%	0.0%	0.0%	0.0%	1.0%	0.0%	0.0%	0.0%
	8 Roofing Materials	0.0%	0.0%	0.0%	0.0%	75.0%	95.0%	0.0%	0.0%	0.0%
	9 Plastic	0.0%	15.0%	0.0%	5.0%	0.0%	1.0%	1.0%	0.0%	0.0%
	10 MSW	0.0%	20.0%	0.0%	0.0%	0.0%	1.0%	1.0%	0.0%	0.0%
	11 Misc.	0.0%	5.0%	0.0%	0.0%	0.0%	0.0%	1.0%	0.0%	0.0%
	12 Carpet	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	13 Tile	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	14 Other	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	25.0%	0.0%	0.0%
TOTAL		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Exhibit 4
Residential Renovation Raw Data

	Sample Number	49	50	51	Average	Std. Dev.
	Material Categories	%	%	%	%	%
	1 Wood	0.0%	65.0%	10.0%	17.6%	22.2%
	2 Concrete	0.0%	0.0%	0.0%	0.3%	0.7%
	3 Drywall	0.0%	0.0%	80.0%	14.4%	29.2%
	4 Dirt/soil	0.0%	0.0%	0.0%	1.3%	3.5%
	5 Metal	0.0%	2.0%	9.0%	2.8%	3.1%
	6 Land Clearing Debris	100.0%	10.0%	0.0%	35.6%	47.2%
	7 Cardboard	0.0%	3.0%	0.0%	0.5%	1.1%
	8 Roofing Materials	0.0%	0.0%	0.0%	21.3%	39.7%
	9 Plastic	0.0%	20.0%	1.0%	2.9%	6.9%
	10 MSW	0.0%	0.0%	0.0%	0.3%	0.5%
	11 Misc.	0.0%	0.0%	0.0%	0.1%	0.4%
	12 Carpet	0.0%	0.0%	0.0%	0.0%	0.0%
	13 Tile	0.0%	0.0%	0.0%	0.0%	0.0%
	14 Other	0.0%	0.0%	0.0%	3.1%	8.8%
TOTAL		100.0%	100.0%	100.0%	100.0%	

Exhibit 5

Non-Residential Renovation Raw Data

	Sample Number	3	5	6	11	13	14	15	21	24
	Material Categories	%	%	%	%	%	%	%	%	%
	1 Wood	25.0%	0.0%	0.0%	60.0%	55.0%	0.0%	2.0%	20.0%	63.0%
	2 Concrete	5.0%	0.0%	0.0%	0.0%	0.0%	95.0%	0.0%	20.0%	0.0%
	3 Drywall	0.0%	0.0%	0.0%	10.0%	0.0%	0.0%	0.0%	0.0%	5.0%
	4 Dirt/soil	0.0%	98.0%	100.0%	0.0%	0.0%	0.0%	6.0%	0.0%	0.0%
	5 Metal	20.0%	0.0%	0.0%	15.0%	5.0%	5.0%	1.0%	50.0%	18.0%
	6 Land Clearing Debris	35.0%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	7 Cardboard	5.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.0%	6.0%
	8 Roofing Materials	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.0%	0.0%	0.0%
	9 Plastic	5.0%	0.0%	0.0%	3.0%	5.0%	0.0%	1.0%	5.0%	1.0%
	10 MSW	3.0%	0.0%	0.0%	12.0%	10.0%	0.0%	0.0%	0.5%	2.0%
	11 Misc.	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	1.0%
	12 Carpet	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	13 Tile	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%
	14 Other	0.0%	0.0%	0.0%	0.0%	25.0%	0.0%	85.0%	0.0%	3.0%
TOTAL		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Exhibit 5

Non-Residential Renovation Raw Data

	Sample Number	25	27	33	34	40	41	42	Average	Std. Dev.
	Material Categories	%	%	%	%	%	%	%	%	%
	1 Wood	0.0%	30.0%	95.0%	25.0%	30.0%	50.0%	14.0%	29.3%	28.3%
	2 Concrete	0.0%	20.0%	0.0%	0.0%	0.0%	49.5%	25.0%	13.4%	25.9%
	3 Drywall	0.0%	15.0%	0.0%	26.0%	35.0%	0.0%	35.0%	7.9%	12.9%
	4 Dirt/soil	0.0%	2.0%	0.0%	0.0%	0.0%	0.0%	5.0%	13.2%	33.6%
	5 Metal	0.0%	10.0%	5.0%	10.0%	20.0%	0.0%	5.0%	10.3%	12.8%
	6 Land Clearing Debris	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	8.6%	25.9%
	7 Cardboard	0.0%	3.0%	0.0%	0.0%	0.0%	0.0%	1.0%	1.2%	2.1%
	8 Roofing Materials	0.0%	0.0%	0.0%	10.0%	0.0%	0.0%	0.0%	0.9%	2.7%
	9 Plastic	0.0%	1.5%	0.0%	2.0%	3.0%	0.0%	10.0%	2.3%	2.8%
	10 MSW	0.0%	1.0%	0.0%	1.5%	0.0%	0.5%	1.0%	2.0%	3.6%
	11 Misc.	0.0%	0.5%	0.0%	0.5%	2.0%	0.0%	1.0%	0.5%	0.7%
	12 Carpet	0.0%	15.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.9%	3.8%
	13 Tile	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.3%
	14 Other	0.0%	2.0%	0.0%	25.0%	10.0%	0.0%	3.0%	9.6%	21.8%
TOTAL		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

Exhibit 6

Non-Residential Demolition Raw Data

	Sample Number	4	7	10	46	47	Average	Std. Dev.
	Material Categories	%	%	%	%	%	%	%
	1 Wood	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	2 Concrete	0.0%	20.0%	0.0%	95.0%	95.0%	42.0%	49.1%
	3 Drywall	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	4 Dirt/soil	90.0%	65.0%	100.0%	0.0%	0.0%	51.0%	48.3%
	5 Metal	5.0%	0.0%	0.0%	5.0%	4.0%	2.8%	2.6%
	6 Land Clearing Debris	5.0%	0.0%	0.0%	0.0%	0.0%	1.0%	2.2%
	7 Cardboard	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	8 Roofing Materials	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	9 Plastic	0.0%	0.0%	0.0%	0.0%	1.0%	0.2%	0.4%
	10 MSW	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	11 Misc.	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	12 Carpet	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	13 Tile	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	14 Other	0.0%	15.0%	0.0%	0.0%	0.0%	3.0%	6.7%
TOTAL		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

Exhibit 7

Residential Other Raw Data [1]

	Sample Number	43	44	Average	Std. Dev.
	Material Categories	%	%	%	%
	1 Wood	0%	15%	7.5%	10.6%
	2 Concrete	0%	0%	0.0%	0.0%
	3 Drywall	0%	0%	0.0%	0.0%
	4 Dirt/soil	0%	0%	0.0%	0.0%
	5 Metal	18%	20%	19.0%	1.4%
	6 Land Clearing Debris	0%	0%	0.0%	0.0%
	7 Cardboard	5%	0%	2.5%	3.5%
	8 Roofing Materials	0%	0%	0.0%	0.0%
	9 Plastic	20%	5%	12.5%	10.6%
	10 MSW	40%	30%	35.0%	7.1%
	11 Misc.	2%	5%	3.5%	2.1%
	12 Carpet	0%	0%	0.0%	0.0%
	13 Tile	0%	0%	0.0%	0.0%
	14 Other	15%	25%	20.0%	7.1%
TOTAL		100%	100%	100.0%	

[1] "Other" indicates that waste was not generated from construction, demolition, or renovation activities.

Exhibit 8

Non-Residential Other Raw Data [1]

	Sample Number	20	29	35	45	Average	Std. Dev.
	Material Categories	%	%	%	%	%	%
	1 Wood	75.0%	35.0%	100.0%	15.0%	56.3%	38.4%
	2 Concrete	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	3 Drywall	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	4 Dirt/soil	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	5 Metal	0.0%	65.0%	0.0%	10.0%	18.8%	31.2%
	6 Land Clearing Debris	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	7 Cardboard	23.0%	0.0%	0.0%	5.0%	7.0%	10.9%
	8 Roofing Materials	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	9 Plastic	2.0%	0.0%	0.0%	50.0%	13.0%	24.7%
	10 MSW	0.0%	0.0%	0.0%	18.0%	4.5%	9.0%
	11 Misc.	0.0%	0.0%	0.0%	2.0%	0.5%	1.0%
	12 Carpet	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	13 Tile	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	14 Other	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
TOTAL		100.0%	100.0%	100.0%	100.0%	100.0%	

[1] "Other" indicates that waste was not generated from construction, demolition, or renovation activities.

APPENDIX E

**COMPOSITION OF MUNICIPAL SOLID WASTE
DISPOSED IN SARASOTA COUNTY**

Final Report

Composition of Municipal Solid Waste Disposed in Sarasota County, FL



Florida Department of Environmental Protection

State-wide Waste Composition Computer Model

1999-2000 Innovative Recycling Grant

June 2001

1999-2000 FLORIDA INNOVATIVE RECYCLING GRANT SARASOTA COUNTY WASTE COMPOSITION STUDY

INTRODUCTION

In early 2000, Charlotte County was awarded an Innovative Recycling Grant by the Florida Department of Environmental Protection (FDEP) for the purpose of developing a State-wide statistical model to predict the composition of municipal solid waste disposed within each of Florida's counties. As part of the model development process, the Grant provided for Charlotte County and three other partner counties (Citrus, Okaloosa, and Sarasota) to conduct county-wide waste composition studies. The results of these four studies will be used as input in the development of the computer model. A complete overview of the project can be found in Charlotte County's 1999-2000 Innovative Recycling Grant Proposal, found on the Web at <http://www.dep.state.fl.us/dwm/programs/recycling/>.

In 1996, the Florida Center for Solid and Hazardous Waste developed, and FDEP subsequently approved, a methodology for conducting waste characterization analyses in the state of Florida¹ ("Florida Methodology"). An objective of the Innovative Recycling Grant project was to perform all field studies in accordance with the Florida Methodology.

R. W. Beck, Inc., was ultimately retained by Charlotte County to perform the field data collection and subsequently develop a State-wide waste composition computer model. The remainder of this report summarizes the results of the Sarasota County waste composition study, conducted by R. W. Beck (in accordance with the Florida Methodology) over two seasons in September 2000 and March 2001.

SAMPLING SUMMARY

In accordance with the Florida Methodology, sampling and sorting was conducted over two seasons to capture representative samples from both summer (non-tourist) and winter (tourist) seasons. Field sampling and sorting targeted the following three generating sectors:

- Single-family residential waste;
- Multi-family residential waste; and
- Commercial waste (including industrial, institutional, and all other non-residential waste).

Prior to conducting the field sorts, R. W. Beck surveyed all of the haulers (both public and private) that deliver municipal solid waste (MSW) to the Sarasota County landfill. Haulers were asked to provide a list of truck numbers and truck types, and also to specify the origin(s) of waste collected on each truck. Based on these responses, as well as on annual disposal tonnages provided by Sarasota County, R. W. Beck developed a sampling plan for the two-season waste composition study.

Exhibit 1 lists the single-family residential, multi-family residential and commercial trucks from which samples were taken during both seasons of sorting at the Sarasota County landfill. Sampling highlights include:

- Sampling was conducted over two one-week periods. Summer (non-tourist) season sampling was performed from August 28-31, 2000. Winter (tourist) season was performed from March 19-23, 2001;
- A total of 80 samples were ultimately sorted, including
 - 25 single-family residential samples,

¹ "Method for Conducting Composition Study for Discarded Waste," Florida Center for Solid and Hazardous Waste Management, January 1996.

- 21 multi-family residential samples, and
- 34 commercial samples;
- The samples were divided between the summer and winter seasons, with slightly more samples (43 out of 80) taken during the winter season to reflect the higher waste disposal volumes during this season;
- Samples were targeted at 200 pounds, and were randomly selected from targeted truckloads;
- Over 16,000 pounds of waste were ultimately sorted over the two seasons; and
- Samples averaged 203 pounds by weight.

COMPOSITION SUMMARY BY WASTE STREAM

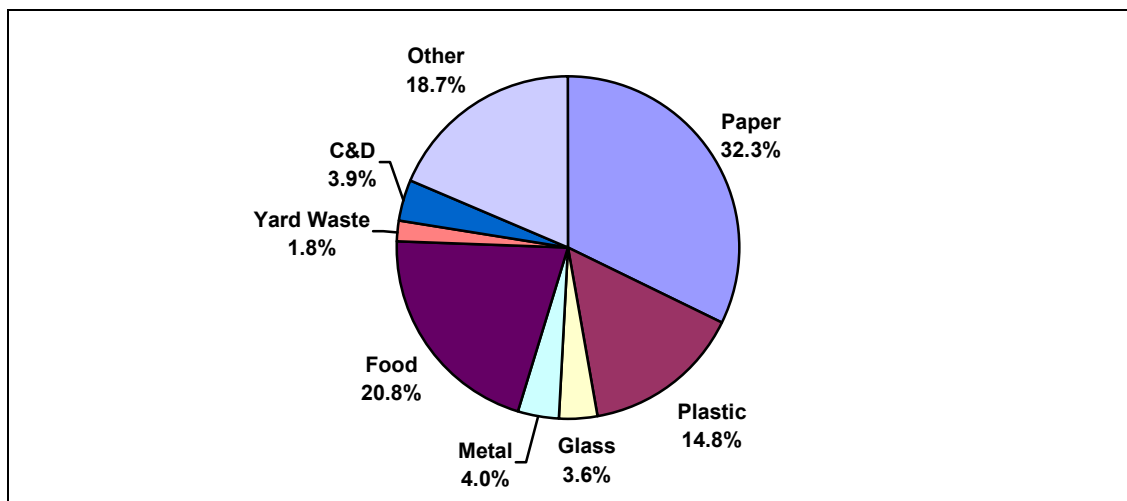
All field data collected over both seasons was entered into a specially designed spreadsheet for statistical analysis. Field data were analyzed separately for single family residential, multi-family residential, and commercial waste samples. For each generating sector, R. W. Beck calculated the mean composition, standard deviation, and upper and lower confidence intervals at a 95 percent level of confidence for each material type defined in the study.

Exhibits 2A, 2B, and 2C summarize the results of the statistical analysis for the single-family residential, multi-family residential, and commercial waste, respectively, disposed² in Sarasota County.

Sampling highlights include:

- *Single-family residential (Exhibit 2A):* Paper (32.3%) and organics (30.1%) were the two largest material groups disposed by single-family households. Food waste was the single largest material category (20.8%), followed by other paper (15.9%). A pie chart of major material groups is shown in Figure 1.

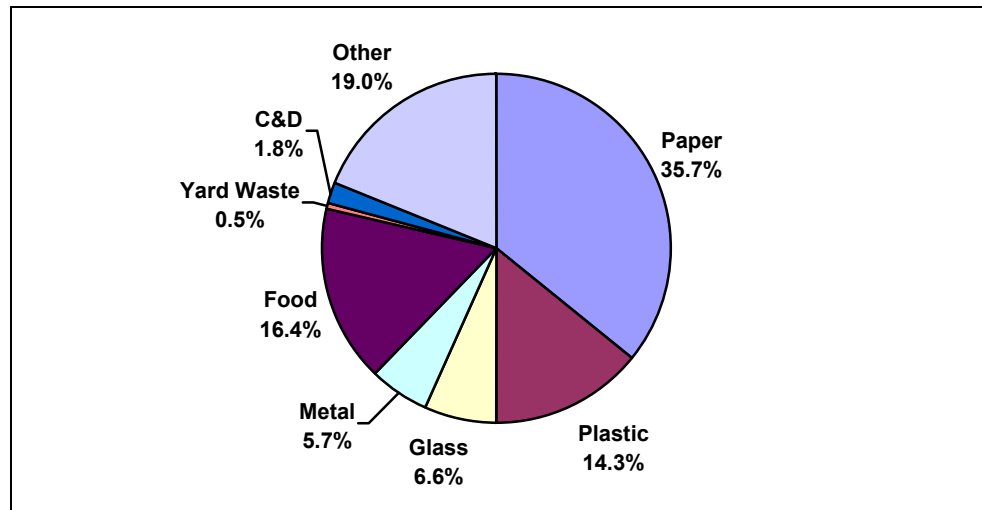
Figure 1
Composition of Single-family Waste



² Note that the study attempted to characterize only the waste being disposed in the County's landfill. No attempt was made to include recyclables, yard waste, tires, or other wastes handled by the County but not disposed in the landfill.

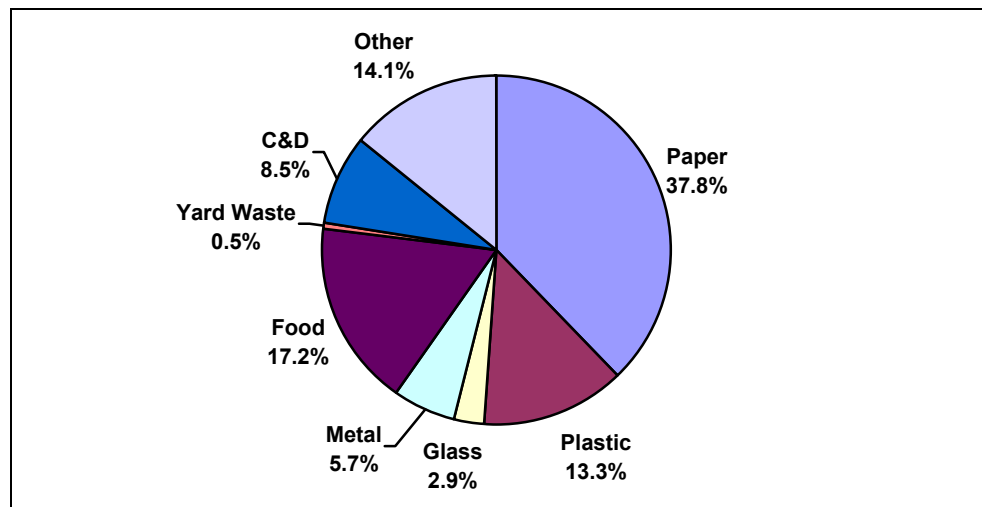
- Multi-family residential (Exhibit 2B):* Multi-family waste was quite similar to single-family waste in Sarasota County. Multi-family waste was also high in paper (35.7%) and organics (24.9%). A breakdown of major material groups in the multi-family waste stream is shown in Figure 2.

Figure 2
Composition of Multi-family Waste



- Commercial (Exhibit 2C):* Commercial waste differed somewhat from residential waste in Sarasota County. Commercial waste contained higher fractions of corrugated cardboard (8.2%) and C&D debris (8.5%). As expected, variation in the commercial stream (as indicated by the width of the confidence intervals) is significantly higher compared to the residential waste stream. The breakdown of commercial waste by major material group is shown in Figure 3.

Figure 3
Composition of Commercial Waste



AGGREGATE ANNUAL RESULTS

In order to estimate the aggregate composition of the waste disposed in Sarasota County, it is necessary to calculate a weighted average of the composition of all three generating sectors targeted in the study. Table 1 summarizes the annual tons disposed at the Sarasota County landfill, as well as an estimate of the tons disposed by generating sector. For the sake of consistency with later calculations, calendar year 1999 tonnage is shown.

Table 1
Waste Disposed in Sarasota County (CY 1999)

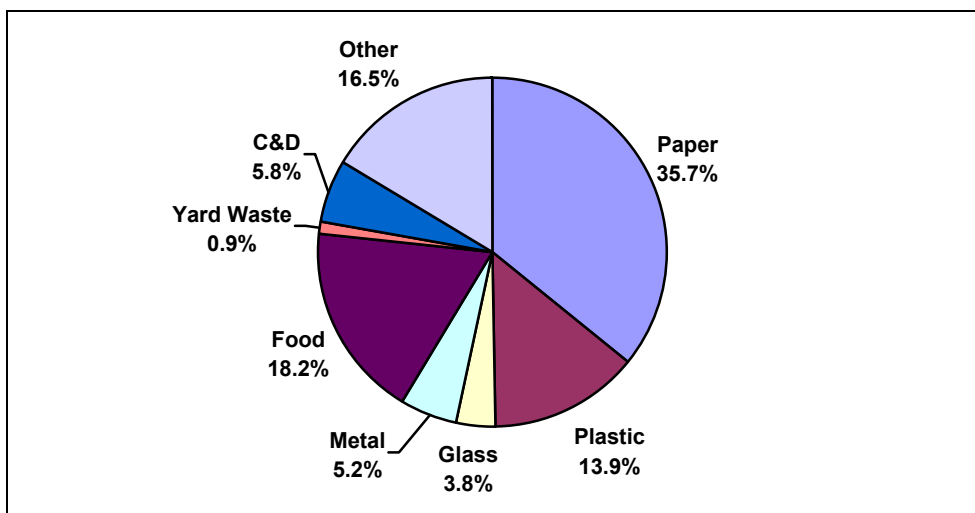
Generating Sector	Annual Tons Disposed	Percent of Total*
County-wide Aggregate	263,300	100%
Single-Family Waste	84,000	31.9%
Multi-family Waste	48,200	18.3%
Commercial Waste	131,100	49.8%

* Percentages disposed by generating sector represent best estimates based on available data.

Based on these data, Exhibit 3 illustrates the aggregate composition of waste disposed in Sarasota County (combining the single-family residential, multi-family residential, and commercial waste sectors). Exhibit 3 also includes standard deviations and confidence intervals for each material type.

A breakdown of major material groups in the aggregate Sarasota County waste stream is shown in Figure 4.

Figure 4
County-wide Aggregate Waste Composition



COMPUTER MODEL INPUT

Ultimately, the data collected in Sarasota County will be used as input into the computer model being developed as part of this Innovative Grant. An objective of the computer model is to define waste quantities in accordance with FDEP reporting requirements.

The Sarasota County waste composition study divided the waste stream into 31 separate material types. For compatibility with FDEP's annual reporting requirements, these 31 material types will need to be mapped into the 19 material types included in FDEP documents (such as Recycling and Education Grant documentation). Table 2 summarizes how the Sarasota County results will be mapped into the FDEP-defined material categories for purposes of computer model development.

Table 2

Mapping of Sarasota County Sort Categories into FDEP Material Categories

Sarasota County Material Categories	Maps into FDEP-Defined Material Category
Newspaper	Newspaper
Corrugated Cardboard	Corrugated Cardboard
Office Paper	Office Paper
Polycoated/Aseptic	Other Paper
Mixed Paper	Other Paper
Other Paper	Other Paper
#1 PET Bottles	Plastic Bottles
#2 HDPE Bottles	Plastic Bottles
#3-#7 Bottles	Plastic Bottles
Polystyrene Foam	Other Plastic
Other Rigid Plastic	Other Plastic
Film Plastic	Other Plastic
Recyclable Glass	Glass
Non-recyclable Glass	Glass
Steel/Bi-metal Cans	Steel Cans
Other Ferrous	Ferrous
Aluminum Cans	Aluminum Cans
Other Non-Ferrous	Other Nonferrous
Food Waste	Food Waste
Yard Waste	Yard Waste
Rubber	Rubber
Diapers & Sanitary Products	Miscellaneous
Wood	Miscellaneous
Other Organics	Miscellaneous
Textiles	Textiles
C&D Debris	C&D Debris
White Goods	White Goods
Tires	Tires
Hazardous	Miscellaneous
Brown Goods	Miscellaneous
Other Inorganics	Miscellaneous

Based on the material category mapping shown in the Table above, Exhibit 4 summarizes single family residential, multi-family residential, and commercial waste composition according to FDEP-defined material categories.

COUNTY-WIDE WASTE STREAM SUMMARY

The sole objective of this study was to estimate the composition of the waste being disposed in the Sarasota County landfill. Such composition data is useful for evaluating the success of

current recycling efforts, and also to help understand which materials may be candidates for future recycling or source reduction efforts.

It was beyond the scope of the study to develop a definitive recycling rate for Sarasota County. However, the composition data obtained in the study will greatly assist the County in developing not only a County-wide recycling rate, but also in estimating defensible material-specific recycling rates. The purpose of this section is to illustrate how the results of this study can be used to determine material-specific recycling rates. Note that additional effort may be required to verify and update the data used to illustrate this exercise.

Exhibit 5 presents County-wide waste disposal, recycling, and generation by material category³. Waste disposal quantities are derived by applying the mean composition of each material category to the total annual disposal quantity reported by the County. Recycling quantities are those reported from FDEP-Certified Recovered Material Dealers for Sarasota County.

IMPACT OF MOISTURE CONTENT ON RECYCLING RATE

As described in the Florida Methodology, a significant portion of disposed waste is moisture. It was beyond the scope of the Sarasota County study to determine moisture content of disposed waste categories through laboratory testing. However, prior waste composition studies performed in the State of Florida have included such testing.

Based on an assessment of existing moisture analyses performed during other Florida waste composition studies, R. W. Beck has developed average moisture content data for use in Florida. Table 3 summarizes the average estimated moisture content for each of the FDEP-defined material categories. These data will be incorporated into development of the computer model, and are presented here for use by Sarasota County.

³ The data used to perform this exercise have been compiled from multiple sources across different calendar years. These results should not be construed to represent the true Sarasota County recycling rate.

**Table 3
Moisture Content Analyses Comparison**

Material Categories	Moisture Content
Newspaper	27.9%
Corrugated	24.1%
Office Paper	13.4%
Other Paper	26.9%
Plastic Bottles	4.6%
Other Plastic	19.2%
Glass	3.0%
Steel Cans	9.1%
Ferrous	5.4%
Aluminum Cans	12.9%
Non-ferrous	16.9%
Food Waste	59.8%
Yard Waste	50.6%
Textiles	17.2%
C&D	8.9%
White Goods	NA
Tires	NA
Miscellaneous	29.1%
Rubber	NA

By applying the moisture content factors shown in Table 3, it is possible to calculate the dry quantity of waste disposed and recycled in Sarasota County. Exhibit 6 summarizes disposed and recycled waste, excluding moisture content, for the County, and re-calculates the County recycling rates. Note that adjusting for moisture content has minimal impact on the County’s recycling rate.

ANALYSIS OF HOUSEHOLD HAZARDOUS WASTE

Sarasota County has focused significant effort on managing household hazardous waste (HHW) within the County. As part of this project, R. W. Beck performed a sub-sort of HHW items to gain a better understanding of HHW disposal habits of the County’s residents. HHW containers (both empty and full) were divided into five County-defined subgroups:

- **Flammables** such as solvents, aerosol cans, varnish, etc.;
- **Corrosives** such as pool chemicals and caustics;
- **Reactives** such as chlorine and some strong fertilizers;
- **Toxics** such as insect and weed killer; and
- **Other HHW**, which included motor oil and oil filters, batteries, fluorescent bulbs, propane cylinders, and any other hazardous material not clearly defined above.

Within each subgroup, HHW containers were further evaluated to determine if they were empty (i.e., all of the HHW had been discharged from the container) or full (i.e., some HHW remained in the container). For example, a can of insect poison that had been entirely

discharged would be classified as empty. However, if the container was mostly empty, but several ounces of poison remained in the can, the container was classified as full.

Figure 5 presents the breakdown of HHW by category in the County. Note that this figure includes both empty and full containers. As shown, flammables and other HHW are far and away the two most commonly disposed HHW types.

Figure 5
Composition of HHW in Sarasota County

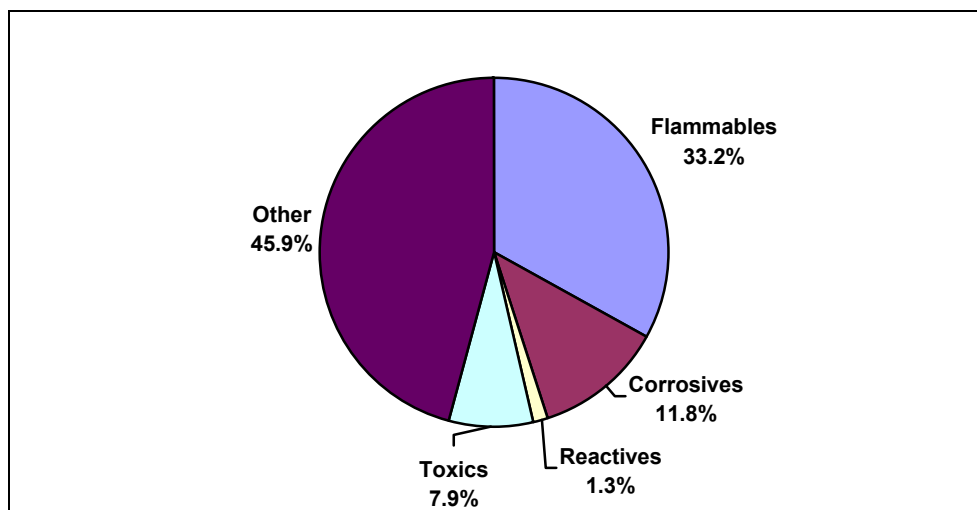
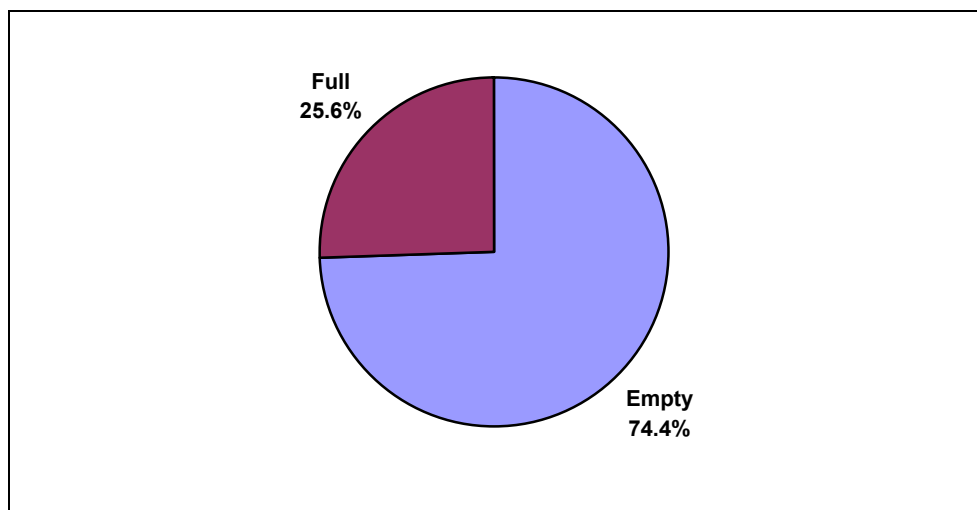


Figure 6 shows the split between empty and full containers. As shown, HHW containers are generally fully discharged prior to disposal of the container. This suggests that County public education efforts targeting HHW management are relatively successful.

Figure 6
Comparison of Empty vs Full HHW Containers



ACKNOWLEDGEMENTS

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Incorporated Cities	Sarasota North Port Venice
Haulers	Waste Management EDCO
Facility Operators	Waste Management/Sarasota County Landfill BFI/City of Sarasota Transfer Station

Exhibit 1
Sarasota County, FL
Summary of Trucks Sampled

Summer Season (August 28-31, 2000)

Sample Number	Date	Facility	Hauler	Truck Number	Truck Type	Single Family	Multi-Family	Commercial
1	8/28/2000	Landfill	Venice	459	FEL			1
2	8/28/2000	Landfill	Waste Management	437	RO			1
3	8/28/2000	Landfill	Englewood	123	RL	1		
4	8/28/2000	Landfill	Venice	464	RO			1
5	8/28/2000	Landfill	Englewood	140	RL	1		
6	8/28/2000	Landfill	Waste Management	386	RL	1		
7	8/28/2000	Landfill	Waste Management	249	FEL		1	
8	8/28/2000	Landfill	Waste Management	396	RL	1		
9	8/28/2000	Landfill	Waste Management	397	RL	1		
10	8/29/2000	Landfill	Waste Management	266	FEL			1
11	8/29/2000	Landfill	Englewood	135	FEL			1
12	8/29/2000	Landfill	Venice	465	FEL		1	
13	8/29/2000	Landfill	Venice	465	FEL		1	
14	8/29/2000	Landfill	Venice	465	FEL		1	
15	8/29/2000	Landfill	Venice	470	FEL	1		
16	8/29/2000	Landfill	Englewood	135	FEL			1
17	8/29/2000	Landfill	Waste Management	397	RL	1		
18	8/29/2000	Landfill	Waste Management	424	RO			1
19	8/29/2000	Landfill	Waste Management	466	FEL		1	
20	8/29/2000	Landfill	Waste Management	466	FEL		1	
21	8/29/2000	Landfill	Waste Management	466	FEL		1	
22	8/30/2000	Landfill	Waste Management	237	FEL			1
23	8/30/2000	Landfill	Waste Management	423	RO			1
24	8/30/2000	Landfill	Englewood	115	FEL			1
25	8/30/2000	Landfill	Waste Management	249	FEL			1
26	8/30/2000	Landfill	Waste Management	373	RL	1		
27	8/30/2000	Landfill	Waste Management	379	RL	1		
28	8/30/2000	Landfill	Waste Management	237	FEL			1
29	8/30/2000	Landfill	Englewood	91	RL	1		
30	8/30/2000	Landfill	Waste Management	264	FEL		1	
31	8/30/2000	Landfill	Waste Management	264	FEL		1	
32	8/31/2000	Landfill	Waste Management		RO			1
33	8/31/2000	Landfill	Waste Management	266	FEL			1
34	8/31/2000	Landfill	Waste Management	430	RO			1
35	8/31/2000	Landfill	Waste Management	300	RL	1		
36	8/31/2000	Landfill	Waste Management	430	RO		1	
37	8/31/2000	Landfill	Waste Management	378	RL	1		
Totals						12	10	15

Exhibit 1
Sarasota County, FL
Summary of Trucks Sampled

Winter Season (March 19-22, 2001)

Sample Number	Date		Hauler	Truck Number	Truck Type	Single Family	Multi-Family	Commercial
1	3/19/2001	BFI xfer sta	City of Sarasota	22566	FEL			1
2	3/19/2001	BFI xfer sta	City of Sarasota	23304	FEL			1
3	3/19/2001	BFI xfer sta	City of Sarasota	14908	SL		1	
4	3/19/2001	BFI xfer sta	City of Sarasota	20260	FEL			1
5	3/19/2001	BFI xfer sta	City of Sarasota	22556	SL			1
6	3/19/2001	BFI xfer sta	City of Sarasota	22506	SL	1		
7	3/19/2001	BFI xfer sta	City of Sarasota	19189	SL	1		
8	3/20/2001	BFI xfer sta	City of Sarasota	20260	FEL		1	
9	3/19/2001	BFI xfer sta	City of Sarasota	20281	FEL		1	
10	3/20/2001	BFI xfer sta	City of Sarasota	20260	FEL			1
11	3/20/2001	BFI xfer sta	City of Sarasota	22566	FEL		1	
12	3/20/2001	BFI xfer sta	City of Sarasota	20261	FEL			1
13	3/20/2001	BFI xfer sta	City of Sarasota	20271	SL			1
14	3/20/2001	BFI xfer sta	City of Sarasota	23304	FEL			1
15	3/20/2001	BFI xfer sta	City of Sarasota	20297	SL	1		
16	3/20/2001	BFI xfer sta	City of Sarasota	23302	SL	1		
17	3/20/2001	BFI xfer sta	City of Sarasota	20270	SL	1		
18	3/20/2001	BFI xfer sta	City of Sarasota	20271	SL	1		
19	3/20/2001	BFI xfer sta	City of Sarasota	20261	FEL		1	
20	3/21/2001	BFI xfer sta	City of Sarasota	459	FEL	1		
21	3/21/2001	Landfill	Waste Management	26096	FEL			1
24	3/21/2001	Landfill	Waste Management	249	FEL			1
25	3/21/2001	Landfill	Waste Management	434	Roll-off		1	
26	3/21/2001	Landfill	Waste Management	108	Grapple/RO			1
27	3/21/2001	Landfill	Venice	459	FEL			1
28	3/21/2001	Landfill	Waste Management	392	RL	1		
29	3/21/2001	Landfill	Englewood	116	Roll-off			1
30	3/21/2001	Landfill	Englewood	125	RL	1		
31	3/22/2001	Landfill	Waste Management	139	FEL			1
32	3/22/2001	Landfill	Waste Management	249	FEL			1
33	3/22/2001	Landfill	Waste Management	135	FEL			1
34	3/22/2001	Landfill	Venice	466	FEL			1
35	3/22/2001	Landfill	Venice	459	FEL			1
36	3/22/2001	Landfill	Venice	459	FEL		1	
37	3/22/2001	Landfill	Waste Management	379	RL	1		
38	3/22/2001	Landfill	Waste Management	124	RL	1		
39	3/22/2001	Landfill	Waste Management	381	RL	1		
40	3/22/2001	Landfill	Venice	472	FEL		1	
41	3/22/2001	Landfill	North Port	107	Grapple		1	
42	3/22/2001	Landfill	North Port	105	Grapple	1		
43	3/22/2001	Landfill	North Port	102	RL			1
44	3/22/2001	Landfill	Waste Management	429	Roll-off		1	
45	3/22/2001	Landfill	Waste Management	429	Roll-off		1	
Totals						13	11	19

Exhibit 1
Sarasota County, FL
Summary of Trucks Sampled

		Single Family	Multi- Family	Commercial
Total Samples=	80	25	21	34

Exhibit 2A
Sarasota County Single-family Results

		Material Categories	Annual Average	Standard Deviation	Lower Bound	Upper Bound
Paper	1	Newspaper	3.4%	2.3%	2.4%	4.6%
	2	Corrugated Cardboard	3.4%	2.9%	2.3%	4.7%
	3	Office Paper	1.8%	4.5%	0.7%	3.2%
	4	Polycoated/Aseptic	0.4%	0.4%	0.2%	0.6%
	5	Mixed Paper	7.5%	4.6%	5.2%	10.0%
	6	Other Paper	15.9%	6.6%	13.2%	18.8%
			TOTAL PAPER	32.3%	10.8%	27.9%
Plastic	7	#1 PET Bottles	0.8%	0.5%	0.6%	1.2%
	8	#2 HDPE Bottles	0.7%	0.6%	0.5%	1.0%
	9	#3-#7 Bottles	0.2%	0.2%	0.1%	0.3%
	10	Polystyrene Foam	0.8%	0.4%	0.6%	0.9%
	11	Other Rigid Plastic	4.7%	4.3%	3.2%	6.5%
	12	Film Plastic	7.6%	3.1%	6.5%	8.8%
			TOTAL PLASTIC	14.8%	5.5%	12.6%
Glass	13	Recyclable Glass	3.0%	2.5%	1.8%	4.4%
	14	Non-recyclable Glass	0.6%	1.1%	0.3%	1.1%
			TOTAL GLASS	3.6%	2.4%	2.6%
Metal	15	Steel/Bi-metal Cans	1.2%	0.7%	0.9%	1.5%
	16	Other Ferrous	1.7%	2.7%	0.8%	2.9%
	17	Aluminum Cans	0.6%	0.4%	0.4%	0.8%
	18	Other Non-Ferrous	0.6%	0.6%	0.3%	0.9%
			TOTAL METAL	4.0%	3.1%	3.0%
Organic	19	Food Waste	20.8%	13.5%	15.8%	26.4%
	20	Yard Waste	1.8%	2.9%	0.9%	3.1%
	21	Rubber	0.4%	1.0%	0.2%	0.8%
	22	Diapers & Sanitary Products	2.2%	2.9%	1.1%	3.7%
	23	Wood	2.5%	3.3%	1.2%	4.2%
	24	Other Organics	2.3%	3.0%	1.2%	3.8%
			TOTAL ORGANICS	30.1%	12.9%	24.9%
Textiles	25	Textiles	5.1%	4.1%	3.5%	7.1%
C&D	26	C&D Debris	3.9%	5.1%	1.7%	6.8%
Wh. Goods	27	White Goods	0.0%	0.0%	0.0%	0.0%
Tires	28	Tires	0.0%	0.0%	0.0%	0.0%
Misc	29	Hazardous	1.2%	1.8%	0.6%	2.0%
	30	Brown Goods	3.0%	6.3%	1.2%	5.6%
	31	Other Inorganics	1.9%	4.1%	0.8%	3.6%
			TOTAL MISCELLANEOUS	6.1%	9.5%	3.3%
TOTAL			100.0%			

Exhibit 2B
Sarasota County Multi-family Results

		Material Categories	Annual Average	Standard Deviation	Lower Bound	Upper Bound
Paper	1	Newspaper	4.8%	2.5%	3.7%	6.1%
	2	Corrugated Cardboard	4.2%	4.3%	2.4%	6.6%
	3	Office Paper	0.6%	0.8%	0.3%	1.2%
	4	Polycoated/Aseptic	0.4%	0.3%	0.3%	0.6%
	5	Mixed Paper	9.6%	5.0%	7.0%	12.5%
	6	Other Paper	16.0%	8.4%	12.6%	19.8%
			TOTAL PAPER	35.7%	6.9%	32.6%
Plastic	7	#1 PET Bottles	1.3%	0.6%	1.0%	1.5%
	8	#2 HDPE Bottles	1.1%	0.6%	0.8%	1.4%
	9	#3-#7 Bottles	0.1%	0.1%	0.0%	0.1%
	10	Polystyrene Foam	0.6%	0.3%	0.5%	0.7%
	11	Other Rigid Plastic	4.2%	1.4%	3.5%	4.9%
	12	Film Plastic	7.1%	2.4%	6.1%	8.3%
			TOTAL PLASTIC	14.3%	3.0%	13.0%
Glass	13	Recyclable Glass	4.3%	4.3%	2.6%	6.6%
	14	Non-recyclable Glass	2.3%	3.3%	0.9%	4.1%
			TOTAL GLASS	6.6%	4.3%	4.8%
Metal	15	Steel/Bi-metal Cans	1.3%	0.7%	1.0%	1.8%
	16	Other Ferrous	3.0%	3.6%	1.6%	4.9%
	17	Aluminum Cans	0.7%	0.4%	0.5%	1.0%
	18	Other Non-Ferrous	0.6%	0.8%	0.3%	1.0%
			TOTAL METAL	5.7%	3.6%	4.3%
Organic	19	Food Waste	16.4%	5.9%	13.7%	19.2%
	20	Yard Waste	0.5%	0.8%	0.2%	1.0%
	21	Rubber	0.4%	1.2%	0.2%	0.8%
	22	Diapers & Sanitary Products	3.7%	2.7%	2.3%	5.4%
	23	Wood	1.1%	2.2%	0.4%	2.2%
	24	Other Organics	2.8%	3.3%	1.3%	4.9%
		TOTAL ORGANICS	24.9%	7.3%	21.6%	28.4%
Textiles	25	Textiles	6.3%	4.3%	4.4%	8.6%
C&D	26	C&D Debris	1.8%	2.6%	0.8%	3.3%
Wh. Goods	27	White Goods	0.0%	0.0%	0.0%	0.0%
Tires	28	Tires	0.0%	0.0%	0.0%	0.0%
Misc	29	Hazardous	0.7%	1.3%	0.2%	1.4%
	30	Brown Goods	2.4%	2.6%	1.2%	4.1%
	31	Other Inorganics	1.5%	2.4%	0.5%	2.8%
			TOTAL MISCELLANEOUS	4.6%	4.3%	2.5%
TOTAL			100.0%			

Exhibit 2C
Sarasota County Commercial Results

		Material Categories	Annual Average	Standard Deviation	Lower Bound	Upper Bound
Paper	1	Newspaper	4.1%	6.0%	2.3%	6.3%
	2	Corrugated Cardboard	8.2%	9.2%	5.4%	11.6%
	3	Office Paper	3.0%	3.9%	1.7%	4.7%
	4	Polycoated/Aseptic	0.2%	0.3%	0.1%	0.3%
	5	Mixed Paper	6.4%	6.8%	4.3%	8.8%
	6	Other Paper	16.0%	15.0%	11.3%	21.4%
			TOTAL PAPER	37.8%	18.8%	30.4%
Plastic	7	#1 PET Bottles	0.8%	0.7%	0.5%	1.1%
	8	#2 HDPE Bottles	0.5%	0.6%	0.3%	0.8%
	9	#3-#7 Bottles	0.1%	0.2%	0.0%	0.2%
	10	Polystyrene Foam	1.1%	1.0%	0.7%	1.4%
	11	Other Rigid Plastic	3.8%	3.9%	2.7%	5.2%
	12	Film Plastic	7.0%	3.9%	5.5%	8.6%
			TOTAL PLASTIC	13.3%	6.4%	10.6%
Glass	13	Recyclable Glass	2.5%	3.4%	1.3%	3.9%
	14	Non-recyclable Glass	0.4%	1.1%	0.2%	0.7%
			TOTAL GLASS	2.9%	3.5%	1.6%
Metal	15	Steel/Bi-metal Cans	0.8%	1.1%	0.5%	1.3%
	16	Other Ferrous	2.6%	5.3%	1.3%	4.4%
	17	Aluminum Cans	0.6%	0.6%	0.4%	0.9%
	18	Other Non-Ferrous	1.6%	7.1%	0.6%	3.1%
			TOTAL METAL	5.7%	11.0%	3.3%
Organic	19	Food Waste	17.2%	16.9%	11.0%	24.4%
	20	Yard Waste	0.5%	1.3%	0.2%	1.0%
	21	Rubber	0.4%	1.2%	0.2%	0.7%
	22	Diapers & Sanitary Products	1.2%	3.2%	0.5%	2.3%
	23	Wood	1.2%	2.7%	0.5%	2.3%
	24	Other Organics	1.3%	4.6%	0.5%	2.4%
			TOTAL ORGANICS	21.8%	17.6%	15.1%
Textiles	25	Textiles	7.5%	21.7%	2.7%	14.5%
C&D	26	C&D Debris	8.5%	15.5%	3.9%	14.6%
Wh. Goods	27	White Goods	0.0%	0.0%	0.0%	0.0%
Tires	28	Tires	0.0%	0.0%	0.0%	0.0%
Misc	29	Hazardous	1.4%	3.1%	0.6%	2.6%
	30	Brown Goods	0.6%	1.6%	0.2%	1.1%
	31	Other Inorganics	0.5%	1.4%	0.2%	1.0%
			TOTAL MISCELLANEOUS	2.5%	4.1%	1.2%
TOTAL			100.0%			

Exhibit 3
Sarasota County Aggregate Waste Stream Composition

	Material Categories	Average	Standard Deviation	Lower Bound	Upper Bound
Paper	1 Newspaper	4.0%	3.2%	3.1%	5.1%
	2 Corrugated Cardboard	6.0%	3.4%	4.5%	7.7%
	3 Office Paper	2.2%	3.2%	1.4%	3.1%
	4 Polycoated/Aseptic	0.3%	0.4%	0.2%	0.4%
	5 Mixed Paper	7.3%	7.0%	6.0%	8.8%
	6 Other Paper	16.0%	13.7%	13.5%	18.8%
	TOTAL PAPER	35.7%	27.1%	31.8%	39.8%
Plastic	7 #1 PET Bottles	0.9%	0.8%	0.7%	1.1%
	8 #2 HDPE Bottles	0.7%	0.7%	0.5%	0.8%
	9 #3-#7 Bottles	0.1%	0.2%	0.1%	0.2%
	10 Polystyrene Foam	0.9%	0.7%	0.7%	1.1%
	11 Other Rigid Plastic	4.2%	4.8%	3.4%	5.1%
	12 Film Plastic	7.2%	6.5%	6.4%	8.1%
	TOTAL PLASTIC	13.9%	12.5%	12.5%	15.5%
Glass	13 Recyclable Glass	3.0%	3.1%	2.3%	3.9%
	14 Non-recyclable Glass	0.8%	0.9%	0.5%	1.2%
	TOTAL GLASS	3.8%	3.4%	3.0%	4.7%
Metal	15 Steel/Bi-metal Cans	1.0%	1.1%	0.8%	1.3%
	16 Other Ferrous	2.4%	2.3%	1.6%	3.4%
	17 Aluminum Cans	0.6%	0.6%	0.5%	0.8%
	18 Other Non-Ferrous	1.1%	0.7%	0.6%	1.8%
	TOTAL METAL	5.2%	3.9%	3.9%	6.7%
Organic	19 Food Waste	18.2%	19.2%	14.8%	22.1%
	20 Yard Waste	0.9%	2.5%	0.6%	1.4%
	21 Rubber	0.4%	0.7%	0.3%	0.6%
	22 Diapers & Sanitary Products	2.0%	2.7%	1.5%	2.8%
	23 Wood	1.6%	3.1%	1.1%	2.4%
	24 Other Organics	1.9%	2.8%	1.3%	2.7%
	TOTAL ORGANICS	25.0%	25.9%	21.3%	29.2%
Textiles	25 Textiles	6.5%	5.1%	4.1%	10.0%
C&D	26 C&D Debris	5.8%	4.9%	3.4%	8.9%
Wh. Goods	27 White Goods	0.0%	0.0%	0.0%	0.0%
Tires	28 Tires	0.0%	0.0%	0.0%	0.0%
Misc	29 Hazardous	1.2%	1.6%	0.8%	1.8%
	30 Brown Goods	1.7%	4.8%	1.1%	2.6%
	31 Other Inorganics	1.1%	3.2%	0.7%	1.8%
	TOTAL MISCELLANEOUS	4.0%	8.0%	2.9%	5.5%
TOTAL		100.0%			

Exhibit 4

DEP-Defined Material Category Composition Summary

DEP-defi Material	Single-Family			Multi-Family			Commercial			County-Wide Aggregate		
	Average	Lower	Upper	Average	Lower	Upper	Average	Lower	Upper	Average	Lower	Upper
1 Newspaper	3.4%	2.4%	4.6%	4.8%	3.7%	6.1%	4.1%	2.3%	6.3%	4.0%	3.1%	5.1%
2 Corrugate	3.4%	2.3%	4.7%	4.2%	2.4%	6.6%	8.2%	5.4%	11.6%	6.0%	4.5%	7.7%
3 Office Pa	1.8%	0.7%	3.2%	0.6%	0.3%	1.2%	3.0%	1.7%	4.7%	2.2%	1.4%	3.1%
4 Other Pap	23.8%	20.3%	27.4%	26.0%	22.8%	29.4%	22.6%	16.9%	28.8%	23.6%	19.7%	28.0%
5 Plastic Bc	1.7%	1.3%	2.2%	2.4%	2.0%	2.9%	1.4%	0.9%	1.9%	1.7%	1.3%	2.1%
6 Other Pla	13.1%	11.0%	15.3%	11.9%	10.7%	13.1%	11.9%	9.4%	14.5%	12.3%	10.5%	14.2%
7 Glass	3.6%	2.6%	4.8%	6.6%	4.8%	8.6%	2.9%	1.6%	4.4%	3.8%	2.8%	5.1%
8 Steel Car	1.2%	0.9%	1.5%	1.3%	1.0%	1.8%	0.8%	0.5%	1.3%	1.0%	0.8%	1.3%
9 Ferrous	1.7%	0.8%	2.9%	3.0%	1.6%	4.9%	2.6%	1.3%	4.4%	2.4%	1.6%	3.4%
10 Aluminum	0.6%	0.4%	0.8%	0.7%	0.5%	1.0%	0.6%	0.4%	0.9%	0.6%	0.5%	0.8%
11 Non-ferro	0.6%	0.3%	0.9%	0.6%	0.3%	1.0%	1.6%	0.6%	3.1%	1.1%	0.6%	1.8%
12 Food Was	20.8%	15.8%	26.4%	16.4%	13.7%	19.2%	17.2%	11.0%	24.4%	18.2%	14.8%	22.1%
13 Yard Was	1.8%	0.9%	3.1%	0.5%	0.2%	1.0%	0.5%	0.2%	1.0%	0.9%	0.6%	1.4%
14 Textiles	5.1%	3.5%	7.1%	6.3%	4.4%	8.6%	7.5%	2.7%	14.5%	6.5%	4.1%	10.0%
15 C&D Deb	3.9%	1.7%	6.8%	1.8%	0.8%	3.3%	8.5%	3.9%	14.6%	5.8%	3.4%	8.9%
16 White Go	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
17 Tires	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
18 Miscellan	13.2%	9.2%	17.6%	12.2%	9.7%	15.0%	6.2%	3.9%	9.1%	9.5%	6.4%	14.0%
19 Rubber	0.4%	0.2%	0.8%	0.4%	0.2%	0.8%	0.4%	0.2%	0.7%	0.4%	0.3%	0.6%
Total	100.0%			100.0%			100.0%			100.0%		

Exhibit 5
Sarasota County Waste Disposal and Recycling Summary

Categories	Aggregate Composition at County L (Mean) A	Tons Disposed at County LF [3] (Mean) B A x total	Tons Disposed Elsewhere C	Tons Recycled [1] (1999 data) D	Total Generation (tons) E B + C +D	Recycling Rate F D / E
Newspaper	4.0%	10,530		26,792.0	37,322	71.8%
Corrugated	6.0%	15,690		42,935.0	58,625	73.2%
Office Paper	2.2%	5,707		871.0	6,578	13.2%
Other Paper	23.6%	62,091		7,014.0	69,105	10.1%
Plastic Bottles	1.7%	4,429		2,260.0	6,689	33.8%
Other Plastic	12.3%	32,265		120.0	32,385	0.4%
Glass	3.8%	9,984		25,596.0	35,580	71.9%
Steel Cans	1.0%	2,698		1,548.0	4,246	36.5%
Ferrous	2.4%	6,330		8,972.0	15,302	58.6%
Aluminum Cans	0.6%	1,689		1,063.0	2,752	38.6%
Non-ferrous	1.1%	2,901		2,577.0	5,478	47.0%
Food Waste	18.2%	47,931		159.0	48,090	0.3%
Yard Waste	0.9%	2,452		80,131.0	82,583	97.0%
Textiles	6.5%	17,234		361.0	17,595	2.1%
C&D Debris[2]	5.8%	15,214	1,343	-	16,557	0.0%
White Goods	0.0%	0		1,034.0	1,034	100.0%
Tires	0.0%	9		524.0	533	98.3%
Miscellaneous	9.5%	25,130		159.0	25,289	0.6%
Rubber	0.4%	1,058			1,058	0.0%
Totals	100.0%	263,345	1,343	202,116.0	466,804	43.3%

[1] As reported in Sarasota County's 1999 Recycling and Education Grant.

[2] Quantities from Sarasota County reported to be disposed by WasteCorp in Polk County

[3] Reported from County Scale records for calendar year 1999

Exhibit 6
Net Impact of Moisture Analysis

Categories	Percent Moisture [1]	Tons Disposed (Mean)	Net Tons Disposed	Tons Recycled (Mean)	Net Tons Recycled [2]	Net Generation (tons)	Moisture-Adjusted Recycling Rate
Newspaper	27.9%	10,530.2	7,597.6	26,792.0	19,330.4	26,928.0	71.8%
Corrugated	24.1%	15,690.0	11,916.5	42,935.0	32,609.1	44,525.7	73.2%
Office Paper	13.4%	5,707.4	4,942.6	871.0	754.3	5,696.9	13.2%
Other Paper	26.9%	62,090.9	45,363.2	7,014.0	5,124.4	50,487.6	10.1%
Plastic Bottles	4.6%	4,429.2	4,226.2	2,260.0	2,156.4	6,382.6	33.8%
Other Plastic	19.2%	32,265.4	26,070.4	120.0	97.0	26,167.4	0.4%
Glass	3.0%	9,983.5	9,680.4	25,596.0	24,818.8	34,499.1	71.9%
Steel Cans	9.1%	2,698.3	2,453.1	1,548.0	1,407.3	3,860.4	36.5%
Ferrous	5.4%	6,330.4	5,988.5	8,972.0	8,487.5	14,476.0	58.6%
Aluminum Cans	12.9%	1,689.4	1,471.5	1,063.0	925.9	2,397.3	38.6%
Non-ferrous	16.9%	2,901.0	2,410.8	2,577.0	2,141.5	4,552.2	47.0%
Food Waste	59.8%	47,931.4	19,292.4	159.0	64.0	19,356.4	0.3%
Yard Waste	50.6%	2,452.2	1,211.4	80,131.0	39,584.7	40,796.1	97.0%
Textiles	17.2%	17,234.2	14,269.9	361.0	298.9	14,568.8	2.1%
C&D Debris	8.9%	16,557.5	15,083.9	0.0	0.0	15,083.9	0.0%
White Goods	NA	0.0	0.0	1,034.0	1,034.0	1,034.0	100.0%
Tires	NA	9.0	9.0	524.0	524.0	533.0	98.3%
Miscellaneous	29.1%	25,129.7	17,817.7	159.0	112.7	17,930.4	0.6%
Rubber	NA	1,058.3	1,058.3	0.0	0.0	1,058.3	0.0%
Totals		264,687.9	190,863.2	202,116.0	139,470.9	330,334.1	42.2%

[1] As documented in Technical Memorandum dated April 23, 2001.

[2] No analysis has been performed to determine the moisture content of recycled materials.

The same moisture content was used to net out moisture for both disposed material and recycled material. The actual moisture content for recycled material may be different than that used to net out moisture from recycled material.

**Exhibit 7
HHW Composition Detail**

	Categories	Single-Family Residential			Multi-Family Residential			Com'l/ Indus'l/ Inst'l			County-wide Aggregate		
		Average	Lower Bound	Upper Bound	Average	Lower Bound	Upper Bound	Average	Lower Bound	Upper Bound	Average	Lower Bound	Upper Bound
32	Flammab	13.1%	3.1%	28.5%	34.3%	14.7%	57.3%	33.9%	21.0%	48.2%	27.4%	19.6%	36.7%
33	Flammab	3.5%	0.9%	7.7%	2.3%	0.7%	4.7%	8.5%	4.7%	13.3%	5.8%	3.7%	8.5%
34	Corrosive	5.3%	0.8%	13.2%	0.0%	0.0%	0.0%	20.3%	10.7%	32.1%	11.8%	6.9%	18.0%
35	Corrosive	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
36	Reactives	4.1%	1.3%	8.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.3%	0.4%	2.6%
37	Reactives	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
38	Toxics-Er	12.3%	3.7%	25.2%	8.3%	1.7%	19.4%	0.0%	0.0%	0.0%	5.5%	2.5%	9.9%
39	Toxics-Fu	0.0%	0.0%	0.0%	13.4%	4.5%	26.0%	0.0%	0.0%	0.0%	2.4%	0.9%	4.6%
40	Other-Em	30.7%	12.3%	53.1%	25.0%	7.6%	48.2%	28.3%	17.9%	39.9%	28.5%	20.3%	38.3%
41	Other-Ful	31.0%	12.0%	54.2%	16.7%	4.2%	35.1%	9.0%	5.5%	13.2%	17.4%	10.9%	25.5%
	TOTAL H	100.0%			100.0%			100.0%			100.0%		
	Total Em	65.5%	40.6%	86.6%	67.7%	45.4%	86.3%	82.5%	73.3%	90.1%	74.4%	64.7%	82.5%
	Total Full	34.5%	13.4%	59.4%	32.3%	13.7%	54.6%	17.5%	9.9%	26.7%	25.6%	17.5%	35.3%
	TOTAL H	100.0%			100.0%			100.0%			100.0%		

APPENDIX F

**STATISTICAL ANALYSIS
TECHNICAL MEMORANDUM**

TECHNICAL MEMORANDUM



To: Barbara Kula, Charlotte County
Susie Metcalfe, Citrus County
Tom Keith, Sarasota County

cc: Peter Goren, Department of Environmental Protection

From: John Culbertson

Subject: **Innovative Recycling Grant—Statistical Analysis**

Date: August 29, 2002

The purpose of this Technical Memorandum is to explain the statistical analysis of existing waste composition studies to be used in developing the Florida Statewide Waste Composition computer model for the 1999-2000 Innovative Recycling Grant.

In developing the statistical analysis, R. W. Beck compiled the results from eleven existing waste composition studies and evaluated a wide range of external variables to be used as predictors of waste composition. A regression analysis approach to test for reasonableness was used to find the variables that best estimate the composition of the eighteen categories of waste defined in State reporting forms. Separate statistical analyses were performed for residential, commercial, and aggregate (i.e., residential plus commercial) waste composition.

The sections that follow discuss:

- Compilation and evaluation of predictive variables;
- Regression analysis; and
- Results.

COMPILATION AND EVALUATION OF PREDICTIVE DATA

In order to develop a statistical analysis that would result in a predictive model for waste composition, R.W. Beck first compiled a wide range of economic, demographic, and waste-related data that could possibly predict waste composition.

While an almost infinite number of explanatory variables could have been selected, it was necessary to limit our modeling based on several criteria. These are listed below:

- 1) **Solid Waste System Data:** Because waste composition is largely dependent on the characteristics of the local solid waste management and collection system, we attempted to capture characteristics about the local systems in each County. Our statistical analysis first evaluated solid waste system characteristics, such as the cost of disposal, recycling quantities and availability of curbside recycling.
- 2) **General Demographic and Economic Data:** The local demographic and business characteristics impact waste generation, and therefore the composition of disposed waste. For example, a county with a large tourist economy would likely generate different waste compared to a county with significant agricultural or industrial influences. Our statistical analysis then investigated these

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general demographic and economic characteristics, using readily available demographic data such as employment by NAICS code, per capita income, population density, and others.

- 3) **Data Availability:** The data selected for use as explanatory variables for waste composition statistical modeling had to be readily available from a reputable source, for each of the counties in Florida. For example, the U.S. Census Bureau compiles a range of data at the County level, much of which was included in our modeling. Similarly, the State compiles extensive solid waste system data in its annual report *Solid Waste in Florida*. The version of this report dated 2001 was used for our analysis.
- 4) **Use of Percentages:** Because we are modeling composition percentage, we opted to convert all explanatory variables to a percentage instead of modeling on the absolute values. For example, the U.S. Census provides the total retail employment in each county. In our statistical modeling, we used “retail employment as a percentage of total employment” (i.e., a percentage between 0% and 100%) as our coefficient, instead of “retail employment” (i.e., an absolute number from 0 to 100,000+).

A full range of explanatory variables is shown below:

Solid Waste System data

The data below are reported in Solid Waste Management in Florida 2001 and/or are included in the Recycling and Education Grant applications of Florida counties:

- Disposal tip fee in the county relative to State-wide average tip fee¹;
- Tons of waste disposed in MSW landfills (or incinerated);
- Tons of C&D debris disposed in C&D/Class III landfills;
- Tons of material recycled, for the following material types:
 - Newspaper,
 - Corrugated cardboard,
 - Office paper,
 - Other paper,
 - Plastic bottles,
 - Other plastic,
 - Glass,
 - Steel cans,

¹ All of the counties in the statistical analysis have a tip fee that reflects the full cost of disposal in that county. However, we note that some counties in Florida have a tip fee that does not capture the full cost (i.e., some disposal costs are hidden or captured via some other revenue mechanism). While this may result in minor discrepancies in the results of the predictive model for these counties (e.g., Palm Beach County), the impacts are not expected to be significant overall.

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- Ferrous metal,
 - Aluminum cans,
 - Nonferrous metal,
 - Food waste,
 - Yard waste,
 - Textiles,
 - C&D debris,
 - White goods,
 - Tires, and
 - Miscellaneous;
- Estimated recycling percentages for the residential and commercial sectors;
 - Percentage of households in the County with access to a curbside recycling program (in total and by material); and
 - Recycling participation rates.

Demographic and Economic Data

The data below were compiled from the U.S. Census Bureau, the Bureau of Economic Analysis, the University of Florida Bureau of Economic and Business Research, and the Florida Home Builders Association.

- Geographic location of the County, either coastal or inland;
- County population and population density;
- Per capita income relative to the Florida average per capita income;
- Employment data for the following industry sectors:
 - Farm,
 - Agriculture/Forestry/Fishing,
 - Mining,
 - Construction,
 - Manufacturing,
 - Transportation,
 - Wholesale trade,
 - Retail trades,

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- Finance, insurance, real estate,
 - Service,
 - Government, and
 - Miscellaneous employment,
- Housing starts in the County as a percentage of population relative to State-wide housing starts as a percent of State-wide population.

In our research into variables that may explain waste composition, we identified other variables not shown above that might be expected to impact waste composition. However, due to a lack of consistent, readily available, county-level data, we were not able to incorporate the following potentially explanatory variables into the analysis:

- Average annual rainfall,
- Incidence of storms or hurricanes,
- Construction, demolition and renovation building permits,
- Dollar value of construction and renovation projects, and
- Seasonal population variation.

The impact of these variables on waste composition may be considered for future study.

REGRESSION ANALYSIS

For each of the eighteen categories of waste, a single equation was developed to predict its percentage as a component of the total waste stream. The individual waste category equations were derived by examining the statistical significance of each potential explanatory variable. Statistical significance is measured by the standard error of each coefficient in comparison with the magnitude of the coefficient itself. This measure is commonly referred to as the “t-statistic” of the explanatory variable. Generally speaking, this “t-statistic” must be greater than 2 for the coefficient to be “statistically significant.” In some cases, explanatory variables were left in the final equations even though the associated t-statistic was less than 2. In all such cases, the t-statistic was large enough to indicate a substantial probability of significance.

Besides the statistical significance of each explanatory variable, we also examined the theoretical or expected influence of the variables ultimately included in each equation. Regardless of statistical significance, only those variables that had a reasonable explanation of their quantified relationship remain in the final equations. For example, the percentage of non-ferrous metals in the waste stream may have shown a correlation with farm employment. However, if no reasonable explanation could be found for such a correlation, then farm employment was not considered to be a good explanatory variable and was removed from the equation.

In addition to the economic, demographic, and waste-related variables already described, a “dummy” variable—indicating whether the county is located on the coast or inland—was also included in the

analysis. This variable served to normalize the county data for differences that may be traced to the geographic location of the county in the state. In most cases, we suspect that the dummy variable is acting as a “proxy” for an explanatory variable not included in our data. The “true” or underlying explanatory variable may be unavailable (not routinely gathered), not easily quantified, or simply unknown. Proxy variables are typical in regression analysis, and usually indicate areas for further research.

Unlike many regression studies, our analysis seeks to explain the *percentage* of a given category’s waste in the total waste stream. Since we are examining *all* waste categories, increases (or decreases) in any category’s percentage imply decreases (or increases) in another category or categories.

RESULTS OF REGRESSION ANALYSIS

The regression analysis has been performed for the single-family, commercial and countywide aggregate waste streams. Insufficient data existed to develop meaningful estimates for the multi-family waste.

A sample regression equation for a specific material in a specific generating sector is shown below:

$$\begin{array}{l} \text{Percentage of Single-family Corrugated} \\ \text{Cardboard in Disposed MSW equals} \end{array} \quad 0.69 - (0.001868 \times \text{Population density}) - (0.0843 \times \\ \text{Percentage of SF MSW Recycled}) + (0.3595 \times \text{Percent} \\ \text{Employment in Retail Trade)}$$

Exhibits 1, 2 and 3 summarize the regression coefficients for aggregate, single family residential, and commercial disposed waste composition, respectively. In each Exhibit, predictive variables are shown in the left-most column. Values shown in the remaining columns indicate if the composition of a specific material correlates with the predictive variables. For example, in Exhibit 1, the composition of disposed newspaper has a positive correlation with the county’s per capita income, and a negative correlation with the level of manufacturing employment in the county and also with the availability of a curbside recycling program. A blank cell indicates that no correlation was observed. The larger the predictive variable, the more a material’s composition changes when the predictive variable changes. For example, as shown in Exhibit 1, changes in Finance, Insurance and Real Estate (FIRE) Employment result in a relatively large change in the composition of office paper in the aggregate waste stream (0.3429), while changes in population density have a relatively small impact on yard waste composition (0.0044).

In general, the equations developed have been good predictors of the actual compositions observed in the twelve existing waste composition studies. For most waste categories, the equation predicts within 1% of the actual percentage observed for the county. The greatest error found has been approximately 4%, for the categories of yard waste and miscellaneous. This could mean that the predictive variables being used in the analysis do not include the best variables for these categories and that we may need to look further for predictors of these categories. It may also mean that the existing waste composition studies are too highly variable for the percentages shown in these categories to allow development of an accurate predictive equation.

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As a further test of the regression analysis, we have evaluated the results for other counties not included in the study to identify the prevalence of “outlier” results. By outlier results, we mean any results that are obviously not possible based on other quantitative data and/or common sense. In these cases, we have integrated some limitations on the regression equations to assure that predicted results are not unreasonable. The primary outlier results occurred on the composition categories that were found to correlate with (1) county population density as a percentage of Florida’s state-wide population density and (2) housing starts in the county as a percentage of county population. This could mean that the predictive variables being used in the analysis do not include the best variables for these categories and that we may need to look further for predictors of these categories. It may also mean that the existing waste composition studies are too highly variable for the percentages shown in these categories to allow development of an accurate predictive equation

These results have been incorporated into the draft spreadsheet computer model and will be ported to an Internet site for ease of access by all interested stakeholders. Please contact me at (407) 648-3563 or jculbertson@rwbeck.com if you have any questions or comments on the analysis or this memorandum. Thank you for your participation in this project.

Exhibit 3
Predictive Coefficients for Commercial Disposed Waste Stream Composition

Predictive Variable	News- paper	Corr. Cardbd	Office Paper	Other Paper	Plastic Bottles	Other Plastic	Glass	Steel Cans	Ferrous	Alum- inum	Non- Ferrous	Food Waste	Yard Waste	Textiles	C&D	White Goods	Tires	Misc.
Location (Inland)	1.7400					2.2500							-1.1800	1.0300				6.5500
County per capita Income	0.0576										-0.0048							
Farm Employment											-0.0354			0.0977				
Construction Employment				1.4138			0.5714	0.1292				1.4465						-1.5385
Mfg Employment	-0.3804																	
Retail Employment				-1.3206							0.0628							
FIRE Employment	0.3085																	
Service Employment					-0.0410			-0.0281		-0.0178	0.0748			0.2219		0.0159		
Government Employment						0.1154			0.1722			-0.1634			-0.4660			
Curbside Availability	-0.0394									0.0042		0.0371						
Curbside Household Participation											-0.0204			0.0215				
Curbside Recycling Availability																		
Housing Starts																		
C&D Disposed Tons															0.2300			
Population Density		-0.0060																
MSW Disposal Tip Fee	-0.0107		-0.0130				0.0388					0.0776						-0.0024
Miscellaneous Material Recycled																		
Office Paper Recycled			-1.7924															
Other Paper Recycled																		
Glass Recycled																		
Textiles Recycled														-2.0240				
Tires Recycled																		-0.2160
White Goods Recycled																		
C&D Recycled																		
Newspaper Recycled	-0.1137																	
Single-family Recycling Participation																		
Commercial Recycling Participation		-0.2310							0.1129							-0.0178		